

ACTIVITIES REPORT - 2010

ISR-LISBON
IMAR-DOP/UAç
IN+
CREMINER



ISR – Torre Norte, IST, Av. Rovisco Pais, 1049-001 Lisboa, PORTUGAL
Fax: 351-21-8418291
Tel: 351-21-8418289
E-mail: vab@isr.ist.utl.pt

General Information	
Name of Research Unit:	(LA-LVT-9) Instituto de Sistemas e Robótica - ISR - Lisboa
Coordinator:	Victor Alberto Neves Barroso
Main Scientific Domain:	Engenharia Electrotécnica e Informática
Other Subdomains:	Engenharia Mecânica
Host Institutions	
Leading Host Institution:	Instituto Superior Técnico - Universidade Técnica de Lisboa
Other Institutions Involved:	Instituto do MarFundação da Faculdade de Ciências - Faculdade de Ciências da Universidade de Lisboa Instituto Superior Técnico - Universidade Técnica de Lisboa
Objectives & Achievements	
Unit Description	
<p>The Associate Laboratory has the following organization structure:</p> <ul style="list-style-type: none"> Coordinating board Executive board Managers of thematic area Advisory board <p>Coordinating Board</p> <p>The Coordinating Board has as functions to supervise and to guide in general lines the cooperation activities of the four participant research units and to decide in cases of doubt resultant of divergent interpretations of the terms of the signed protocol.</p> <p>The Coordinating Board is composed by the scientific coordinators of the involved units and by the managers of the thematic areas, and is presided over by the President of the Executive Board of the Laboratory that will assure that the Coordinating Board will meet at least once a year. The meetings of the Coordinating Board can be convoked by any one of its members.</p> <p>Executive Board</p> <p>The Executive Board is composed by the coordinators of the involved units and presided over by the scientific coordinator of the ISR-Lx. The Executive Board has as functions to assure the current management of the activities resulting from the collaboration among the participant units and to guarantee its accurate fulfillment.</p> <p>Managers of Thematic Area</p> <p>Each thematic area has a manager elected by the researchers involved in that particular area, for a period of 3 years. He has not responsibilities of executive management, but rather tasks like:</p> <ul style="list-style-type: none"> to plan the activities to carry through in the thematic area and to promote its strategic orientation; to obtain the necessary human resources; to guarantee the cooperation and integration of the activities of the various groups; to prepare, in cooperation with the area researchers, project proposals and find financing sources for these projects (FCT, European Union, others). to prepare annual activities plans and reports in the domain of the thematic area to submit to the consideration of the Coordinating Board. <p>Advisory Board</p> <p>The activities of the associate laboratory is followed by an Advisory Board, consisting of national and international experts, nominated by decision of the Coordinating Board. The Advisory Board is requested to give his judgment whenever the Coordinating Board considers it opportune and under proposal of the Executive Board.</p>	
General Objectives	
<p>The strategic plan for the AL aims at: i) consolidating successful research lines and increasing the level of interaction among them, ii) opening new lines of research that show considerable promise, and iii) fostering interaction with stakeholders and establishing common joint ventures with commercial agents on issues with societal and economic relevance. As such, the plan embodies in its structure a threefold strategy that hinges upon three main lines of action: science, technology, and interaction with the society and the industry, all sharing a systems approach to research rooted in solid mathematical methods. This tripartite structure is a fertile ground for cross-fertilization of ideas, motivates challenging problems for engineers and mathematicians, and affords scientists advanced methods and new tools for their research activity. In what concerns application themes with potential societal and economic impact we have elected, due to their increasing importance and the sheer magnitude of the scientific and technological problems that they pose, the open oceans and the deep sea, sustainable urban systems, and sustainable energy, environment, and economic development.</p> <p>The key thrust of the AL activity will be threefold: research, training, and public service. In both research and training, the AL will complement its</p>	

Objectives & Achievements

internal multidisciplinary with external cooperation by networking with highly reputed research and academic institutions and industrial partners worldwide. To this effect, impetus will be given to the exchange of scientific personnel, participation in international projects, and hiring of exceptional PhD students and senior researchers.

Public service is foreseen as one of the most important missions of the AL. This can take the form of consultancy services to public administration bodies, including governmental departments and local administrations.

We will reinforce outreaching activities, in particular by taking initiatives to disseminate scientific knowledge and culture to the public at large, with special attention being given to the organization of summer schools and internships.

Advanced training initiatives will continue to be a major objective. The AL is presently involved in several international partnerships: (i) Carnegie Mellon-Portugal Program: Dual Doctoral Programs with Instituto Superior Técnico in Electrical and Computer Engineering, Engineering and Public Policy, and Technological Change and Entrepreneurship; (ii) MIT-Portugal Program: Doctoral Program at Instituto Superior Técnico with the Massachusetts Institute of Technology, in Sustainable Energy Systems, and (iii) Joint Doctoral Initiative in the area of Distributed and Cognitive Robotics involving Instituto Superior Técnico and École Polytechnique Federal de Lausanne (EPFL).

The programs with Carnegie Mellon and MIT merge several Portuguese research units and AL's, in close collaboration with Universities and Industrial Partners.

Main Achievements during the year of 2010

With respect to 2009, the funding for research projects increased in 2010 approximately 17% (national, FCT mainly) and 23% (international, EU mainly) for a total of 70 and 27 projects, respectively. 19 is the number of patents/prototypes produced. The AL researchers published 118 articles in international peer review journals and more than 200 communications in the proceedings of international conferences and workshops. 16 journal papers and 23 conference communications are collaborative publications involving researchers from different groups and thematic areas of the AL and, in some cases, from international research institutions or universities. 17 PhD thesis were completed. Our researchers have organized or participated in organizing committees of 18 international conferences, workshops or working groups meetings.

Scientific and Engineering Achievements

Robotic Monitoring and Surveillance: Search and rescue, field and urban robotics ((Muti-)robot task plan, decentralized planning under uncertainty); Surveillance (Gesture and activity understanding from video, Representation of complex activities with bank of visual motion fields); Cognitive robotic assistant (iCub robot fully operational [Vislab]).

Sustainable Technologies and Environmental Systems: Development of a set of advanced energy systems models (energy use in buildings, interaction with electric vehicles); Development of major methodologies and tools in the assessment and the design of new products and new policies; Support to entrepreneurial initiatives in Industrial Ecology in Portugal; Support to Portuguese public policy on the use of natural carbon sinks (including geological carbon sequestration).

Technologies for Ocean Exploration: Development of new methodologies and software/hardware for: a) multiple vehicle cooperative motion planning, navigation, and control, b) optimal networked sensor placement for underwater target positioning, and c) sensor-based control for unmanned air vehicles. IMAR has become the world leading research center on the study of the deep-sea chemo-synthetic mussel Bathymodiolus and the 10th Web of Knowledge ranked institution on the study of hydrothermal vent extreme ecosystems (2006-2010); IMAR came to the fore with the installation of a new laboratory (CoralLab). Creminer is completing a major study on Arctic hydrothermal systems, with great emphasis on the deep biosphere and on comparison with the Azores hydrothermal fields. Showcase of Science and Technology in the Azores in the scope of the FREESUBNET Workshop, co-organized by IMAR and ISR –advanced robots and marine equipment were used intensively at sea by a large group of European researchers to: i) map the habitat around a newly found of a hydrothermal vent field, and ii) to perform acoustic telemetry and tracking of fish carrying acoustic emitters.

Signal Processing for Communicatio Networks and Multimedia: Breakthroughs that produced theorems/procedures for some relevant problems (Minimization of a Quadratic function on Smooth Manifolds, Minimization of a singular value of a partially prescribed matrix, Integer 0-1 problems). Main contributions at the enabling methodologies (Reconstruction of non-rigid objects from video sequences, Image matching for object recognition, Distributed consensus and detection in Sensor Networks, Localization and tracking in sensor Networks). Cutting-edge technological developments with impact on society at the industrial, services, cultural and policy levels (Pollution monitoring using a bus fleet, Image retrieval in large scale databases (internet!) for images of art).

Activities

Integrative/multidisciplinary activities during the year of 2010

Final Freesubnet Workshop during which more than 30 scientists from 13 countries got together. The week-long event focused on the interplay between marine science and technology and consisted of a series of talks by experts and practical work at sea and in the laboratory. A previously unknown hydrothermal vent field in about 30m depth off Espalamaca, Faial Island, was described and mapped, an AUV built by students was tested in its first sea trial and a positioning system for biotelemetric studies was tested in cooperation with VEMCO (Canada). [Horta, 18-24 July 2010]

Science and Technology for the Deep-Sea: Session 1: Biodiversity and Ecosystem Functioning – Technology and Monitoring (6 July: 09:30 – 11:00); Session 2: Resources and Opportunities (6 July: 11:00 – 13:00). Ciência 2010 - 4- 7 July 2010. Fundação Calouste Gulbenkian, Lisbon.

PRINTART workshop "Where Computer Vision Meets Art", that gathered researchers from the areas of computer vision and art history, Museu Nacional do Azulejo, Lisboa, Portugal.

"Towards Closing the Loop: Active Learning for Robotics", Full day workshop at Robotics: Science and Systems 2010, University of Zaragoza, Spain.

iCub and friends: a workshop for open source robotics", held with IEEE Humanoids 2010, Nashville, Tennessee, December 2010.

Activities

Outreach activities during the year of 2010

Oficina de Robótica, in collaboration with Ciência Viva, July 2010.

Research Groups

Reference	Title / Principal Investigator
RG-LVT-50009-3422	<u>Evolutionary Systems and Biomedical Engineering</u> (Agostinho Claudio da Rosa)
RG-Centro-50009-3433	<u>Centre of IMAR of the University of the Azores/ Department of Oceanography and Fisheries (IMAR-DOP/UAz)</u> (Ricardo Piedade Abreu Serrão Santos)
RG-LVT-50009-3438	<u>DSORL - Dynamical Systems and Ocean Robotics Laboratory</u> (Carlos Jorge Ferreira Silvestre)
RG-LVT-50009-3447	<u>Signal and Image Processing Group</u> (Isabel Maria Gonçalves Lourtie)

Research Groups

Reference	Title / Principal Investigator
RG-LVT-50009-3508	<u>VisLab - Computer and Robot Vision Laboratory</u> (Jose Alberto Rosado Santos Victor)
RG-LVT-50009-3583	<u>Laboratory for Energy and Environmental Studies at IN+ Center for Innovation, Technology and Policy Research</u> (Paulo Manuel Cadete Ferrao)
RG-LVT-50009-3584	<u>Laboratory of Thermofluids, Combustion and Energy Systems, at IN+ Center for Innovation, Technology and Policy Research</u> (Antonio Luis Nobre Moreira)
RG-LVT-50009-3585	<u>Laboratory of Technology Policy and Management of Technology, at IN+ Center for Innovation, Technology and Policy Research</u> (Rui Miguel Loureiro Nobre Baptista)
RG-LVT-50009-3589	<u>Centre of Mineral Resources, Mineralogy and Crystallography of the Faculty of Science of Lisbon University (CREMINER)</u> (Fernando José Arraiano de Sousa Barriga)
RG-LVT-50009-3853	<u>Intelligent Robots and Systems</u> (Pedro Manuel Urbano de Almeida Lima)
RG-T-LVT-50009-3503	<u>Mobile Robotics Laboratory - MRLab</u> (Maria Isabel Lobato de Faria Ribeiro)
RG-T-LVT-50009-3505	<u>Intelligent Systems Laboratory</u> (Pedro Manuel Urbano de Almeida Lima)

Research Lines

Reference	Title / Principal Investigator
RL-EEI-LA09-133	<u>Robotic Monitoring and Surveillance</u> (Jose Alberto Rosado Santos Victor)
RL-EME-LA09-137	<u>Sustainable Technologies and Environmental Systems</u> (Paulo Manuel Cadete Ferrao)
RL-EEI-LA09-145	<u>Signal Processing for Communicatio Networks and Multimedia</u> (Joao Paulo Salgado Arriscado Costeira)
RL-EEI-LA09-151	<u>Technologies for Ocean Exploration</u> (António Manuel dos Santos Pascoal)

Other Activities

External Services and Resources

Marine Strategy Framework Directive, the Azores Marine Park.

Involvement in the implementation of the Condor Seamount Observatory, on the Monitoring, Control and Erradication of the Invasive seaweed *Caulerpa*.

Services of continuous evaluation of the Rural Development Program for Continental Portugal 2007-2013 - contract with the Ministry of Agriculture in consortium with two other organizations (2009-2015).

Involvement in significant activities of assessment of the government and local authorities on mineral resources, environmental protection and land use. Also, work in shale resources of Northern Portugal; Lithium resources; resources of Marco de Canavezes and Mondim de Basto; special clays of Meirinhas (Pombal).

Training Activities

Strong involvement in the doctoral programs in the framework of the international partnerships with american and european universities (promoted by the portuguese government), in particular with MIT, Carnegie Mellon and EPFL.

Organization of International Events

Final Freesubnet Workshop during which more than 30 scientists from 13 countries got together. The week-long event focused on the interplay between marine science and technology and consisted of a series of talks by experts and practical work at sea and in the laboratory. A previously unknown hydrothermal vent field in about 30m depth off Espalamaca, Faial Island, was described and mapped, an AUV built by students was tested in its first sea trial and a positioning system for biotelemetric studies was tested in cooperation with VEMCO (Canada). [Horta, 18-24 July 2010]

Other Activities

ICES Working Group on Marine Mammal Ecology Meeting, 12-15 April 2010, Horta, Açores, Portugal.

International Working Group for the Conservation of the Northwest Atlantic Loggerhead Nesting Population, September 14-16, 2010, Horta, Azores, Portugal.

Annual Meeting of the ICES Working Group on Marine Mammal Ecology, 12- 16 April. Horta, Azores, Portugal.

Annual Meeting of the ICES Working Group on Elasmobranchs, 22-29 July. Horta, Azores, Portugal.

2nd Annual MIT-Portugal Conference: Creating Values through Systems Thinking. FEUP, Porto, 28 de Setembro de 2010

15th International Symposium on Applications of Laser techniques to Fluid Mechanics, 05-08 July 2010, Lisbon, Portugal

Internal Evaluations

Summary of internal evaluations during 2010

During 2010, we made a deep analysis of the future of the AL. This resulted in a proposal of reorganization of the AL, including the integration of other groups/research units and the redefinition of the scientific and management organization. This proposal was submitted to FCT in July 2010.

Future internal Evaluations plan for 2011

This year (2011) we will nominate a new advisory board. We will promote a visit of the board to take place at the end of the year or as soon as possible in 2012.

Group Description	
Title of Research Group:	(RG-LVT-50009-3422) Evolutionary Systems and Biomedical Engineering
Principal Investigator:	Agostinho Claudio da Rosa
Main Scientific Domain:	Engenharia Electrotécnica e Informática
Group Host Institution:	Instituto Superior Técnico - Universidade Técnica de Lisboa

Funding, source, dates	
Funding, source, dates	
Pluriannual Base: Agostinho C da Rosa FCT Project OpenMicroBio PTOC/BIO/693/2006	

Objectives & Achievements

Objectives
<p>The long term objective of LaSEEB group is to develop model-based real-time detection and classification of brain states using the multi-channel Electroencephalogram (EEG) signal, where models and classifiers are optimized by bio-inspired algorithms. The final goal is not only to provide a better understanding of the brain functions but also providing affordable efficient training, prevention and therapy techniques.</p> <p>Modelling and Classification of brain States during awake and sleep for Neurocognitive training using Self-Organized Swarm Intelligence techniques.</p>

Main Achievements

<p>The main achievements during 2010 are the first steps toward the new proposal of Linguistic Modelling through Rhythm Segmentation of the Electroencephalographic (EEG) signals of Human Sleep and on further development, implementation and application of Neurofeedback (NF) based Brain Training and Neurophysiologic Therapy. The potential application of the advances have been demonstrated namely on the definition of Peripheral Vision (PV) Indexes for Team Sports or Driving/Steering Machines and currently on the development of PV enhancement through NF. The topic of biologically inspired new algorithms and paradigms for search and optimization has been extended. Current focus is on Evolutionary Algorithms for Dynamic Environments and Artificial Life Modelling and Simulations of Bio-systems and its application to Exams Timetabling. Advantages of using multiprocessor or multicell architectures have been investigated as workhorse for Agent Based Modelling and Simulations Systems.</p>
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Group Productivity

Publications in peer review Journals

1. Calapez A, Rosa A. A Statistical Pixel Intensity Model for Segmentation of Confocal Laser Scanning Microscopy Images. IEEE Trans Imaging Processing, Vol 19, NO. 9, pp 2408-2418, 2010.
2. Carlos M. Fernandes. Pherographia: Drawing by Ants, Leonardo J Vol 4, Issue 2, the Journal of the International Society for the Arts, Sciences and Technology, pp 107-112, MIT Press, April 2010.
3. Alves GR, Rosa AC, Brito M, Pradella-Hallinam M, Tufik S. Cyclic Alternating Pattern (CAP) in normal children from 12 to 24 months. Arq NeuroPsiquiatr 2010,68(5),689-693,.
4. C Isidoro, N Fachada, F Barata, AC Rosa. An Agent Based Model of Dengue Disease Transmission by Aedes aegypti Populations. In Lecture Notes on Computer Science, Artificial Life Part I, pp 339 – 346, Springer.
5. CM Fernandes, CF Lima, JLJ Gimenez, AC Rosa, JJ Merelo. An Ant-based Rule for UMDA's update Strategy. Lecture Notes on Computer Science, Artificial Life Part II, pp 386-393, Springer.
6. AC Rosa and JP Rodrigues. Dream therapy: correlation of dream contents with encephalographic and cardiovascular activations. In "States of Consciousness: Experimental Insights into Meditation, Waking, Sleep and Dreams", Dean Cvetkovic and Irene Cosic (eds), Springer, The Frontiers Collection, ISBN 9-78-3-642-18046-0.
7. Madani K, Correia A.D., Rosa A, Filipe J. (eds): Computational Intelligence, Springer, ISBN 978-3-642-20285-6

Other international publications

1. Daria G Migotina, Agostinho C Rosa, Ana LN Fred. Automatic K-complex detection using Hjorth parameters and fuzzy decision. ACM SAC 2010, pp 979 – 980, 2010.
2. Joao PM Rodrigues, Daria G Migotina, Agostinho C da Rosa. EEG Training Platform; improving brain-computer Interface and cognitive skills. IEEE HSI 2010, pp 425-429 , 2010.

Group Productivity

3. Joao PM Rodrigues, Joao Semedo, Fernando M Melicio, Agostinho C da Rosa. Peripheral Vision Pattern Detection Dynamic Test. ICEIS pp 242 – 247, 2010.
4. Dulce Calçada, Agostinho Rosa, Luis C Duarte, Vitor V Lopes. Comparison of GA and PSO Performance in Parameter Estimation of Microbial Growth Models: A Case-Study Using Experimental Data. IEEE WCCI 2010, pp 1-8, 2010.
5. Carlos M Fernandes, Agostinho C Rosa, Juan Julian Merelo. Investigation Replacement Strategies for the Adaptive Dissortative Mating Genetic Algorithm. IJCCI-ICEC 2010, pp 104 – 113, 2010.
6. A.M. Mora, C.M. Fernandes, L.J. Herrera, P.A. Castillo, J.J. Merelo, A.C. Rosa, Sleeping with Ants, SVMs, Multilayer Perceptrons and SOMs, to appear in ISDA'10, 2010, pp126-131.
7. Carlos M. Fernandes, J.L.J. Laredo, J.J. Merelo, Rojas F and A.C. Rosa, A Self-Organized Criticality Online Adjustment of Genetic Algorithms' Mutation Rate, Workshop on Self-Tuning, Self-Configuring and Self-Generating Search Heuristics (Self* 2010), 2010.
8. A.M. Mora, Carlos M. Fernandes, L.J. Herrera, P.A. Castillo, A.C. Rosa, JJ Merelo, Automatic Sleep Classification Procedure Using Wavelet Based Feature Extraction, in Proceedings of the 2010 International Conference on Metaheuristics and Nature Inspired Computing, METAheuristics 2010.
9. J.J. Merelo, A.M. Mora, J.L.J. Laredo, P.A. Castillo, C.M. Fernandes, Optimizing Evolutionary Algorithms at Program Level, in Proceedings of the 2010 International Conference on Metaheuristics and Nature Inspired Computing, METAheuristics 2010.
10. Silveira M, Figueiredo P. (2010) Joint fMRI brain activation detection and segmentation using level sets. Proc. 32nd Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC 2010); 1:5708-11, August 31 - September 4, Buenos Aires, Argentina.
11. Silvestre C, Figueiredo P, Rosa P. (2010) Multiple-Model Set-Valued Observers: A new tool for HRF model selection in fMRI. Proc. 32nd Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC 2010); 1:5704-7, August 31 - September 4, Buenos Aires, Argentina.
12. Silvestre C, Figueiredo P, Rosa P. (2010) On the distinguishability of HRF models in fMRI. Proc. 32nd Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC 2010); 1:5677-80, August 31 - September 4, Buenos Aires, Argentina.
13. Santos N, Sanches JM, Figueiredo P (2010) Bayesian optimization of perfusion and transit time estimation in PASL-MRI. Proc. 32nd Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC 2010); 1:4284-7, August 31 - September 4, Buenos Aires, Argentina.
14. Figueiredo P, Silvestre C, Rosa P (2010) Nonlinear HRF model identification using multiple model set valued observers. Proc. 16th Annual Meeting of the Organization for Human Brain Mapping (HBM 2010), June 2010, Barcelona, Spain.
15. Saiote C, Silva J, Gomes C, Lauterbach M, Reimão S, Figueiredo P (2010) Parametric fMRI correlates of multiple face orientations. Proc. 16th Annual Meeting of the Organization for Human Brain Mapping (HBM 2010), June 2010, Barcelona, Spain.
16. Afonso D, Figueiredo P, Sanches J (2010) Parameter free Bayesian activity detection in fMRI. Proc. 16th Annual Meeting of the Organization for Human Brain Mapping (HBM 2010), June 2010, Barcelona, Spain.
17. Fernandes H, Andrade A, Santos G, Figueiredo P (2010) Temporal Representation of fMRI Time Series in Rest Connectivity Studies. Proc. 16th Annual Meeting of the Organization for Human Brain Mapping (HBM 2010), June 2010, Barcelona, Spain.
18. Figueiredo P, Leal A (2010) Investigation of seizure propagation using EEG-fMRI and dynamic causal modelling. Proc. 18th Annual Meeting of the International Society for Magnetic Resonance in Medicine (ISMRM 2010), May 2010, Stockholm, Sweden.
19. Pimentel M, Sousa I, Vilela P, Figueiredo P (2010) Localization of the hand motor area using BOLD and ASL fMRI. Proc. 18th Annual Meeting of the International Society for Magnetic Resonance in Medicine (ISMRM 2010), May 2010, Stockholm, Sweden.
20. Pimentel M, Sousa I, Vilela P, Figueiredo P (2010) Correction of partial volume effects in PASL perfusion measurements. Proc. 18th Annual Meeting of the International Society for Magnetic Resonance in Medicine (ISMRM 2010), May 2010, Stockholm, Sweden.
21. Sanches J, Sousa I, Figueiredo P (2010) Bayesian Fisher Information Criterion for Sampling Optimization in ASL-MRI, Proc. 10th IEEE International Symposium on Biomedical Imaging (ISBI 2010), 14-17 April, Rotterdam, The Netherlands.

Other national publications

Figueiredo P. (2010) Manipulando os spins nucleares por ressonância magnética para obter imagens da perfusão cerebral. Gazeta da Física Vol. 33, N. 3/4, p. 6.

Organization of conferences

ACM SAC 2010 – Computational Intelligence Image Analysis track, Crans-Montana, Switzerland.

INSTICC – IJCCI - International Conference on Evolutionary Computation 2010 – Programme Chair, Valencia, Spain.

Internationalization

Federal University of Sao Paulo, Brazil

Alves GR, Rosa AC, Brito M, Pradella-Hallinam M, Tufik S. Cyclic Alternating Pattern (CAP) in normal children from 12 to 24 months. Arq NeuroPsiquiatr 2010,68(5),689-693,.

University Of Granada, Spain.

CM Fernandes, CF Lima, JLJ Gimenez, AC Rosa, JJ Merelo. An Ant-based Rule for UMDA's update Strategy. Lecture Notes on Computer Sciences, Artificial Life, pp 386-393. Springer.

Carlos M Fernandes, Agostinho C Rosa, Juan Julian Merelo. Investigation Replacement Strategies for the Adaptive Dissortative Mating Genetic

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Algorithm. IJCCI-ICEC 2010, pp 104 – 113, 2010.

A.M. Mora, C.M. Fernandes, L.J. Herrera, P.A. Castillo, J.J. Merelo, A.C. Rosa, Sleeping with Ants, SVMs, Multilayer Perceptrons and SOMs, to appear in ISDA'10, 2010, pp126-131.

Carlos M. Fernandes, J.L.J. Laredo, J.J. Merelo, Rojas F and A.C. Rosa, A Self-Organized Criticality Online Adjustment of Genetic Algorithms' Mutation Rate, Workshop on Self-Tuning, Self-Configuring and Self-Generating Search Heuristics (Self* 2010), 2010.

A.M. Mora, Carlos M. Fernandes, L.J. Herrera, P.A. Castillo, A.C. Rosa, JJ Merelo, Automatic Sleep Classification Procedure Using Wavelet Based Feature Extraction, in Proceedings of the 2010 International Conference on Metaheuristics and Nature Inspired Computing, METAheuristics 2010.

J.J. Merelo, A.M. Mora, J.L.J. Laredo, P.A. Castillo, C.M. Fernandes, Optimizing Evolutionary Algorithms at Program Level, in Proceedings of the 2010 International Conference on Metaheuristics and Nature Inspired Computing, METAheuristics 2010.

UMIT, Melbourne, Australia.

AC Rosa and JP Rodrigues. Dream therapy: correlation of dream contents with encephalographic and cardiovascular activations. In "States of Consciousness: Experimental Insights into Meditation, Waking, Sleep and Dreams", Dean Cvetkovic and Irene Cosic (eds), Springer, The Frontiers Collection, ISBN 9-78-3-642-18046-0.

COST, European Cooperation in Science and Technology

Participation in the Arterial spin labelling Initiative in Dementia (AID) European Cooperation in Science and Technology (COST) Action (P. Figueiredo).

Group Description	
Title of Research Group:	(RG-Centro-50009-3433) Centre of IMAR of the University of the Azores/ Department of Oceanography and Fisheries (IMAR-DOP/UAz)
Principal Investigator:	Ricardo Piedade Abreu Serrão Santos
Main Scientific Domain:	Ciências do Mar
Group Host Institution:	Instituto do Mar

Funding, source, dates	
Funding, source, dates	
<p>FCT</p> <p>TRACE-PTDC/MAR/74071/2006</p> <p>CORAZON- PTDC/MAR/72169/2006</p> <p>IMUNOVENT-PTDC/MAR/65991/2006</p> <p>CHEMECO-: EURODEEP/0001/2007</p> <p>REDECO ESF/MARINERA/Mr/003/2008</p> <p>BIOMOUNT-PTDC/MAR/105486/2008</p> <p>METHAFISHCODE -PTDC/MAR/101795/2008</p> <p>Rish&Shine-PTDC/BIA-BEC/103734/2008</p> <p>DEECON -EURODEEP/0002/2007</p> <p>SEAMOV-PTDC/MAR/108232/200/8</p> <p>CARCASE-PTDC/MAR/099656/2008</p> <p>DIMBIO PTDC BIA/BDE/67286/2006</p> <p>EC & OTHER INTERNATIONAL FUNDING</p> <p>MESH-Atlantic (Atlantic Area 2009-1/110).</p> <p>HERMIONE-FP7 ENV/2008/1/226354</p> <p>CORALFISH -FP7 ENV/2007/1/213144</p> <p>MADE FP7 KBBE/2007/1/210496</p> <p>ESONET</p> <p>MEFEPO- FP7 KBBE-2007-1-4-19</p> <p>FREESUBNET</p> <p>CONDOR EEA PT0040/2008</p> <p>CORALCHANGE-FP7-MC-IRG</p> <p>Bangen -PTC/MAC/1/C070</p> <p>Marprof/MAC/2/M065</p> <p>Agreement nº 58-0210-7F135</p> <p>Sustainable Fisheries in Azores</p>	

Objectives & Achievements	
Objectives	
<p>The conservation of marine life and the sustainable use of living resources in the North-East Atlantic Ocean and the ecosystems of islands slopes, the Deep-Sea and Open Ocean at large are the main objectives of the research and outreach activities developed at the Centre of IMAR of the University of the Azores/Department of Oceanography and Fisheries (IMAR-DOP/UAç). Those objectives are shared with the generations of young students and newly graduated researchers in marine sciences that integrate IMAR-DOP/UAç. The members of IMAR-DOP/UAç have been involved in the development of different activities within these fields, in a multidisciplinary effort to integrate the research for a better understanding of the dynamics of this region, and its biological, physical, chemical and geological backgrounds.</p> <p>The Research Group operates in 5 flexible Working Groups and 6 Laboratories. The actual WGs are dedicated to: "Ecosystem Based Approaches to Marine Habitats & Biodiversity", "Ecosystem Based Management to Fisheries", "Chemosynthetic Ecosystems", "Seamounts and Cold Water Corals", "Oceanography". The main fields of research are: molecular genetics and biotechnology, eco-toxicology, satellite oceanography, fisheries dynamics, behavioral ecology, bio-telemetry, acoustic of the seabed and water column in view of the mapping of habitats and biodiversity and scenarios for sea-going technologies.</p> <p>This centre supports and helps pure and applied research. It is highly involved in co-operation activities with public and private institutions from Portugal and other countries, including universities, research centers and institutes, enterprises and professional associations. IMAR-DOP/UAç</p>	

Objectives & Achievements

also carries out services for industry and public administration. It is also involved in activities of promotion and divulgation of research activities in media, museums, at the primary and high school system and through the internet.

IMAR-DOP/UAz will continue involved and given emphasis in deep-sea research.

Portugal holds jurisdiction, and exclusive economic rights, over a very large area of the seabed. One of the main national objectives, at the present time, is to increase the knowledge that exists on the resources and ecosystem functioning.

Our research aims key issues of ecosystem functioning in a time of changes, climate change and anthropogenic exploration of Open Ocean and deep-sea biotic resources. We are focused on island slopes, deep-sea ridge systems and open ocean. A lot is still left to do in view to have a synoptic and holistic perspective integrating these components of the ecosystem, and there is a need to accomplish the ecosystems approach for management. Focus is given to bio-telemetry studies of top predators together with habitat mapping at the level of seafloor and water column. These studies serve to characterize essential habitats of priority species namely cold water corals and deep-sea fishes, and large pelagic predators. New sensors and permanent stations, including landers, are deployed. Together with the fixed observatory type studies of seamount and vents ecosystems, we will continue tagging several species with acoustic and satellite transmitters incorporating data-loggers for different types of environmental and physiological data acquisition.

Main Achievements

IMAR-DOP/UAz, has effectively become a leading research center for integrated studies on seamounts and hydrothermal vents, involved in 8 projects of the FP6 and 4 of the FP7; it is also the world leading research center on the study of the deep-sea chemo-synthetic mussel *Bathymodiolus* and the 10th Web of Knowledge ranked institution on the study of hydrothermal vent extreme ecosystems (2006-2010); the implementation of LabHorta (a new international laboratory for the study of hydrothermal vents) was a major milestone, for it opened a new window on the studies of extreme ecosystems of the deep-sea. More recently we came out with the installation of new laboratory (CoralLab), dedicated to the husbandry and experimentation with cold-water corals, making possible the study of certain aspects of the biology and physiological processes of cold-water corals and associated fauna, which are difficult in situ. For example, in CoralLab seawater temperature and pH can be independently controlled in different aquaria, enabling the simulation of seawater temperature and acidity increases predicted as consequences of climate change, and the study of physiological responses.

Ongoing experiments at CoralLab include studies on: (i) physiological responses of scleractinian and corals to increased seawater carbon dioxide partial pressure (pCO₂) and temperature; (ii) the sensitivity/resilience of gorgonians to mechanical injury under different temperature conditions; (iii) gene expression analysis of relevant genes known to be directly involved in immune and stress responses to the presence of pathogens and or environmental stressors.

Current status

Projects and research lines have been developed to address several biotechnological related issues at DOP:

1. Marine enzymes from environmental microbes (Deep-sea vents and shallow water vents): mostly through a DNA-based approach using metagenomic analyzes, i.e the sequencing of all the genomes present in microbial communities. Some of the enzymes we are targeting have a direct implication in industry: proteases; amylases, pullulanase, glucoamylases, glucosidases, cellulases, xylanases, Lipases, esterases. 2. Enzymatic activities detected by screening methods using bulk extracts from microalgae, fungi, bacteria and marine invertebrates collected in the Azores. We have given special emphasis to the detection of antibacterial activities and we are setting new protocols for the purification of natural antibiotics of marine origin. 3. The establishment of global gene expression analyses or transcriptome analyses using state-of-the-art technologies such as the 454-sequencing to generate several thousands of DNA sequences corresponding to new genes whose putative biological functions may be biotechnology relevant.

Another achievement was the understanding the Trophodynamic of the CONDOR seamount (Azores, Portugal, North Atlantic). Stable carbon and nitrogen isotopic signatures were determined on these species and compared to other samples from the Mid-Atlantic Ridge (South and North of the Azores). The energetic content of each group was established through their biochemical composition (total proteins; lipids and sugars). We establish the trophic structure of the colonizing modules through stable isotope and fatty acid approach from hydrothermal sites (Lucky Strike and Rainbow) on the Mid-Atlantic Ridge and on the mud volcanoes in the Gulf of Cadiz.

Group Productivity

Publications in peer review Journals

Andris, M. et al. 2010. Permanent genetic resources added to Molecular Ecology Resources Database. *Molecular Ecology Resources* 10: 1106-1108.

Bettencourt R, et al. 2010. Out of the deep-sea into a land-based aquarium environment: Investigating innate immunity in the hydrothermal vent mussel *Bathymodiolus azoricus*. *Cahiers de Biologie Marine*, 51 (4): 341-350.

Bettencourt, R., et al. 2010. High-throughput sequencing and analysis of the gill tissue transcriptome from the deep-sea hydrothermal vent mussel *Bathymodiolus azoricus*. *BMC Genomics*, 11: 559.

Bried, J., et al. 2010. The effects of competition for nests on genetic monogamy in Cory's shearwater. *Journal of Avian Biology*, 41 (4): 407-418.

Clark, M.R., et al. 2010. Are deep-sea demersal fish assemblages globally homogenous? insights from seamounts. *Special Seamounts issue of Marine Ecology*. 31 (Suppl. 1): 39-51

Claudet J, et al. 2010. Marine reserves: fish life history and ecological traits matter. *Ecological Applications* 20(3): 830-839.

Company, R., et al. 2010. Sub-lethal effects of cadmium on the antioxidant defence system of the hydrothermal vent mussel *Bathymodiolus azoricus*. *Ecotoxicology and Environmental Safety*, 73 (5): 788-795.

Cuvelier, D, et al. 2010. Hydrothermal faunal assemblages and habitat characterisation at the Atlantic Eiffel Tower edifice (Lucky Strike vent field). *Marine Ecology*: doi: 10.1111/j.1439-0485.2010.00431.x

Faria, C., et al. 2010. A comparison between the ontogeny of two related blennioid species *Parablennius gattorugine* and *Parablennius ruber* (Pisces: Blenniidae). *Journal of the Marine Biological Association of the U.K.*, 90 (7): 1263-1268.

Group Productivity

- Fontes, J., et al. 2010. Seasonal variability of larval growth, size, stage duration and recruitment success of a temperate wrasse, *Coris julis*, from the Azores. *Scientia Marina* 74 (4) 721-729.
- Fontes, J., et al. 2010. Larval growth, size, stage duration and recruitment success of a temperate reef fish. *Journal of Sea Research* 65, 1–7.
- Glover, A.G, et al. (2010). Temporal Change in Deep-Sea Benthic Ecosystems: A Review of the Evidence From Recent Time-Series Studies *Advances in Marine Biology* 58 : 1-95.
- Higgins RM, et al. (2010). Multidisciplinary fingerprints reveal the harvest origins of cod (*Gadus morhua*) in the northeast Atlantic. *Marine Ecology Progress Series*, 404, 197-206.
- Lopez D. A., B et al. 2010. Barnacle culture: background, potential and challenges. *Aquaculture Research* 41(10): 367-375.
- Morato T., et al. 2010. Can we protect seamount for research? A call for conservation. *Oceanography*, 23(1): 190-199.
- Morato, T., et al. 2010. Seamounts are hotspots of pelagic biodiversity in the open ocean. *Proceedings of the National Academy of Science US* 107(21): 9707-9711.
- Morato, T., et al. 2010. Tuna longline fishing around West and Central Pacific seamounts. *PLoS ONE* 5(12): e14453.
- Morato, T., T.J. Pitcher, M.R. Clark, G. Menezes, F. Tempera, F. Porteiro, E. Giacomello & R.S. Santos (2010). Can we protect seamounts for research? A Call for Conservation. *Oceanography*, 23 (1): 190-199.
- Neves VC, et al. 2010. Are European Starlings breeding in the Azores archipelago genetically distinct from birds breeding in mainland Europe? *European Journal of Wildlife Research* 56: 95-100.
- Pitcher, T.J., et al. 2010. Seamount fisheries: do they have a future? *Oceanography* 23(1): 134-144.
- Pitcher, T.J., T et al. 2010. Seamount Ecosystem Evaluation Framework (SEEF): a tool for global seamount research and data synthesis. *Oceanography* 23(1):123-125.
- Pontier, D., et al. 2010. Can cat predation help competitors coexist in seabird communities? *Journal of Theoretical Biology* 262: 90-96.
- Quartau, R., A et al. 2010. Modelling the Development of a Volcanic Island Shelf by Erosion: Faial Island in the Azores Archipelago. *Marine Geology*, 275 (1-4): 66-83.
- Quérrouil, S. et al. 2010. Sex bias in biopsy samples collected from free-ranging dolphins. *European Journal of Wildlife Research*, 56: 151-158.
- Quérrouil, S. et al. 2010. Molecular insight into the population structure of common and spotted dolphins inhabiting the pelagic waters of the Northeast Atlantic. *Marine Biology* 157:2567-2580.
- Ribeiro PA, et al. 2010. Recent changes in the distribution of a marine gastropod, *Patella rustica*, across the Iberian Atlantic coast, did not result in diminished genetic diversity or increased connectivity. *Journal of Biogeography* 37:1782-1796.
- Riou V., et al. 2010. Variation in physiological indicators in *Bathymodiolus azoricus* (Bivalvia: Mytilidae) at the Menez Gwen Mid Atlantic Ridge deep sea hydrothermal vent site within a year. *Marine Environmental Research*, 70 (3-4): 264-271.
- Riou, V.; Colaço, A., et al. (2010). The mixotrophic side of the deep sea hydrothermal, dual endosymbiotic, mytilid *Bathymodiolus azoricus*: assimilation of dissolved and particulate organic matter. *Marine Ecology Progress Series* 405:187-201.
- Riou, V, et al. (2010) Variation in physiological indicators in *Bathymodiolus azoricus* (Bivalvia: Mytilidae) at the Menez Gwen deep sea hydrothermal vent site within a year. *Marine Environmental Research* 70: 264-271
- Santos, RS et al. 2010. Dom João de Castro Seamount. *Oceanography* 23(1): 200-201
- Santos, RS et al. 2010. Sedlo Seamount. *Oceanography*, 23 (1): 202-203.

Other international publications

- Amaral J, Almeida S., Sequeira M. & Neves VC (2010). Black rat *Rattus rattus* eradication by trapping allows recovery of breeding roseate tern *Sterna dougallii* and common tern *S. hirundo* populations on Feno islet, the Azores, Portugal. *Conservation Evidence* 7:16-20
- Baker M. C., E. Z. Ramirez-Llodra, P. A. Tyler, C. R. German., A. Boetius, E. E. Cordes, N. Dubilier, C. R. Fisher, L. A. Levin, A. Metaxas, A. A. Rowden, R. S. Santos, T. M. Shank., C. L. Van Dover, C. M. Young, A. Warén 2010. Biogeography, Ecology, and Vulnerability of Chemosynthetic Ecosystems in the Deep Sea. Pp. 161-182. Alasdair D. McIntyre (Ed.). *Life in the World's Oceans*. Wiley Blackwell Publishing Ltd. 384pp.
- Carreiro-Silva M, E Giacomello, A Braga-Henriques, J Jakobsen, K Jakobsen, G Menezes, T Morato, FM Porteiro, F Tempera and RS Santos (2010). Sea-based and land-based observatories: new approaches for the integrated study of biodiversity and ecosystem function on seamounts. *MARS Newsletter* no.9.
- Cochrane, S. K. J., D. W. Connor, P. Nilsson, I. Mitchell, J. Reker, J. Franco, V. Valavanis, S. Moncheva, J. Ekebom, K. Nygaard, R. S. Santos, I. Naberhaus, T. Packeiser, W. van de Bund and A. C. Cardoso 2010. Marine Strategy Framework Directive. Guidance on the interpretation and application of Descriptor 1: Biological diversity. Report by Task Group 1 on Biological diversity for the European Commission's Joint Research Centre, Ispra, Italy. 120pp. ISBN 978-92-79-15650-2; ISSN 1018-5593; doi:10.2788/86653
- Faustino, C.E.S., et al. 2010. Designing a shipboard line transect survey to estimate cetacean abundance off the Azores archipelago. *Arquipélago. Life and Marine Sciences*, 27: 49-58.
- HERMIONE newsletter issue 3. Seamounts give up their secrets in the Azores. Spring 2010.
- HERMIONE newsletter issue 4. Investigations and colonisation studies at the seamounts of the Azores. Autumn/Winter 2010.
- Pham, C.K. and E. Silva. 2010. New species in European shellfish aquaculture; Barnacle farming in the Azores. *Aquaculture Europe*. 35(2):27-29.
- Pham C.K. and E. Isidro. 2010. Experimental harvesting of juvenile common octopus *Octopus vulgaris*, for commercial on-growing in the Azores. *Arquipélago, Life and Marine Sciences*. 27: 41-47.
- Rice, J., M. F. Borges, A. Grehan, A. Kenny, H. Loeng, F. Maynou, R. S. Santos, H. R. Skjoldal, O. Thébaud, V. Vassilopoulou, F. Volckaert, A. Carbonnière 2010. Science dimensions of an Ecosystem Approach to Management of Biotic Ocean Resources (SEAMBOR). *Marine Board-ESF*

Group Productivity

Position Paper 14 : 86pp. ESF – Marine Board, Ostend, Belgium. ISBN: 978-2-918428-10-7.

Santos, R. S. & A. Colaço (2010). Background Document for Oceanic ridges with hydrothermal vents/fields. Biodiversity Series (Publication No. 490/2010): 17pp. OSPAR Commission. ISBN 978-1-907390-31-9.

Santos, R. S., F. Tempera & T. Morato (2010). Background Document for Seamounts. Biodiversity Series (Publication No. 492/2010): 28pp. OSPAR Commission. ISBN 978-1-907390-33-3.

Santos, R. S., R. Delgado & R. Ferraz (2010). Background Document for Azorean limpet *Patella aspera*. Biodiversity Series (Publication No. 488/2010): 14pp. OSPAR Commission. ISBN 978-1-907390-29-6.

Tempera, F., E. Giacomello, N. Mitchell, A.S. Campos, A. Braga Henriques, A. Martins, I. Bashmachnikov, T. Morato, A. Colaço, F.M. Porteiro, D. Catarino, J. Gonçalves, M.R. Pinho, E.J. Isidro, R.S. Santos and G. Menezes (in press). Mapping the Condor seamount seafloor environment and associated biological assemblages (Azores, NE Atlantic). In Baker, E. and P. Harris (eds.). Seafloor Geomorphology as Benthic Habitat: Geohab Atlas of Seafloor Geomorphic Features and Benthic Habitats. Elsevier Insights.

Tempera, F., M. McKenzie, I. Bashmachnikov, M. Puotinen, R.S. Santos & R. Bates (in press). Predictive modelling of dominant macroalgae abundance on temperate island shelves (Azores, northeast Atlantic). In Baker, E. and P. Harris (eds.). Seafloor Geomorphology as Benthic Habitat: Geohab Atlas of Seafloor Geomorphic Features and Benthic Habitats. Elsevier Insights.

Vecchione V., Odd Aksel Bergstad, Ingvar Byrkjedal, Tone Falkenhaus, Andrey V. Gebruk, Olav Rune Godø, Astthor Gislason, Mikko Heino, Åge S. Høines, Gui M. M. Menezes, Uwe Piatkowski, Imants G. Priede, Henrik Skov, Henrik Søliland, Tracey Sutton, Thomas de Lange WenneckLife Chapter 6: pp. 103-121. In the World's Oceans: Diversity, Distribution, and Abundance. Editors, Alasdair McIntyre (2010). Biodiversity Patterns and Processes on the Mid- Atlantic Ridge. Wiley Blackwell (Oxford)

Other national publications

Barriga, F. & R. S. Santos 2010. Capítulo 2. Ecologia do Mar. Parte 4. Recursos minerais marinhos, metálicos, não metálicos e energéticos: potencial e impactos ambientais. Pp. 86-95. In: N. V. Matias, V. Soromenho-Marques, J. Falcato, A. G. Leitão (Coord.). Políticas Públicas do Mar – Para um Novo Conceito Estratégico Nacional. 297pp. Esfera do Caos. Coleção Ideias (15), Lisboa. [ISBN 978-989-680-016-1]

Borges, P.A.V., Bried, J., Costa, A., Cunha, R., Gabriel, R., Gonçalves, V., Martins, A.F., Melo, I., Parente, M., Raposeiro, P., Rodrigues, P., Santos, R.S., Silva, L., Vieira, P., Vieira, V., Mendonça, E. and Boieiro, M. 2010. Description of the terrestrial and marine Azorean biodiversity. In A list of the terrestrial and marine biota from the Azores (Borges, P.A.V., Costa, A., Cunha, R., Gabriel, R., Gonçalves, V., Martins, A.F., Melo, I., Parente, M., Raposeiro, P., Rodrigues, P., Santos, R.S., Silva, L., Vieira, P. and Vieira, V., eds.). Príncipe, Cascais. Pp 9-33.

Martins, H., J.N. Pereira & F.M. Porteiro 2010. Thirty years of natural sciences in the Atlantic Ocean. 2010. Editorial Notes, Arquipélago. Life and Marine Sciences. no.27, 77 pp.

Porteiro Filipe M, Gui M. Menezes, Pedro Afonso, João Gama Monteiro & Ricardo. Serrão Santos. Peixes marinhos (Chondrichthyes, Actinopterygii), pp. 9-33. Borges, P.A.V., Costa, A., Cunha, R., Gabriel, R., Gonçalves, V., Martins, A.F., Melo, I., Parente, M., Raposeiro, P., Rodrigues, P., Santos, R.S., Silva, L., Vieira, P. & Vieira, V. (eds.) A list of the terrestrial and marine biota from the Azores, Príncipe, Cascais, 432 pp.

Prieto, R. & Silva, M. A. 2010. Marine Mammals. pp. 344-345 In: Borges, P.A.V., Costa, A., Cunha, R., Gabriel, R., Gonçalves, V., Martins, A.F., Melo, I., Parente, M., Raposeiro, P., Rodrigues, P., Santos, R.S., Silva, L., Vieira, P. & Vieira, V. (eds.) A list of the terrestrial and marine biota from the Azores, Príncipe, Cascais, 432 pp.

Reis, C. S. & R. S. Santos 2010. Capítulo 2. Ecologia do Mar. Parte 7. Os recursos pesqueiros. Pp. 112-118. In: N. V. Matias, V. Soromenho-Marques, J. Falcato, A. G. Leitão (Coord.). Políticas Públicas do Mar – Para um Novo Conceito Estratégico Nacional. 297pp. Esfera do Caos. Coleção Ideias (15), Lisboa. [ISBN 978-989-680-016-1]

Rodrigues, P., Bried, J., Rodebrand, S. and Cunha, R. 2010. Aves. In A list of the terrestrial and marine biota from the Azores (Borges, P.A.V., Costa, A., Cunha, R., Gabriel, R., Gonçalves, V., Martins, A.F., Melo, I., Parente, M., Raposeiro, P., Rodrigues, P., Santos, R.S., Silva, L., Vieira, P. and Vieira, V., eds.). Príncipe, Cascais. Pp 255-258.

Santos R. S. , Raul Bettencourt e Ana Colaço (in press). Os Campos Hidrotermais e a sua Biosfera. Proceedings of the Conference: Congresso dos Mares da Lusofonia - Comissão D. Carlos – 100 Anos. Lisboa

Santos, R. S. & E. Gonçalves 2010. Capítulo 2. Ecologia do Mar. Parte 8. Áreas marinhas protegidas. Pp. 119-127. In: N. V. Matias, V. Soromenho-Marques, J. Falcato, A. G. Leitão (Coord.). Políticas Públicas do Mar – Para um Novo Conceito Estratégico Nacional. 297pp. Esfera do Caos. Coleção Ideias (15), Lisboa. [ISBN 978-989-680-016-1]

Santos, R. S. 2010. A FLAD e o Departamento de Oceanografia e Pescas da Universidade dos Açores. Pp. 175-179. In FLAD 2010. 25 Anos-Depoimentos. Lisboa Abril 2010. 198pp.

Santos, R. S. 2010. Avanços na Investigação Científica no Mar dos Açores e Novas Oportunidade para a Economia do Mar. INGENIUM (II Série), 117: 32-34.

Santos, R. S. 2010. Capítulo 2. Ecologia do Mar. Parte 1. Introdução: A importância dos Oceanos. Pp. 73-74. In: N. V. Matias, V. Soromenho-Marques, J. Falcato, A. G. Leitão (Coord.). Políticas Públicas do Mar – Para um Novo Conceito Estratégico Nacional. 297pp. Esfera do Caos. Coleção Ideias (15), Lisboa. [ISBN 978-989-680-016-1]

Ph.D. thesis completed

Virginie Riou - MoMARNet (FP6-RTN/2003/505026) Marie Curie Fellowship 2005: Trophic ecology of the hydrothermal vent mussel *Bathymodiolus azoricus*. (co-tutela: PhD awarded by the University of the Azores, Portugal and by the Université Libre de Bruxelles, Belgium). (Approved 14 of January 2010) [supervised by Ricardo Serrão Santos and Ana Colaço]

Inês Martins – SFRH/BD/19736/2004: Ecotoxicological response of mussel *Bathymodiolus azoricus* from Lucky Strike hydrothermal vent: microenvironment biotic and abiotic influence. (University of the Azores). (Approved 9 of November 2010) [supervised by Ricardo Serrão Santos and Ana Colaço]

Group Productivity

Daphne Cuvelier – MarBEF (FP6-GOCE-CT-2003-505446) fellowship DeepSets 2006 & SFRH/BD/47301/2008: Temporal variations of the Mid-Atlantic hydrothermal vent communities from the Lucky Strike vent field. (PhD to be awarded by University of the Azores. In collaboration with University of Southampton-UK, MNH-UK, IFREMER-France, AWI-Germany). (entered for evaluation June 2010) [supervised by Ricardo Serrão Santos and Ana Colaço]

Patents/protopypes

None

Organization of conferences

- Final Freesubnet Workshop during which more than 30 scientists from 13 countries got together. The week-long event focused on the interplay between marine science and technology and consisted of a series of talks by experts and practical work at sea and in the laboratory. A previously unknown hydrothermal vent field in about 30m depth off Espalamaca, Faial Island, was described and mapped, an AUV built by students was tested in its first sea trial and a positioning system for biotelemetric studies was tested in cooperation with VEMCO (Canada). [Horta, 18-24 July 2010]

- ICES Working Group on Marine Mammal Ecology Meeting, 12-15 April 2010, Horta, Açores, Portugal.

- Science and Technology for the Deep-Sea: Session 1: Biodiversity and Ecosystem Functioning – Technology and Monitoring (6 July: 09:30 – 11:00);

Session 2: Resources and Opportunities (6 July: 11:00 – 13:00). Ciência 2010 - 4- 7 July 2010. Fundação Calouste Gulbenkian, Lisbon.

- Workshop on "Environmental Management of Deep-Sea Chemosynthetic Ecosystems: Justification of and Considerations for a Spatially Based Approach", 31 May through 4 June 2010, CRESCO, Dinard, France (Steering Committee).

- Conference: A Unified Approach for Sustainability in a Changing World: From Ocean Policy to Observations. 7-8 October 2010, Lisbon (FLAD and ISPA-IU) (Steering Committee).

- International Working Group for the Conservation of the Northwest Atlantic Loggerhead Nesting Population, September 14-16, 2010, Horta, Azores, Portugal.

- Annual Meeting of the ICES Working Group on Marine Mammal Ecology, 12- 16 April. Horta, Azores, Portugal.

- Annual Meeting of the ICES Working Group on Elasmobranchs, 22-29 July. Horta, Azores, Portugal.

Industry contract research

POPA - The Observers Program of the Fisheries of the Azores (Tuna component):

The Programme results from an agreement between Regional Administration, Earth Island Institute, the Tuna Canning Industry Association (Pão do Mar), the Fishing Boat Owners Association (APASA) and IMAR – Instituto do Mar - through the University of The Azores Center (IMAR-DOP/UAc), which carries out the programme.

In 1999, the Regional Secretary has implemented a regional law (portaria regional 31/99) which recognizes POPA as a Program with full capacity for monitoring any kind of fishery. The POPA Program worked with several fisheries. under contract with the fisheries industry, such as:

1) black scabbard fishery with drift bottom long line, 2) experimental king crab fishery with bottom traps, 3) pole and line fishery for tuna in Angola. 4) Shrimp fisheries in teh Mediterranean.

Certification of canned tune. Contracts with the tuna canned industry in view to certify the product in terms of safety for health (heavy metals and histamines).

Internationalization

- Member of the Pelagic Working Group under the Global Ocean Biodiversity Initiative. Meeting a moving target, Realizing global objectives for conservation of the pelagic realm.

- Member of the International Working group for the Conservation of the Northwest Atlantic Loggerhead Nesting Population

- Collaborative research with the Oceanic Fisheries Programme of the Secretariat of the Pacific Community (SPC), Noumea, New Caledonia to analyses tuna fishing on west and central Pacific Ocean seamounts.

- Working Group and Strategic paper on: 2010 - Science dimensions of an Ecosystem Approach to Management of Biotic Ocean Resources (SEAMBOR). Marine Board-ESF Position Paper 14 : 86pp. ESF – Marine Board, Ostend, Belgium. ISBN: 978-2-918428-10-7

- Working Group and Strategic paper on: 2010. Marine Strategy Framework Directive. Guidance on the interpretation and application of Descriptor 1: Biological diversity. Report by Task Group 1 on Biological diversity for the European Commission's Joint Research Centre, Ispra, Italy. 120pp. ISBN 978-92-79-15650-2; ISSN 1018-5593; doi:10.2788/86653

- Responsible for ackground papers for OSPAR : 1) 2010- Oceanic ridges with hydrothermal vents/fields. Biodiversity Series (Publication No. 490/2010): 17pp. OSPAR; 2) 2010. Seamounts. Biodiversity Series (Publication No. 492/2010): 28pp..

- Supervision of four MSc thesis students (Norway, Italy, Serbia, South Africa) of the Erasmus Mundus Master of Science in Marine Biodiversity and Conservation (EMBC).

- Member of the International Scientific Committee of OCOSS'10"Ocean & Coastal Observation"

- Co-chair of the Interridge group "Monitoring and Observatories; Member of the ESONET Scientific Council; Member of the ESONET Scientific

Group Productivity

Council.

- Collaborative research on sperm whale socio-ecology with the Woods Hole Oceanographic Institution (USA), the University of Southern Denmark (USD) and the University of Århus (UA), Denmark.

Scientific international cruises: 1) RRS James Cook with the ROV Isis to the Mid-Atlantic-Ridge, project ECOMAR – 'Ecosystems of the Mid-Atlantic Ridge at the sub-polar front and Charlie-Gibbs Fracture Zone'; 2) MoMARSAT on board the RV PourquoiPas? with the ROV Victor-6000 to install an observatory at Lucky Strike; 3) MenezMAR on board the RV Meteor with the ROV Quest.

Government/Organization contract research

The Research Group (RG) has been involved in contracts with Government Bodies concerning, e.g. the following Public Policies and governance bodies: International Whaling Commission, Common Fisheries Policies, Habitats and Birds Directives (Natura 2000), OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic, Convention of Biological Diversity, and the International Council for the Exploration of the Seas, the Marine Strategy Framework Directive, the Azores Marine Park.

Additionally the Group as been involved in the implementation of the Condor Seamount Observatory, on the Monitoring, Control and Eradication of the Invasive seaweed Caulerpa.

Contracts:

1 - CAULERPA - Monitoring, Control and Eradication of the Invasive seaweed Caulerpa.

2- POPA - Fisheries Observer Program of the Azores

3 - CETPESCA - Monitoring interactions of cetaceans and the squid fishery. Contract Research with the Regional Secretariat for the Environment and the Sea

4 - DEMERSAIS - Monitoring deep-sea fisheries cruises

5- Ships - Management and operation of RV Arquipelago and LI Águas-Vivas

- some reports:

ICES. 2010. Report of the Working Group on Marine Mammal Ecology (WGMME), April 12-15 2010, Horta, The Azores, ICES CM 2010/ACOM, 200pp.

IWC. 2010. PORTUGAL: Progress report on cetacean research, January 2009 to December 2009, with statistical data for the calendar year 2009. Report of the International Whaling Commission, SC-62-ProgRep Portugal, 15pp.

OSPAR Commission. 2010. Background Document for the Northern right whale *Eubalaena glacialis*. Biodiversity Series, 496/2010, 21pp.

OSPAR Commission. 2010. Background Document for blue whale *Balaenoptera musculus*. Biodiversity Series, 495/2010, 20pp.

OSPAR Commission. 2010. Background Document for bowhead whale *Balaena mysticetus*. Biodiversity Series, 494/2010, 19pp.

Marine Board/ESF 2010 - Science dimensions of an Ecosystem Approach to Management of Biotic Ocean Resources (SEAMBOR). Marine Board-ESF Position Paper 14 : 86pp. ESF – Marine Board, Ostend, Belgium. ISBN: 978-2-918428-10-7.

JRC 2010 - Marine Strategy Framework Directive. Guidance on the interpretation and application of Descriptor 1: Biological diversity. Report by Task Group 1 on Biological diversity for the European Commission's Joint Research Centre, Ispra, Italy. 120pp. ISBN 978-92-79-15650-2; ISSN 1018-5593; doi:10.2788/86653

Group Description	
Title of Research Group:	(RG-LVT-50009-3438) DSORL - Dynamical Systems and Ocean Robotics Laboratory
Principal Investigator:	Carlos Jorge Ferreira Silvestre
Main Scientific Domain:	Engenharia Electrotécnica e Informática
Group Host Institution:	Instituto Superior Técnico - Universidade Técnica de Lisboa

Funding, source, dates
Funding, source, dates
Source Project Reference DSORL Funding in 2010
National
FCT DENO 2007-2010 PTDC/EEA-ACR/67020/2006
FCT HELICIM 2007-2010 PTDC/EEA-ACR/72853/2006
FCT OBSERVFLY 2008-2011 PTDC/MAR/64546/2006
FCT NAV 2007-2010 PTDC/EEA-ACR/65996/2006
AdI AIRTICI 2009-2012 QREN
European
EC FREEsubNET - 2006-2010 MRTN-CT-2006-036186
EC CO3AUVs 2009-2012 FP720073 ICT-2007.2.1
EC TRIDENT 2010-2013 FP7248497 ICT-2009.2.1
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Objectives & Achievements
Objectives
<p>The key objectives of the R&D work carried out at the DSORL are twofold: i) to study a number of challenging theoretical problems in the areas of advanced robotic vehicle systems design, navigation, and control, and ii) exploit the theoretical methodologies developed to yield faster, cheaper, and far more efficient tools for ocean exploration and exploitation as well as critical infrastructure monitoring, than those available today. The tools include surface and underwater robots, as well as aerial vehicles working as communication relays or re-directing the operations of marine vehicles upon detection of relevant episodic events. These goals have motivated the definition of a research and development program addressing theoretical and practical engineering topics, as well as issues that are at the crossroads of marine science and technology, the main focus of the cooperative research and development work set forth under Thematic Area A. Two main lines of action underpin the work carried out at the DSORL:</p>
<p>1. Contributing to furthering the knowledge in the general area of dynamical system theory.</p>
<p>2. Developing new analysis and design tools in the areas of navigation, guidance, and control (NGC) and applying them to the development of advanced systems enabling the operation of multiple networked autonomous marine and aerial vehicles.</p>
<p>- Theoretical Objectives:</p>
<p>A. Linear and nonlinear systems theory: study and development of theoretical tools for the analysis and design of linear and nonlinear control / filtering systems.</p>
<p>B. Robust Multiple Model Adaptive Control (RMMAC): Development of new methodologies for the design of robust adaptive controllers for plants with structured and unstructured uncertainty.</p>
<p>C. Design of Navigation and Positioning Systems for autonomous underwater platforms and human divers. Study of advanced solutions focusing on the: i) development of high performance, moderate cost heading and attitude reference units; ii) study and practical evaluation of acoustics-based systems for underwater vehicle positioning; iii) development of geophysical-based navigation algorithms.</p>
<p>D. Motion Control of single and multiple vehicles under stringent communication constraints, including those imposed by a very special medium: the ocean, with its plethora of phenomena that include multiple path effects, ray bending, and fading. Problems addressed: i) Motion control of autonomous vehicles with inner-outer loop control loops; ii) Visual servoing control; iii) Path Following; iv) Terrain Contour Tracking; v) Coordinated/cooperative control and navigation of groups of autonomous vehicles; vi) Diver assisted control by resorting to robot companions; vii) Networked control over faulty communication links.</p>
<p>E. Development of advanced methods for Cooperative Multiple Vehicle Mission Planning and Execution under energy and temporal constraints, in the presence of stationary and moving obstacles.</p>
<p>- Practical Objectives:</p>

Objectives & Achievements

- A. Design and development of Autonomous Underwater Vehicles (AUVs), Autonomous Surface Crafts (ASCs), and Unmanned Air Vehicles (UAVs); with on-board integration of scientific sensor suites and data acquisition / logging systems.
- B. Distributed hardware and software architectures for coordinated navigation and motion control of multiple vehicles as well as mission control of heterogeneous platforms.
- C. Tests and scientific missions with the robots developed in cooperation with the scientific partners in Thematic Area A and other international institutions.
- D. Dissemination actions for young students and the general public with the objective of bringing visibility to the challenging area of advanced marine / aerial robotics systems and their application to demanding scientific, surveillance, and security mission scenarios.

Main Achievements

THEORETICAL ACHIEVEMENTS

1. Further advances in the formulation of a Multiple-Model Adaptive Control (MMAC) architecture for linear time-invariant and time-varying plants subjected to structured and unstructured uncertainty, and sensor noise. The techniques yield - under certain conditions - closed loop robust stability and performance guarantees.
2. Study of new algorithms for control and state estimation on $SE(3)$ to: i) extend the LQR problem to non-compact Lie Groups and ii) solve the state estimation problem of left-invariant dynamical system evolving on the special Euclidean group $SE(3)$ with implicit output functions. These techniques have wide ranging applications in control and estimation of autonomous robotic vehicles equipped with vision systems.
3. Further developments on multiple model adaptive estimation (MMAE) and model identification (MMAI) methods that rely on a minimum energy criterion.
4. Further developments on a new methodology for multiple vehicle cooperative path planning to meet desired temporal and energy expenditure objectives, with due account for temporal or spatial deconfliction as well as communication and geophysical-based navigational requirements.
5. Further studies and assessment in simulation of the efficacy of a set of algorithms for cooperative motion control of multiple autonomous marine vehicles in the presence of communication failures, with due account for collision avoidance in dynamic environments.
6. Study and assessment (in simulation and through field tests) of the performance achievable with time-coordinated path following systems for multiple UAVs over time-varying networks using L1 adaptation (work done in cooperation with the Naval Postgraduate School, Monterey, CA and the Univ. Illinois, Urbana, USA).
7. Development of Lyapunov-based adaptive nonlinear control systems with application to the design of depth tracking and attitude controllers for underwater towed vehicles with parametric uncertainty.
8. Further development of new algorithms for AUV single beacon acoustic navigation in the presence of unknown ocean currents.
9. Improvement of the capabilities of "NetMarSyS: A Networked Marine Systems Simulator for Hardware-In-The-Loop Testing of Cooperative Multiple Vehicle Control and Navigation Systems" developed at the ISR/IST to assess the performance of advanced cooperative and navigation control algorithms prior to system implementation and testing at sea.
10. Study of nonlinear filtering structures for USBL tightly coupled inertial navigation and development of nonlinear GPS/IMU based observers for rigid body attitude and position estimation.
11. Derivation of a Rotorcraft image based controllers for extended flight envelope coverage. The proposed solution consists of a nonlinear state feedback controller for thrust and torque actuations that uses directly in the control loop the image features.
12. Further development of new methods to prove almost input-to-state stability (ISS) and almost global stability of nonlinear "rotational motion" systems by exploiting the combined use of Lyapunov Functions and Density Functions.
13. Development of algorithms for Nonlinear Attitude Estimation Systems Using Active Vision and Inertial Measurements, as applied to the problem of estimating the attitude of a rigid body equipped with a triad of rate gyros and a pan and tilt camera.
14. Further results on Networked Control Systems. New developments were obtained for a class of systems that is especially suited to model networked control systems utilizing CSMA-type protocols, with stochastic intervals between transmissions and packet drops.
15. Development of a new methodology for optimal placement of networked acoustic sensors to track multiple underwater targets by resorting to tools from estimation theory and multiple-objective optimization.

PRACTICAL ACHIEVEMENTS

1. Design, development, and test of an autonomous quadrotor for the inspection of critical infrastructures. This aerial vehicle, developed under the AIRTICI project, is equipped with video cameras and lasers that together with advanced control and navigation algorithms will allow the robot to operate close to walls or under bridges without GPS.
2. Design, development, and test of an integrated Ultra Short Baseline (USBL) and Inertial Navigation System (INS) to be used as a low cost cooperative navigation system for underwater robotic vehicles. Preliminary sea tests were conducted in Sesimbra in the scope of the TRIDENT project.
3. Further development and testing of MEDUSA, an autonomous semi-submersible vehicle (SSB) that is being used in the scope of the EU

Objectives & Achievements

CO3AUVs project. The vehicle is equipped with acoustic devices for underwater target tracking and complementary terrain-based / single beacon navigation experiments.

Group Productivity

Publications in peer review Journals

Duarte Antunes, Carlos Silvestre, Rita Cunha, On the Design of Multi-Rate Tracking Controllers: Application to Rotorcraft Guidance and Control, International Journal of Robust and Nonlinear Control, Volume 20, Issue 16, Pages: 1879–1902 , November 2010.

P. Batista, C. Silvestre, P. Oliveira, A time differences of arrival based homing strategy for autonomous underwater vehicles, International Journal of Robust and Nonlinear Control, Vol.20, Issue 15, Pages 1758–1773, October 2010.

Francisco C. Teixeira, A. Pedro Aguiar and António M. Pascoal, Nonlinear adaptive control of an underwater towed vehicle. Ocean Engineering, Vol. 37, No. 13, pp. 1193-1220, September 2010.

P. Batista, C. Silvestre, P. Oliveira, Optimal Position and Velocity Navigation Filters for Autonomous Vehicles, Elsevier Automatica, Vol.46, Issue 4, Pages 767-774, April 2010.

I. Kammer, A. Pascoal, E. Xargay, N. Hovakimyan, C. Cao, and V. Dobrokhodov, Path Following for Unmanned Aerial Vehicles using L1 Adaptive Augmentation of Commercial Autopilots, Journal of Guidance, Control, and Dynamics, Vol. 33, NO. 2, pp. 550-565, March-April 2010.

J. F. Vasconcelos, C. Silvestre, P. Oliveira, B. Guerreiro, Embedded UAV model and LASER aiding techniques for inertial navigation systems. Elsevier Control Engineering Practice, Vol.18, Issue 3, Pages 262-278, March 2010.

J. F. Vasconcelos, Rita Cunha, Carlos Silvestre, Paulo Oliveira, A nonlinear position and attitude observer on SE(3) using landmark measurements. Elsevier Systems and Control Letters, Vol.59, issue 3, Pages 155–166, 2010.

P. Oliveira, Gomes L., Interpolation of Signals with Missing Data using Principal Component Analysis. Multidimensional Systems and Signal Processing Journal, Springer, Vol. 21, no1, Pages 25-43, March 2010.

Other international publications

João Almeida, Carlos Silvestre, António Pascoal, Self-Triggered State Feedback Control of Linear Plants under Bounded Disturbances, Proc. 49th IEEE CDC 2010, Atlanta, Georgia, USA, December 2010.

Alessandro Saccon, John Hauser, and A. Pedro Aguiar, Optimal Control on Non-Compact Lie Groups: A Projection Operator Approach, 49th IEEE CDC 2010, Georgia USA, Dec. 2010.

M. Morgado, P. Batista P. Oliveira, C. Silvestre, Position USBL/DVL Sensor-Based Navigation Filter in the Presence of Unknown Ocean Currents, Proc. 49th IEEE CDC 2010, Atlanta, Georgia, USA, December 2010.

Duarte Antunes, João P. Hespanha, Carlos Silvestre, Impulsive Systems Triggered by Superposed Renewal Processes, Proc. 49th IEEE CDC 2010, Atlanta, Georgia, USA, December 2010.

Pedro Serra, Florent Le Bras, Tarek Hamel, Carlos Silvestre, Rita Cunha, Nonlinear IBVS Controller for the Flare Maneuver of Fixed-Wing Aircraft Using Optical Flow, Proc. 49th IEEE CDC 2010, Atlanta, Georgia, USA, December 2010.

D. Cabecinhas, C. Silvestre, R. Cunha, Vision-Based Quadrotor Stabilization Using a Pan and Tilt Camera, Proc. 49th IEEE CDC 2010, Atlanta, Georgia, USA, December 2010.

Paulo Rosa, Carlos Silvestre, Jeff S. Shamma, Michael Athans, Fault Detection and Isolation of LTV Systems Using Set-Valued Observers, Proc. 49th IEEE CDC 2010, Atlanta, Georgia, USA, December 2010.

Marco Morgado, Paulo Oliveira, and Carlos Silvestre, Experimental evaluation of a USBL underwater positioning system, Proc. 52nd International IEEE Symposium ELMAR-2010, Zadar, Croatia, September 2010.

Narcis Palomeras, Pere Ridao, Marc Carreras, Carlos Silvestre, Towards a Deliberative Mission Control System for an AUV, 7th IFAC Symposium on Intelligent Autonomous Vehicles, IAV 2010, Lecce, Italy, September, 2010.

Pedro J. Sanz, Pere Ridao, Gabriel Oliver, Claudio Melchiorri, Giuseppe Casalino, Carlos Silvestre, Yvan Petillot, Alessio Turetta, TRIDENT: A Framework for Autonomous Underwater Intervention Missions with Dexterous Manipulation Capabilities, 7th IFAC Symposium on Intelligent Autonomous Vehicles, IAV 2010, Lecce, Italy, September, 2010.

Paulo Rosa, Carlos Silvestre, Jeff S. Shamma, Michael Athans, Fault Detection and Isolation of an Aircraft Using Set-Valued Observers, 18th IFAC Symposium on Automatic Control in Aerospace ACA2010, Nara, Japan, September 2010.

B. Guerreiro, C. Silvestre, R. Cunha, Laser-Based Trajectory Tracking H2 Control of Autonomous Rotorcraft, 18th IFAC Symposium on Automatic Control in Aerospace ACA2010, Nara, Japan, September 2010.

Pedro Batista, Carlos Silvestre, Paulo Oliveira, A Sensor-based Long Baseline Position and Velocity Navigation Filter for Underwater Vehicles, 8th IFAC Symposium on Nonlinear Control Systems (NOLCOS 2010), Bologna, Italy, September 2010.

C. Silvestre, P. Figueiredo, and P. Rosa, Multiple-Model Set-Valued Observers: a new tool for HRF model selection in fMRI, Proc. of EMBC 2010 - 32th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Buenos Aires, Argentina, September, 2010.

Group Productivity

C. Silvestre, P. Figueiredo, and P. Rosa, On the Distinguishability of HRF Models in fMRI, Proc. of EMBC 2010 - 32th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Buenos Aires, Argentina, September, 2010.

Vahid Hassani, António M. Pascoal, A. Pedro Aguiar, and Michael Athans, A Multiple Model Adaptive Wave Filter for Dynamic Ship Positioning, CAMS 2010 - 8th IFAC Conference on Control Applications in Marine Systems, Rostock, Germany, Sep. 2010.

Sérgio Carvalhosa, A. Pedro Aguiar, and A. Pascoal, Cooperative Motion Control of Multiple Autonomous Marine Vehicles: Collision Avoidance in Dynamic Environments, IAV 2010 - 7th Symposium on Intelligent Autonomous Vehicles, Lecce, Italy, Sep. 2010.

M. Bayat and A. Pedro Aguiar, SLAM for an AUV using vision and an acoustic beacon, IAV 2010 - 7th Symposium on Intelligent Autonomous Vehicles, Lecce, Italy, Sep. 2010.

Andreas J. Häusler, Reza Ghabcheloo, António M. Pascoal, and A. Pedro Aguiar, Multiple Marine Vehicle Deconflicted Path Planning with Currents and Communication Constraints, IAV 2010 - 7th Symposium on Intelligent Autonomous Vehicles, Lecce, Italy, Sep. 2010.

Alessandro Saccon, John Hauser, and A. Pedro Aguiar, Exploration of Kinematic Optimal Control on the Lie Group $SO(3)$, NOLCOS'10 - 8th IFAC Symposium on Nonlinear Control Systems, Bologna, Italy, Sep. 2010.

Sérgio S. Rodrigues, Naveena Crasta, A. Pedro Aguiar, and Fátima S. Leite, State estimation for systems on $SE(3)$ with implicit outputs: An application to visual servoing, NOLCOS'10 - 8th IFAC Symposium on Nonlinear Control Systems, Bologna, Italy, Sep. 2010.

Rui F. Barreiro, A. Pedro Aguiar, and João M. Lemos, Moving Horizon Estimation with Decimated Observations, NOLCOS'10 - 8th IFAC Symposium on Nonlinear Control Systems, Bologna, Italy, Sep. 2010.

V. Dobrokhodov, I. Kaminer, K. Jones, E. Xargay, Z. Li, N. Hovakimyan, A. Pedro Aguiar, A. M. Pascoal, On Coordinated Road Search using Time-Coordinated Path Following of Multiple UAVs, GN&C'10 - AIAA Guidance, Navigation and Control Conference, Toronto, Canada, Aug. 2010.

P. Figueiredo, C. Silvestre, P. Rosa, Nonlinear HRF model identification using multiple model set valued observers, Proc. of HBM 2009 - 16th Annual Meeting of the Organization for Human Brain Mapping, Barcelona, Spain, June 2010.

Batista, Pedro, Silvestre, Carlos, Oliveira, Paulo, Single Beacon Navigation: Observability Analysis and Filter Design, Proc. ACC 2010, Baltimore, Maryland, USA, June 2010.

Brás, S., Cunha, R., Vasconcelos, J. F., Silvestre, C., Oliveira, P., Experimental Evaluation of a Nonlinear Attitude Observer Based on Image and Inertial Measurements, Proc. ACC 2010, Baltimore, Maryland, USA, June 2010.

Antunes, Duarte, Hespanha, João P., Silvestre, Carlos, Stochastic Hybrid Systems with Renewal Transitions, Proc. ACC 2010, Baltimore, Maryland, USA, June 2010.

Palomeras, Narcis, Ridao, Pere, Silvestre, Carlos, El-fakdi, Andres, Multiple vehicles mission coordination using Petri nets, Proc. of the IEEE ICRA 2010, Anchorage AL, USA, May 2010.

Cabecinhas, D., Naldi, R., Marconi, L., Silvestre, C., Cunha, R., Robust take-off and landing for a quadrotor vehicle, Proc. of the IEEE ICRA 2010, Anchorage AL, USA, May 2010.

Morgado, M., Oliveira, P., Silvestre, C., Design and experimental evaluation of an integrated USBL/INS system for AUVs, Proc. of the IEEE ICRA 2010, Anchorage AL, USA, May 2010.

Batista, Pedro, Silvestre, Carlos, Oliveira, Paulo, Carneira, Bruno, Low-cost Attitude and Heading Reference System: Filter design and experimental evaluation, Proc. of the IEEE ICRA 2010, Anchorage AL, USA, May 2010.

Ekim P., Gomes J., Xavier J., Oliveira P., A Quasi-Convex Relaxation for Approximate Maximum-Likelihood 2D Source Localization from range Measurements, 35th ICASSP, Dallas, USA, March 2010.

Other national publications

Alessandro Saccon, John Hauser, and A. Pedro Aguiar, On the closed-form solution of an optimal control problem on the Lie Group $SO(3)$, in Proc. of CONTROLO'10 - 9th Portuguese Conference on Automatic Control, Coimbra, Portugal, September 2010.

Rui F. Barreiro, A. Pedro Aguiar, and João M. Lemos, State Estimation of the HIV-1 Infection using a Moving Horizon Based Estimator, in Proc. of CONTROLO'10 - 9th Portuguese Conference on Automatic Control, Coimbra, Portugal, Sep. 2010.

Vahid Hassani, Omid Namaki-Shoushtari, A. Pedro Aguiar, and António M. Pascoal, Robust Interval Observers for Uncertain Continuous-time Systems, in Proc. of CONTROLO'10 - 9th Portuguese Conference on Automatic Control, Coimbra, Portugal, September 2010.

Almeida M., Oliveira P., Estimation of Chaotic States Using Extended Kalman Filters, 9th Portuguese Conference on Automatic Control-CONTROLO2010, Coimbra, September 2010.

Picão J., Morgado M., Oliveira P., Silvestre C., USBL Positioning System: Implementation and Tests at Sea, 9th Portuguese Conference on Automatic Control-CONTROLO2010, Coimbra, September 2010.

Ph.D. thesis completed

Group Productivity

Title: Sensor-based Navigation and Control of Autonomous Vehicles.

Student: Pedro Batista

Thesis reviewers: Prof. Claude Samson (INRIA Sophia Antipolis, France), Prof. Robert Mahoney (Australian National University, Canberra, Australia).

Concluded 2010.

Title: Nonlinear Navigation System Design with Application to Autonomous Vehicles.

Student: José Maria Vasconcelos.

Thesis reviewers: Prof. Anders Rantzer (University of Lund, Sweden), Prof. Jorge Miranda Dias (Universidade de Coimbra, Portugal).

Concluded 2010.

Title: Positioning and Navigation Systems for Robotic Underwater Vehicles.

Student: Alex Alcocer Penas.

Thesis reviewers: Prof. Jérôme Jouffroy, (University of Southern Denmark), Prof. Aníbal Castilho Coimbra de Matos (Faculdade de Engenharia da Universidade do Porto, Portugal).

Concluded 2010.

Patents/propotypes

1. DELFIM and DELFIM_X Autonomous Surface Vehicles (ASCs) – designed and built by ISR/IST to carry out experimental research in the area of ocean robotics and to perform scientific missions at sea. These vehicles have been used to acquire marine data in the Azores, in cooperation with the partner IMAR/DOP and to carry out experiments on single and multiple vehicle cooperative control.

2. INFANTE Autonomous Underwater Vehicle (AUV) – designed and built by ISR/IST and the company RINAVE to carry out experimental research in the area of ocean robotics and to perform scientific missions at sea. The vehicle is 4:5m long, 1:1m wide and 0:6m high. It is equipped with two main thrusters (propellers and nozzles) for cruising and fully moving surfaces (rudders, bow planes and stern planes) for vehicle steering and diving in the horizontal and vertical planes, respectively.

3. MAYA AUV – designed and built by a Luso-Indian consortium consisting of NIO (Goa, India), ISR/IST, IMAR/DOP/UAzores, and RINAVE. A small, modular, autonomous underwater vehicle (AUV) for scientific and commercial applications. Missions include geological and oceanographic surveys, marine habitat mapping, inspection of harbours and estuaries. The first prototype has been tested and used extensively in Goa, India.

4. CARAVELA 2000 Autonomous Research Vessel – designed and built by IMAR/DOP/UAzores, ISR/IST, and the companies RINAVE. and CONAFI Prototype of an autonomous surface craft for long range missions at sea (co-owned by IST/ISR, IMAR/Dept. Oceanography and Fisheries of the Univ. Azores, RINAVE, and CONAFI).

5. Autonomous Helicopter (Bergen Industrial Twin) - a small-scale industrial helicopter. This is a transformed radio-controlled helicopter, about 1.6m long (including the rotor diameter), with a payload capability of 10 kg, and a top speed of 70 Km per hour.

6. Autonomous Quadrotor– designed and built by ISR/IST. A quadrotor helicopter with payload capability of about one kg. Design in the scope of the AIRTICI project for aerial vehicle hardware and software architectures test and evaluation. This prototype will be used in bridge inspection tasks.

7. Medusa – designed and built by ISR/IST. First prototype of a class of semi-submerged vehicles of small size for underwater target positioning. A set of up to 4 vehicles acting cooperatively will be used in the scope of the EU COGAUVs (Cognitive marine robotics) project for assisted diving operations.

Organization of conferences

Member of the Technical Committee of the 18th European Signal Processing Conference - EUSIPCO 2010, Aalborg, Denmark, 2010.

Member of the Technical Committee of the 9th Portuguese Conference on Automatic Control-CONTROLO2010, Coimbra, September 2010.

Member of the Technical Committee of the 10th Conference on Mobile Robots and Competitions "ROBOTICA2010," Leiria, March 2010.

Group Productivity

Member of the Technical Committee of the 7th IFAC Symposium on Intelligent Autonomous Vehicles, Lecce, Italy, September 2010.

Chairman of the session: Fault Diagnosis II, 49th IEEE Conference on Decision and Control (CDC 2010), Atlanta, Géorgia, USA, December 2010.

Chairman of the session: Networked Control Systems IV, 49th IEEE Conference on Decision and Control (CDC 2010), Atlanta, Géorgia, USA, December 2010.

Chairman of the session: Modeling III, 49th IEEE Conference on Decision and Control (CDC 2010), Atlanta, Géorgia, USA, December 2010.

Member of the Technical Committee of the 49th IEEE Conference on Decision and Control (CDC 2010), Atlanta, Georgia, USA, December 2010.

Member of the Technical Committee of the International Conference on Emerging Technologies and Factory Automation, ETFA'2010, Bilbao, Spain, September 2010.

Member of the Technical Committee of the 7th IFAC Symposium on Intelligent Autonomous Vehicles, IAV 2010, , Lecce, Italy, September 2010.

Chairman of the session: Navigation and Path Planning, American Control Conference (ACC 2010), Baltimore, Maryland, USA, July 2010.

Industry contract research

External consultancy in "Embedded Control and Automation Systems for a Pellet Heating System," SOLZAIMA (Águeda), July 2010.

Internationalization

[1] Naval Postgraduate School, Monterey, CA (USA) – a long standing collaborative research program on AUV and UAV Navigation, Guidance, and Control (NGC) as well as cooperative multiple vehicle path planning and control with temporal and spatial deconfliction.

[2] Center for Control, Dynamical Systems, and Computation (CCDC) at the University of California, Santa Barbara, CA (USA) – joint work on control, estimation theory, and networked control systems.

[3] National Institute of Oceanography (NIO), Goa (India) – an intensive AUV research and development program initiated in 1999.

[4] Department of Engineering Cybernetics, Norwegian University of Science and Technology (NTNU), Trondheim (Norway) - exchange of students and research personnel; joint work on cooperative path following control.

[5] IFREMER (French Institute for Ocean Exploitation) – (France). Joint participation in the network of excellence FREESUB. Joint realization of missions at sea.

[6] School of Electrical and Computer Engineering, Georgia Institute of Technology (USA) – exchange of research personnel and joint initiatives on development of decision systems based on Set Valued Observers.

[7] Laboratoire I3S – CNRS, Sophia-Antipolis, NICE France. Exchange of research personnel and joint initiatives on Sensor Based Control for Unmanned Air Vehicles.

[8] Dept. Electrical and Computer Engineering, Carnegie Mellon University, Pittsburgh (USA) - exchange of research personnel and joint initiatives on Analysis and Design of Complex Hybrid Dynamical Control Systems.

[9] University of Lund, Sweden – exchange of research personnel and joint initiatives on the development of stability analysis techniques for nonlinear observers on manifolds.

[10] INRIA, Sophia-Antipolis, NICE France. Exchange of research personnel and joint initiatives on Sensor Based Control for Unmanned Air Vehicles.

* Participation in International Technical Committees

Chair and Member of the IFAC Technical Committee on Marine Systems.

Member of the IFAC Technical Committee on Aerospace

Member of the IEEE Technical Committee on Aerospace Control

Member of the IFAC Technical Committee on Intelligent Autonomous Vehicles.

Associate Editor, IEEE Oceanic Engineering.

Vice-President of EurOcean, the European Portal for Marine Science and Technology.

Group Description	
Title of Research Group:	(RG-LVT-50009-3447) Signal and Image Processing Group
Principal Investigator:	Isabel Maria Gonçalves Lourtie
Main Scientific Domain:	Engenharia Electrotécnica e Informática
Group Host Institution:	Instituto Superior Técnico - Universidade Técnica de Lisboa

Funding, source, dates
<p>Funding, source, dates</p> <p>Source Project Reference Funding in 2010</p> <p>FCT SIPM PTDC/EEA-ACR/73749/2006</p> <p>FCT MODI PTDC/EEA-ACR/72201/2006</p> <p>FCT SMARTVISION PTDC/EIA/73633/2006</p> <p>FCT WEAM PTDC/ENR/70452/2006</p> <p>FCT PHITOM PTDC/EEA-TEL/71263/2006</p> <p>FCT U-BOAT PTDC/EEA-CRO/67066/2006</p> <p>FCT ADDI PTDC/SAU-BEB/103471/2008</p> <p>FCT ARGUS PTDC/EEA-CRO/098550/2008</p> <p>FCT VISTA PTDC/EIA-EIA/105062/2008</p> <p>FCT HEARTRACK PTDC/EEA-CRO/103462/2008</p> <p>FCT SENSOCAN PTDC/EEA-ELC/104561/2008</p> <p>FCT URBISNET PTDC/EEA-CRO/104243/2008</p> <p>FCT PRINTART PTDC/EEA-CRO/098822/2008</p> <p>FCT Fibromyalgia PTDC/SAU-BEB/104948/2008</p> <p>FCT ADCOD PTDC/EEA-TEL/099973/2008</p> <p>EU UAN FP7, ICT/Security</p> <p>EU OAE_x FP7, IRSES, PEOPLE</p> <p>EU IMASEG3D PIIF-GA-2009-236173</p> <p>EU SIMBAD FT7-ICT-2007-C</p> <p>.</p>

Objectives & Achievements
<p>Objectives</p> <p>Fundamentals.</p> <p>Fitting bilinear models to given data with missing measurements is a core problem in many applications stemming from computer vision, wireless communications, machine learning, etc. This translates into difficult constrained nonconvex optimization problems which are commonly addressed on a case-by-case basis. The goal is to develop a novel optimization framework to enable an unified and modular treatment of this class of inference problems.</p> <p>Sensor Networks.</p> <p>Consensus is an iterative distributed algorithm that computes the global average of data distributed among a network of agents using only local communications. It arises in many different areas, e.g., distributed data fusion and coordination of mobile autonomous agents. The speed of consensus algorithms depends critically on the choice of the weights with which neighboring nodes mix their states. Design of optimal weights is well-understood for networks with fixed topologies. However, in practice, networks usually exhibit random time-varying topologies either because the underlying wireless channels supporting the network links experience random fading or the network protocol itself is randomized, e.g., link states along time are controlled by a randomized protocol like standard gossip. The goal is to design the mixing weights for consensus algorithms so that the convergence towards consensus is the fastest possible, for the challenging scenario of networks with random topologies.</p> <p>Many applications of sensor networks require some form of surveillance or tracking, and thus critically rely on the availability of spatial information, e.g., knowing the location of a detected target, or the positions of sensing nodes. Due to economic constraints conventional solutions for localization based on GPS are usually unfeasible, and calibration of sensor positions is often not practical when a very large number of nodes must be deployed. One of the research goals is to obtain estimates for the positions/parameters of point-like or diffusive sources from unreliable measurements of range, received signal strength, or concentrations of some types of gases obtained at the sensors.</p> <p>Underwater Acoustics</p>

Objectives & Achievements

Taking advantage of the spatial diversity of multi-sensor arrays and the inherent physical media variability, the emphasis of this group is to provide enhanced methods for underwater acoustic channel distortion mitigation. Areas of application include: mobile and fixed node underwater acoustic networks, target detection in port protection activities and remote environmental monitoring. This group counts with 4 permanent staff professors, 3 postdoc, 4 PhD students, 2 undergraduate students and 2 engineers.

Image and Video Analysis

In what respects to Image and Video Analysis Several, our group addresses several fundamental problems, guided by key applications. In general, our objectives concern the development of fundamental tools for inferring high level content from image sequences, with applications that range from image recognition to medical image analysis. Examples are the representation and estimation of non-rigid (i.e., deformable) 3D shape of objects from video sequences; the development of representations suitable for image recognition tasks such as image database indexing, information retrieval and object recognition; the recognition of human activity in surveillance applications; the detection of skin lesions in dermoscopic images; and the automatic segmentation of the left ventricle of the heart in ultrasound images.

Main Achievements

Fundamentals.

We developed a novel unified approach to handle seamlessly several bilinear factorization problems in which one of the factors is constrained to lie on a manifold. Also, missing data in the measurements is allowed. We introduced an equivalent problem decoupling the core bilinear aspect from the manifold specificity. We then tackle the resulting constrained optimization problem with Bilinear factorization via Augmented Lagrange Multipliers (BALM). The mechanics of our algorithm are such that only a projector onto the manifold constraint is needed. This work originated an ECCV'10 publication and a journal submission to IEEE-PAMI.

Sensor Networks.

We have developed a method to design optimal weights (i.e., ensuring the fastest speed of convergence) for distributed consensus algorithms running over networks with random topologies. Our results are applicable to networks with correlated random link failures and to networks with randomized protocols. The key was to prove that, for symmetric random links, optimizing the mean-square-error convergence rate can be cast as a convex optimization problem, and, for asymmetric links, optimizing the mean-square deviation from the current average state is also a convex optimization problem. One IEEE-TSP journal paper and one ICASSP'10 conference paper were published. This research was conducted within the Carnegie Mellon-Portugal program in which ISR participates.

We developed centralized algorithms that jointly estimate sensor and target positions from range measurements. These are based on convex semidefinite relaxations of likelihood functions, and as such require very little prior information on sensor positions. This makes them particularly useful for application scenarios where precalibration is unfeasible. Our methods achieve robustness to outlier measurements by adopting (non-differentiable) cost functions where l_1 norms replace the usual squared distances. One conference paper was published, and one IEEE-TSP journal paper was submitted and accepted.

Underwater Acoustics

One of the high points of year 2010 was the organization of the UAN'10 sea trial in the vicinity of the Island of Pianosa (Italy) for testing an underwater acoustic network of sensors for exchanging information between bottom moored and AUV mounted nodes. This sea trial involved partners from the European project UAN plus the personnel and equipment from the NATO Undersea Research Centre in La Spezia (Italy), during the whole month of September. The other topic of interest is the ongoing collaboration with COPPE and IAEPM in Brazil, under the OAE Marie-Curie project, which provided the opportunity for setting up an experiment off the Island of Cabo Frio, for acoustic characterization of the upwelling regime in the area. Data analysis of these two sea trials is ongoing.

Image and Video Analysis

In what respects to the recovery of 3D structure from image sequences, we developed a new representation allowing a robust reconstruction of nonrigid paper-like surfaces (like a movie of a waving flag) and a large scale optimal algorithm for point matching. The latter hinges on a new

theorem that states the uniqueness of a solution to this combinatorial problem in a convex setting (published on Linear Algebra and Applications). In image recognition, we designed a feature extractor methodology that is able to handle several types of matching problems for which the system has not been trained (oral presentation at CVPR2010) and proposed an efficient representation/normalization procedure for arbitrary 2D shapes and images (presented at ICIP2010). In surveillance, we addressed the characterization of human activities in outdoor scenes, using multiple motion fields, learned from the video data. The model selects the motion fields which best describe best the trajectories of the objects of interest and recognizes different types of activities. Finally, in medical imaging, we developed two algorithms for the left ventricle segmentation problem; the first one showed that the use of deep belief networks produce the best results in the field in a public database (presented at ISBI2010 and ICIP2010); the second one, based the use of particle filtering and deep belief networks, demonstrated even better results and was published in CVPR2010 and ICPR2010.

Group Productivity

Publications in peer review Journals

Jacinto C. Nascimento, Mario A. T. Figueiredo, Jorge S. Marques, Trajectory Classification Using Switched Dynamical Hidden Markov Models, IEEE Transactions on Image Processing, vol. 19, no. 5, pp. 1338-1348, 2010.

G. Carneiro and J. C. Nascimento, "Multiple dynamic models for tracking the left ventricle of the heart from ultrasound data using particle filters and deep learning architectures", IEEE Int. Conf. on Computer Vision Pattern Recognition (CVPR2010), pp. 2815-2822, San Francisco, U.S.A., 2010. (Class B Journal).

M. Taiana, J. Santos, J. Gaspar, J. C. Nascimento, A. Bernardino, and P. Lima, "Color 3D model-based tracking with arbitrary projection models", Special Issue on Omnidirectional Robot Vision - Robotics and Autonomous Systems (RAS) Journal, vol. 58, no. 6, pp. 784-795, Jun., 2010.

P. Santos, O. C. Rodríguez, P. Felisberto and S.M. Jesus, "Seabed geoaoustic characterization with a vector sensor array", Journal of the

Group Productivity

Acoustical Society of America, 128, No.5, pp.2652-2663, November 2010.

D. Jakovetic, J. Xavier and J. M. F. Moura, "Weight optimization for consensus algorithms with correlated switching topology", IEEE Transactions on Signal Processing, vol. 58, no.7, pp. 3788-3801, July 2010.

M. Dodig, Marko Stošić, "Combinatorics of Column Minimal Indices and Matrix Pencil Completion Problems", SIAM Journal on Matrix Analysis and Applications, Vol. 31, Issue 5, pp. 2318-2346, 2010.

M. Dodig, Marko Stošić, "On Convexity of Polynomial Paths and Generalized Majorizations", The Electronic Journal of Combinatorics, Vol.17, No.1, R61, pp.1-16, 2010.

S. Khan, J. Sanches, R. Ventura, Robust Band Profile Extraction Using Constrained Nonparametric Machine Learning Technique, IEEE Transactions on Biomedical Engineering, Volume: 57 , Issue: 10, pp:2587 - 2591, Oct. 2010.

Artem Khmelinskii, Rodrigo Ventura and João Sanches , A Novel Metric for Bone Marrow Cells Chromosome Pairing, Biomedical Engineering, IEEE Transactions on Biomedical Engineering, Vol. 57, No. 6, June 2010.

Isabela Silva, Ana G. Almeida and João Sanches, Automatic Cropping for LV Segmentation in Cardiac MRI, International Journal of Tomography & Statistics, Winter 2010, Vol.13, No.W10, Int.J. Tomogr. Stat.,ISSN 0972-9976(Print);ISSN 0973-7294 (Online).

Other international publications

D. Jakovetic, J. Xavier, J. Moura, Consensus in correlated random topologies: weights for finite time horizon, ICASSP

P. Ekim, J. Gomes, J. Xavier, P. Oliveira, A convex relaxation for approximate maximum-likelihood 2D source localization from range measurements, ICASSP

G. Carneiro, J. Nascimento, A. Freitas, Robust left ventricle segmentation from ultrasound data using deep neural networks and efficient search methods, ISBI

J. Seabra, J. Sanches, On Estimating De-speckled and Speckle Components from B-mode Ultrasound Images, ISBI

J. Seabra, J. Sanches, F. Ciompi, P. Radeva, Ultrasonographic Plaque Characterization Using a Rayleigh Mixture Model, ISBI

I. Rodrigues, J. Sanches, Photoblinking/Photobleaching Differential Equation Model for Intensity Decay of Fluorescence Microscopy Images, ISBI

J. Sanches, I. Sousa, P. Figueiredo, Bayesian Fisher Information Criterion for Sampling Optimization in ASL-MRI, ISBI

L. Bandeira, J. Marques, J. Saraiva, P. Pina, M. Dene, Fields Detection by Automated Approaches, DUNES

D. Castells, J. Rodrigues, J. du Buf, Obstacle detection and avoidance on sidewalks, VISAPP

G. Carneiro, J. Nascimento, Multiple dynamic models for tracking the left ventricle of the heart from ultrasound data using particle filters and deep learning architectures, CVPR

G. Carneiro, The Automatic Design of Feature Spaces for Local Image Descriptors using an Ensemble of Non-linear Feature Extractors, CVPR

L. Bandeira, J. Marques, J. Saraiva, P. Pina, Automated Detection of Sand Dunes on Mars, ICIAR

R. Sousa, J. Rodrigues, J. du Buf, Recognition of facial expressions by cortical multi-scale line and edge coding, ICIAR

J. Mota, P. Aguiar, Efficient Methods for Point Matching with Known Camera Orientation, Image Analysis and Recognition, ICIAR

R. Belo, P. Ferreira, R. Telang, The effects of broadband in schooling, NBER Sum. Inst.

R. Saruthirathanaworakun, J. Peha, Dynamic primary-secondary spectrum sharing with cellular systems, CrownCom

N. MARTINS, L. CALADO, A. PAULA, S. JESUS, Classification of three-dimensional ocean features using three-dimensional empirical orthogonal functions, ECUA

A. SILVA, O. RODRÍGUEZ, F. ZABEL, J. HUILLERY, S. JESUS, Underwater Acoustic simulations with a time variable acoustic propagation model, ECUA

O. RODRÍGUEZ, A. SILVA, F. ZABEL, S. JESUS, The TV-APM interface: a web service for collaborative modeling, ECUA

U. VILAIPORENSAWAI, A. SILVA, S. JESUS, Combined adaptive time reversal and DFE technique for time-varying underwater communications, ECUA

E. Zamanizadeh, J. Gomes, J. Bioucas-Dias, Identification of sparse time-varying underwater channels through basis pursuit methods, ECUA

O. Rodríguez, A. Silva, J. Gomes, S. Jesus, Modeling arrival scattering due to surface roughness, ECUA

P. FELISBERTO, P. SANTOS, S. JESUS, Tracking source azimuth using a single vector sensor, SENSORCOMM

M. Bicego, A. Martins, V. Murino, P. Aguiar, M. Figueiredo, 2D Shape Recognition using Information Theoretic Kernels ICPR

M. Silveira, J. Marques, Boosting Alzheimer Disease Diagnosis using PET images, ICPR

G. Carneiro, J. Nascimento, The fusion of deep learning architectures and particle filtering applied to lip tracking, ICPR

G. Carneiro, A Comparison Study on the Use of an Ensemble of Feature Extractors for the Automatic Design of Local Image Descriptors, ICPR

M. Silveira, J. Marques, Boosting Alzheimer's Disease Diagnosis using PET images, ICPR

A. Martins, M. Bicego, V. Murino, P. Aguiar, M. Figueiredo, Information Theoretical Kernels for Generative Embeddings based on Hidden Markov Models, IAPR Work. SSPR & SPR

J. Nascimento. J. Marques, Improved Gradient Vector Flow for robust shape estimation in medical imaging, EMBC

R. Gafaniz, J. Sanches, ATP Consumption and Neural Electrical Activity: A Physiological Model for Brain Imaging, EMBC

I. Rodrigues, J. Sanches, Denoising of LSFCM images with compensation for the Photoblinking/Photobleaching effects, EMBC

N. Santos, J. Sanches, P. Figueiredo, Bayesian optimization of perfusion and transit time estimation in PASL-MRI, EMBC

Group Productivity

R. Ventura, A. Khmelinskii, J. Sanches, Classifier-assisted metric for chromosome pairing, EMBC

J. Seabra, L. Mendes Pedro, J. Fernandes e Fernandes, J. Sanches, Ultrasonographic Characterization and Identification of Symptomatic Carotid Plaques, EMBC

A. Domingues, O. Adamec, T. Paiva, J. Sanches, Automatic Annotation of Actigraphy Data for Sleep Disorders Diagnosis Purposes, EMBC

O. Adamec, A. Domingues, T. Paiva, J. Sanches, Statistical characterization of actigraphy data during Sleep and Wakefulness States, EMBC

M. Silveira, P. Figueiredo, Joint fMRI brain activation detection and segmentation using Level Sets, EMBC

J. Nascimento, J. Silva, Manifold learning for object tracking with multiple motion dynamics. ECCV

A. del Bue, J. Xavier, L. Agapito, M. Paladini, Bilinear factorization via Augmented Lagrange Multipliers, ECCV

E. Zamanizadeh, J. Gomes, J. Bioucas-Dias, Identification and matching of sparse delay-Doppler spread functions from high-frequency communications signals, OCEANS

J. Crespo, P. Aguiar, The 2D Orientation is Unique Through Principal Moments Analysis, ICIP

R. Guerreiro, P. Aguiar, Learning Simple Texture Discrimination Filters, ICIP

M. Bicego, A. Perina, V. Murino, A. Martins, P. Aguiar, M. Figueiredo, Combining Free Energy Score Spaces with Information Theoretic Kernels: Application to Scene Classification, ICIP

J. Nascimento, G. Carneiro, Efficient search methods and Deep belief Networks with particle filtering for non-rigid tracking: Application to lip tracking, ICIP

J. Nascimento, J. Marques, M. Figueiredo, Discriminative Model Selection for Object Motion Recognition, ICIP

J. Nascimento, J. Marques, M. Figueiredo, Classification of Complex Pedestrian Activities from Trajectories, ICIP

J. Nascimento, J. Marques, Improving the Robustness of Gradient Vector Flow in Cluttered Images, ICIP

A. Domingues, O. Adamec, J. Sanches, S. Santos, T. Paiva, Actigraphy Data Classification during Sleep and Wakefulness States ESRS

O. Adamec, A. Domingues, S. Santos, J. Sanches, T. Paiva, A Mixture Distribution Model to describe Actigraphy Data during Sleep and Wakefulness States, ESRS

J. Sanches, B. Pereira, T. Paiva, Cell Phone based Continuous Tympanic Temperature Measurement System, ESRS

J. Sanches, P. Pires, T. Paiva, Cell Phone based Sleep electronic Diary (SeD), ESRS

D. Bajovic, D. Jakovetic, J. Xavier, B. Sinopoli, J. Moura, Distributed detection over random networks: a large deviations analysis, ALLERTON

A. Martins, N. Smith, E. Xing, P. Aguiar, M. Figueiredo, Turbo Parsers: Dependency Parsing by Approximate Variational Inference, EMNLP

A. Martins, N. Smith, E. Xing, P. Aguiar, M. Figueiredo, Online MKL for Structured Prediction, NIPS-NDMKL

A. Martins, N. Smith, E. Xing, P. Aguiar, M. Figueiredo, Augmenting Dual Decomposition for MAP Inference, NIPS-NDMKL

R. Belo, P. Ferreira, R. Telang, The impact of broadband on students's performance, ICIS

Other national publications

Saleiro, M., Rodrigues, J.M.F. and du Buf, J.M.H., "Cognitive robotics: a new approach to simultaneous localisation and mapping", Proc. 16th Portuguese Conf. on Pattern Recogn. (RECPAD2010), Vila Real, Portugal, October 29, 2010.

Ph.D. thesis completed

Nuno Pinho da Silva, "Robust Nonmetric Perception of Moving Rigid Bodies", Ph.D. Thesis, Instituto Superior Técnico, Lisbon, Portugal, June 2010.

Ricardo Ferreira, "Reconstruction Of Isometrically Embedded Flat Surfaces From Scaled Orthographic Image Data", Ph.D. Thesis, Instituto Superior Técnico, Lisbon, Portugal, June 2010.

Patents/propotypes

Patents:

"System and Method for Fetal Biometric Measurements from Ultrasound Data and Fusion of same for Estimation of Fetal Gestational Age", Gustavo Carneiro, Sara Good, Bogdan Georgescu, Paolo Favaro, and Dorin Comaniciu. US Patent number 7783095 granted on August 24, 2010.

Prototypes:

SmartVision: active vision aid for the blind.

Organization of conferences

Program committees:

IEEE International Conference on Image Processing (ICIP)

IEEE International Symposium on Biomedical Imaging (ISBI)

IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP).

Conference of the IEEE Engineering in Medicine and Biology Society (EMBC).

Group Productivity

International Conference on Pattern Recognition (ICPR)

International Conference on Computer Vision Theory and Applications (VISAPP)

International Conference on Image and Signal Processing (ICISP)

International Conference on Image Analysis and Recognition (ICIAR).

Conference on Computer Vision and Pattern Recognition (CVPR)

Canadian Conference on Computer and Robot Vision (CRV)

Computational Modeling of Objects Presented in Images: Fundamentals, Methods and Applications (CompIMAGE).

Mexican International Conference on Artificial Intelligence (MACAI)

Mexican Conference on Pattern Recognition (MCPR).

Other Events:

João Paulo Costeira e Gustavo Carneiro organized, at Museu Nacional do Azulejo, Lisboa, Portugal, the PRINTART project workshop "Where Computer Vision Meets Art", that gathered researchers from the areas of computer vision and art history (<http://printart.isr.ist.utl.pt/workshops.htm>).

Internationalization

D. Jakovetic, J. Xavier, J. Moura, Weight optimization for consensus algorithms with correlated switching topology, IEEE Trans. on Sig. Proc., vol. 58, no.7, pp. 3788-3801, July

M. Bicego, A. Martins, V. Murino, P. Aguiar, M. Figueiredo, 2D Shape Recognition using Information Theoretic Kernels, IAPR Int. Conf. on Pattern Recogn., Aug.

A. Martins, M. Bicego, V. Murino, P. Aguiar, M. Figueiredo, Information Theoretical Kernels for Generative Embeddings based on Hidden Markov Models. Structural, Syntactic, and Statistical Techn. in Pattern Recogn., No. 6218 in Lect. Notes in Computer Sc., Springer-Verlag, Aug.

M. Bicego, A. Perina, V. Murino, A. Martins, P. Aguiar, M. Figueiredo, Combining Free Energy Score Spaces with Information Theoretic Kernels: Application to Scene Classification, IEEE Int. Conf. on Image Proc., Sept.

A. Martins, N. Smith, E. Xing, P. Aguiar, M. Figueiredo, Turbo Parsers: Dependency Parsing by Approximate Variational Inference, SIGDAT Conf. on Empirical Meth. in Natural Language, Oct..

A. Martins, N. Smith, E. Xing, P. Aguiar, M. Figueiredo, Online MKL for Structured Prediction. NIPS Workshop on New Directions in Multiple Kernel Learning, Dec.

A. Martins, N. Smith, E. Xing, P. Aguiar, M. Figueiredo, Augmenting Dual Decomposition for MAP Inference, NIPS Workshop on Optimization for Machine Learning, Dec.

D. Castells, J. Rodrigues, J. du Buf, Obstacle detection and avoidance on sidewalks, Int. Conf. on Computer Vision Theory and Applic., May.

D. Bajovic, D. Jakovetic, J. Xavier, B. Sinopoli, J. Moura, Distributed detection over random networks: a large deviations analysis, 48th Allerton Conf. on Comm., Control, and Computing, Oct.

A. del Bue, J. Xavier, L. Agapito, M. Paladini, Bilinear factorization via Augmented Lagrange Multipliers, European Conf. on Computer Vision, Sept.

D. Jakovetic, J. Xavier, J. Moura, Consensus in correlated random topologies: weights for finite time horizon, IEEE Int. Conf. on Acoust., Speech and Sign. Proc., March

R. Belo, P. Ferreira, R. Telang, The effects of broadband in schooling, Summer Institute 2010, National Bureau of Economic Research, June

R. Belo, P. Ferreira, R. Telang The impact of broadband on students's performance, Int. Conf. on Information Syst., Dec.

J. Seabra, J. Sanches, F. Ciompi, P. Radeva, ULTRASONOGRAPHIC PLAQUE CHARACTERIZATION USING A RAYLEIGH MIXTURE MODEL, IEEE Int. Symp. on Biomedical Imaging

Group Description	
Title of Research Group:	(RG-LVT-50009-3508) VisLab - Computer and Robot Vision Laboratory
Principal Investigator:	Jose Alberto Rosado Santos Victor
Main Scientific Domain:	Engenharia Electrotécnica e Informática
Group Host Institution:	Instituto Superior Técnico - Universidade Técnica de Lisboa

Funding, source, dates
Funding, source, dates
<p>i) INTERNATIONAL</p> <p>First-MM - Flexible Skill Acquisition and Intuitive Robot Tasking for Mobile Manipulation in the Real World, ICT- 248528, Feb 2010 – Jul 2013</p> <p>ROBOSOM: Robotic Sense of Movement, ICT- 248366-ROBOSOM, Dec 2009-Nov 2012</p> <p>HANDLE: Developmental pathway towards autonomy and dexterity in robot in-hand manipulation, ICT –231640– HANDLE, Feb 2009-Jan 2013</p> <p>ROBOT-CUB - ROBotic Open-architecture Technology for Cognition, Understanding, and Behaviour, EU- IST-2004-004370, Sep04 – Feb 2010</p> <p>MAIS-S - Multiagent Intelligent Surveillance System, FCT - CMU-PT/SIA/0023/2009 Sept.2010-August 2013.</p> <p>ii) NATIONAL</p> <p>DCCAL: Discrete Cameras Calibration using Properties of Natural Scenes FCT - PTDC/EEA-CRO/105413/2008, Jan 2010–Dec 2012</p> <p>BIOLOOK: Biomimetic Oculomotor Control for Humanoid Robots FCT - PTDC/EEA-ACR/71032/2006, Oct.2007-Sept.2010</p> <p>MMCACC: Advanced Monte Carlo Algorithms for Computational Control FCT - PTDC/EEA-ACR/70174/2006, Sep.2007–Aug 2010</p> <p>.</p>

Objectives & Achievements
Objectives
<p>One of the key objectives of the VisLab is to conduct research in computer and robot vision aiming at (i) the development of new methodologies and tools for computer and robot vision and the (ii) demonstration of such methodologies in challenging applications.</p> <p>We can learn from biological systems how vision is an extremely powerful sensing modality to perceive the surrounding world (colour, texture, motion, shape, contrast, etc.) and act accordingly, offering large spatial resolution and reasonable temporal dynamics.</p> <p>Our research is organized in two main lines:</p> <ul style="list-style-type: none"> • Vision Based Control and Navigation • 3D Reconstruction, Motion Analysis and Surveillance <p>a) Vision Based Control and Navigation</p> <p>We address the problem of understanding how to use visual information to control an artificial system (robot) in order to perform a given task. Our research is often inspired on biological systems and aims at designing more flexible and robust artificial vision systems and to improve the understanding of biology. Thanks to massive developments in computing power we can now employ powerful learning techniques in the context of vision and robotic problems. The following topics are currently addressed:</p> <ul style="list-style-type: none"> - Design of visual geometries and camera networks - Vision based control, active vision and navigation - Feature learning and object recognition - Learning and cognition for (humanoid) robots <p>b) 3D Reconstruction, Motion Analysis and surveillance</p> <p>Vision allows us to retrieve information about the scene structure (geometry) or camera motion from video sequences. Amongst other topics,</p>

Objectives & Achievements

we are currently investigating the following problems:

- a. Video surveillance systems able to learn and understand patterns of human activity
- b. Calibration of camera networks and nonconventional camera systems
- c. Model based tracking and object recognition
- d. Gesture analysis and recognition

Main Achievements

The work at VisLab aims to develop new methodologies for computer and robot vision as well as to address several applications with societal impact. The approach followed is strongly multidisciplinary with close links to biology, neuroscience or psychology. The group is regularly involved in large-scale, ambitious projects with international partners (e.g. EU).

Some of the main achievements are listed below:

Humanoid robotic platforms

The iCub humanoid platform hosted at the group is now fully functional and serving as a testbed for research in the broad areas of cognitive systems. We have actively contributed to the iCub community by developing both methodologies and software for perception, learning and control of the platform. During 2010, we have continued the development of another mobile platform (Vizzy) combining a humanoid torso and a mobile base.

Cognitive systems and vision

We have pursued efforts to develop methods for sensorimotor learning and coordination with complex humanoid platforms. The affordance model has been extended in the context of a collaboration with international partners to include relational learning tools that should allow for dealing with much larger datasets and complex tasks. This method follows closely findings in developmental psychology and neuroscience.

Human activity analysis

We have continued the development of computer vision methods able to provide an interpretation of the observed scenes. Some methods developed in the context of the URUS project have now been further developed in the context of a project integrated in the CMU-Portugal partnership.

Camera design and camera networks - We developed methods for the calibration of novel camera geometries and networks of cameras from extended observation of video streams. This work is the core of a new national project (DCCAL)

Participation in EU Projects- In addition to key contributions to our major EU Projects (Robotcub and Handle), we have started two new EU Projects (Robosom and First-MM) on the topics of robotic sense of movement and mobile manipulation. The Robosom project was ranked first amongst all projects submitted to the IST-Call 4 on cognitive projects (~120 projects)

International Partnerships - We have also actively participated in the IST-EPFL Joint PhD Initiative with students involved in the joint doctoral studies between IST and EPFL as well as in the CMU-PT dual doctoral program.

Group Productivity

Publications in peer review Journals

- Decentralized Sensor Fusion for Ubiquitous Networking Robotics in Urban Areas, A. Sanfeliu, J. Andrade-Cetto, M. Barbosa, R. Bowden, J. Capitán, A. Corominas, A. Gilbert, J. Illingworth, L. Merino, J. M. Mirats, Plinio Moreno, A. Ollero, João Sequeira, Matthijs Spaan, *Sensors*, 10(3):2274–2314, 2010
- Tracking objects with generic calibrated sensors: an algorithm based on color and 3D shape features, Matteo Taiana, João Santos, José Gaspar, Jacinto Nascimento, Alexandre Bernardino, Pedro Lima, *Robotics and Autonomous Systems*, special issue on Omnidirectional Robot Vision, Vol. 58, Issue 6, 30 June, pp. 784-795, 2010
- Discrete camera calibration from pixel streams, Etienne Grossmann, José António Gaspar and Francesco Orabona, *Computer Vision and Image Understanding (Special issue on Omnidirectional Vision, Camera Networks and Non-conventional Cameras)*, Volume 114, Issue 2, Pages 198-209, February 2010
- A Review of Log-Polar Imaging for Visual Perception in Robotics, Javier Traver, Alexandre Bernardino, *Robotics and Autonomous Systems*, Vol 58, no. 4, pp. 378-398, April, 2010
- The iCub humanoid robot: an open-systems platform for research in cognitive development, G. Metta, L. Natale, Francesco Nori, Giulio Sandini, David Vernon, Luciano Fadiga, Claes von Hofsten, Kerstin Rosander, Manuel Lopes, José Santos-Victor, Alexandre Bernardino, Luis Montesano, *Neural Networks*, 23(8-9), Oct-Nov 2010.

Other international publications

BOOK CHAPTERS

- Abstraction Levels for Robotic Imitation: Overview and Computational Approaches, Manuel Lopes, Luis Montesano, Francisco Melo, José Santos-Victor, *From motor to interaction learning in robots*, Olivier Sigaud & Jan Peters (Eds.), Vol. 264, pp. 313-355, Springer, 2010
- Multimodal Language Acquisition based on Motor Learning and Interaction, J. Hörnstein, L. Gustavsson, J. Santos-Victor, F. Lacerda, in *From Motor Learning to Interaction Learning in Robots*, in Olivier Sigaud & Jan Peters (eds), *From motor to interaction learning in robots*, Vol. 264, pp 466-489, Springer-Verlag, January 2010.

Group Productivity

CONFERENCES

- Sequentially Greedy Unsupervised Learning of Gaussian Mixture Models by Means of A Binary Tree Structure, Nicola Greggio, Alexandre Bernardino, José Santos-Victor, Proc. of IAS-11 2010 - 11th International Conference on Intelligent Autonomous Systems, Ottawa, Canada, 2010
- Image Segmentation for Robots: Fast Self-Adapting Gaussian Mixture Model, Nicola Greggio, Alexandre Bernardino, José Santos-Victor, Proc. of ICIAR 2010 - International Conference on Image Analysis and Recognition, Povoá de Varzim, Portugal, 2010
- A Practical Method for Self-Adapting Gaussian Expectation Maximization, Nicola Greggio, Alexandre Bernardino, José Santos-Victor, Proc. of ICINCO 2010 - 7th International Conference on Informatics in Control, Automation and Robotics, Funchal, Madeira - Portugal, 2010
- Sensor-Based Self Calibration of the iCub's Head, José Santos, Alexandre Bernardino, José Santos-Victor, Proc. of IROS 2010 - IEEE/RSJ International Conference on Intelligent Robots and Systems, Taipei, Taiwan, October 2010
- Integration of vision and central pattern generator based locomotion for path planning of a nonholonomic crawling humanoid robot, S. Gay, S. Dégallier, U. Pattacini, A.J. Ijspeert and J. Santos-Victor. Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2010), Taipei, Taiwan, October, 2010.
- Inference based Trajectory Optimization for Imitation based Grasping, Ashish Jain, Ruben Martinez-Cantin, Alexandre Bernardino, José Santos-Victor, Proc. of IROS 2010 - IEEE/RSJ International Conference on Intelligent Robots and Systems, Taipei, Taiwan, October 2010
- Gaussian Mixture Models for Affordance Learning using Bayesian Networks, P. Osório, Alexandre Bernardino, Ruben Martinez-Cantin, José Santos-Victor, Proc. of IROS 2010 - IEEE/RSJ International Conference on Intelligent Robots and Systems, Taipei, Taiwan, October 2010
- Learning words and speech units through natural interactions, Jonas Hörnstein, José Santos-Victor, Proc. of Interspeech 2010 - International Conference on Spoken Language Processing, Makuhari, Japan, 2010
- Unsupervised and Online Update of Boosted Temporal Models: The UAL2Boost, Pedro Ribeiro, Plinio Moreno, José Santos-Victor, Proc. of ICMLA 2010 - 9th International Conference on Machine Learning and Applications, Washington, USA, 2010
- Self-Adaptive Gaussian Mixture Models for Real-Time Video Segmentation and Background Subtraction, Nicola Greggio, Alexandre Bernardino, C. Laschi, P. Dario, José Santos-Victor, Proc. of ISDA 2010 - 10th International Conference on Intelligent Systems Design and Applications, Cairo, Egypt, 2010
- An Algorithm for the Least Square-Fitting of Ellipses, Nicola Greggio, Alexandre Bernardino, C. Laschi, P. Dario, José Santos-Victor, Proc. of ICTAI 2010 - 22th International Conference on Tools with Artificial Intelligence, Arras, France, 2010
- Unsupervised Greedy Learning of Finite Mixture Models, Nicola Greggio, Alexandre Bernardino, C. Laschi, P. Dario, José Santos-Victor, Proc. of ICTAI 2010 - 22th International Conference on Tools with Artificial Intelligence, Arras, France, 2010

Other national publications

- Multiple Hypothesis Group Tracking in Video Sequences, David Antunes, David Martins de Matos, José Gaspar, In 16th Portuguese Conference on Pattern Recognition (RecPad 2010), Vila Real, Portugal, October 2010.
- Surveillance with Pan-Tilt Cameras: Background Modeling, Ricardo Galego, Alexandre Bernardino, José Gaspar, In 16th Portuguese Conference on Pattern Recognition (RecPad 2010), Vila Real, Portugal, October 2010.
- Random features vs Harris Corners in Real-Time Visual Egomotion Estimation, Nuno Moutinho, Ricardo Ferreira, Alexandre Bernardino, José Gaspar, In 16th Portuguese Conference on Pattern Recognition (RecPad 2010), Vila Real, Portugal, October 2010.
- -Generating Pose Hypothesis for 3D tracking: A Bottom-up Approach, Martim Brandão and Alexandre Bernardino, , In 16th Portuguese Conference on Pattern Recognition (RecPad 2010), Vila Real, Portugal, October 2010.
- A Comparison of Methods for Detection and Recognition of Playing Cards, João Pimentel and Alexandre Bernardino, In 16th Portuguese Conference on Pattern Recognition (RecPad 2010), Vila Real, Portugal, October 2010.
- Sampled Mean-Shift for Fast Image Segmentation, André Grilo, Alessio Del Bue, Alexandre Bernardino, In 16th Portuguese Conference on Pattern Recognition (RecPad 2010), Vila Real, Portugal, October 2010.
- Vestibular Calibration of a Humanoid Robot's Head, José Santos, Alexandre Bernardino, ISR/IST, Portugal, In 10th Conference on Mobile Robot and Competitions (Robotica 2010), Leiria, Portugal, March 2010.

Ph.D. thesis completed

- Reconstruction Of Isometrically Embedded Flat Surfaces From Scaled Orthographic Image Data, Ricardo Ferreira, Ph.D. Thesis, Instituto Superior Técnico, Universidade Técnica de Lisboa, 2010

Patents/prototypes

- iCub humanoid platform: this humanoid platform was developed within the RobotCub project and, with 54degrees of freedom, it is the most sophisticated humanoid platform worldwide.
- Baltazar Humanoid Torso: composed of a high-speed 4 degrees of freedom binocular head, an articulated arm and hand, for research in learning by imitation. This robot was developed at VisLab since 2001 and was one of the most versatile humanoid robots in Portugal.
- Vizzy –humanoid platform mounted on a Segway mobile base. The first stage of integration was completed in 2010 and software development and integration will be done in 2011. This platform was developed within the lab and combines the flexibility and robustness of Baltazar with mobility. Some parts of the mechanical design were inspired after our design for the iCub.
- One robotic head designed for the iCub, each with 6 degrees of freedom, an inertial sensor, audio and ability to perform facial expressions
- TRC LabMate mobile platform, equipped different sorts of cameras, including panoramic ones if curved mirrors.

Group Productivity

- One Pioneer mobile platform equipped with a Katana manipulator used for experiments in navigation, SLAM or mobile manipulation.
- Two Nomad Superscout mobile platforms, equipped with vision and an on-board computer.
- One Tobii system for gaze tracking
- One data glove and magnetic tracker
- The ISobotNet is a testbed for Networked Robot Systems developed by VisLab together with ISLab and MRLab, composed of an indoor area of around 160 m² with 10 webcams placed at the ceiling such that some of the fields of view do not overlap. Besides the camera sensors, four Pioneer AT and one ATRV-Jr robots are available. Each of the robots is equipped with sonars, onboard cameras, laser range finder and is Wi-Fi connected to the network.

Organization of conferences

Vislab members organized the following conferences / workshops / summer schols:

- "Towards Closing the Loop: Active Learning for Robotics",

Full day workshop at Robotics: Science and Systems 2010.

Venue: University of Zaragoza, Spain.

<http://users.isr.ist.utl.pt/~rmcantin/pmwiki/pmwiki.php/RSS10/RSS10>

- iCub and friends: a workshop for open source robotics",

held with IEEE Humanoids 2010,

Nashville, Tennessee, December 2010.

http://eris.liralab.it/wiki/The_iCub_Humanoids_%2710_workshop

VisLab members were involved in the Program Committee of the following conferences:

- a. Robotics Science and Systems (RSS)
- b. Emerging Technologies and Factory Automation, ETFA
- c. International Conference on Computer Vision Systems, ICVS
- d. International Conference on Image Analysis and Recognition, ICIAR
- e. IEEE Intl. Conference on Robotics and Automation, ICRA
- f. IEEE Computer Society Conf. Computer Vision and Pattern Recognition, CVPR
- g. IEEE Intl. Conf. on Intelligent Robots and Systems, IROS
- h. International Conference on Development and Learning, ICDL

Industry contract research

- One EU project started in 2011, includes a large Robotics Company (KUKA)

-- Collaborative project with the company Ydreams

Internationalization

The group has more than 50% of international members and currently comprising 8 different nationalities. Most core activities are carried out in the context of large international projects.

EU PROJECTS AND PARTNERSHIPS

EU Proj:

+ ROBOTCUB

+ FIRST-MM

+ ROBOSOM

+ HANDLE

FCT-CMU/ MAIS-S

PARTNERSHIPS

IST-EPFL Joint Doctoral Initiative

CMU-Portugal Joint Doctoral Initiative

NATIONAL PROJECTS WITH INTL. PARTNERS

- FCT Proj. BIOLOOK – Uppsala Univ.

- FCT Proj. MCMCAC – Univ. of Vancouver.

Group Productivity

- FCT DCCAL - IDIAP.

PARTICIPATION IN THESES COMMITTEES ABROAD

- N. Greggio, "Unsupervised Object Segmentation, Representation, and Tracking for Humanoid Robots", Scuola Superiore Sant'Anna, Pisa, Italy.

SUPERVISION OF INTERNATIONAL STUDENTS

- Afshin Dehghan, BSc student, Univ. of Tehran, Iran
- Ashish Jain, BE student, Manipal Inst. of Technology, India
- Misel Batmendijn (IAESTE), BSc student, Tech. University of Kosice, Slovakia
- Kristijan Petkov, (IAESTE) Univ. St. Cyril and Methodius, Macedonia.
- Urbain Prieur, UPMC, Paris, France. PhD co-tutela IST-UPMC.

INVITED TALKS/SEMINARS

José Santos-Victor,

- Reverse Engineering the Brain with Humanoid Robots, invited talk, International Conference on Image Analysis and Recognition, ICIAR 2010, June, 2010. (<http://www.iciar.uwaterloo.ca/iciar10/talks.php>)

- "Bioinspired Robotics and Vision with Humanoid Robots," Keynote speaker, 7th Intl. Conf. on Informatics in Control, Automation and Robotics (ICINCO), Madeira, June 2010.

A. Bernardino,

- Object Detection and Tracking on the iCub, Workshop iCub and Friends, IROS 2010, Taiwan.

Ruben M.-Cantin

- Towards Closing the Loop: Active Learning for Robotics, Univ. Seville, May 2010,
- Active Learning for Developmental Robotics, Max-Planck Institute, Tuebingen, July.

REVIEWERS INTERNATIONAL JOURNALS

- Autonomous Robots
- EURASIP Journal on Advances in Signal Processing
- IEEE Transactions:
 - + Autonomous Mental Development
 - + Biomed Eng.
 - + Circuits and Systems for Video Technology
 - + Image Proc.
 - + Neural Systems & Rehabilitation Engineering
 - + PAMI
 - + Robotics
 - + System Man and Cybernetics
- Intl. J. of Humanoid Robotics
- Intl. Journal of Robotics Research
- J. of Robotics and Autonomous Systems
- J. of Intelligent and Robotic Systems
- J. of Real-Time Image Processing

Government/Organization contract research

- José Santos-Victor; IST Board Member, Vice-President for International Affairs
- José Santos-Victor; General Secretary of the CLUSTER network (www.cluster.org)
- José Santos-Victor; IST Director for the IST-EPFL Joint Doctoral Program
- Alexandre Bernardino, IST Dept of Electrical and Computer Engineering, Member of the Board

Group Description	
Title of Research Group:	(RG-LVT-50009-3583) Laboratory for Energy and Environmental Studies at IN+ Center for Innovation, Technology and Policy Research
Principal Investigator:	Paulo Manuel Cadete Ferrao
Main Scientific Domain:	Engenharia Mecânica
Group Host Institution:	Instituto Superior Técnico - Universidade Técnica de Lisboa
Funding, source, dates	
Funding, source, dates	
<p>FCT: 2007 – 2011: BioPast - An Integrated Approach to Sown Biodiverse Permanent Pastures Rich in Legumes</p> <p>FCT: 2007 – 2011: PETE – Physical Approaches to an Improved Economic Theory of the Environment</p> <p>FEDER: 2008 – 2011: Life Engine - Desenvolvimento de Realismo Biológico em Jogos de Computador</p> <p>FEDER: 2010 – 2013: Energy Wars - O videojogo de estratégia na economia mundial do fim da era do petróleo</p> <p>EEA Grants 2008-2011: Rural Value – Sustainable Development of Threatened Farming Systems: 2008 -2011</p> <p>FCT 2007-2010: Projecto PTDC/AGR-CFL/69733/2006.</p> <p>Galpenergia, 2010/2012</p> <p>Energopark, 2010/2010</p> <p>Finertec, 2010/2011</p> <p>EDP - Electricidade de Portugal, SA., Contract W/N, 2009/2011</p> <p>FCT, Contract N° PTDC/SEN-ENR/108440/2008, 2010/2012</p> <p>APA, Contract N° 125/2009, 2009/2011</p> <p>FCT, Contract N.º MIT-PT/SES/0008/2006, 2007/2011</p> <p>FCT, Contract N° MIT-PT/AP/0015/2006, 2006/2011</p> <p>FCT, Contract N° MIT-Pt/SES-SUES/0037/2008, 2009/2012</p> <p>FCT, MIT, 2008/2011</p>	
Objectives & Achievements	
Objectives	
<p>The objective is to undertake multidisciplinary research aiming at developing and evaluating emerging and alternative complex engineering systems promoting sustainability, namely in terms of the needs to secure socio-economic development and the quality of the environment, creating a more prosperous and sustainable society.</p> <p>Enabling technologies will be developed and assessed under a systems view, comprising the use and environmental implications of materials, energy, and products in modern societies. To achieve these objectives, research and development activities include the analysis of advanced systems, but also the analysis of the global carbon bio-geochemical cycle and of material flows in the economy, including product and material life cycle management through reuse, remanufacturing, and recycling.</p> <p>Main research areas include:</p> <ul style="list-style-type: none"> - Development of fundamental sustainability theory, linking thermodynamics, ecology and economics. - Environmental modelling - Carbon cycle - Eco-design for sustainability in industrial, domestic and agricultural applications - Total life-cycle energy chain and environmental impact assessment - Economic tools in environmental and sustainability assessment - Flows of materials in the economy from raw-materials extraction to final integration in the natural environment - Techno-economic assessment, technological change and systems integration. 	
Main Achievements	

Objectives & Achievements

The activities developed within this topic were multidisciplinary, linking basic and applied research to technology development, and focused on the issues of sustainability, namely in terms of the needs to secure the quality of the environment, together with the management of energy resources and economic development.

In this context, the Laboratory of Environmental Systems has been able to:

- Promote the IST Design Studio, which aimed at strengthening research and education in engineering design to improve manufacturing competitiveness and innovation.
- Develop major methodologies and tools that bring together economy and environment in the assessment and the design of new products (Eco-design tools) and new policies (e.g.: National Integrated framework for Residues Management, Hybrid Economic Input-Output-Life Cycle Assessment or Life Cycle Activity Analysis) (Amaral and Ferrão, 2006, Behrens et al., 2007).
- Support entrepreneurial initiatives in Industrial Ecology in Portugal, such as the design of a variety of new companies aimed at recycling and further processing end-of-life products or the design and implementation of an Eco-Industrial park at Chamusca.
- Obtain significant results on carbon and water dynamics in forests and grasslands (Granier et al., 2007, Luysaert, 2007, Pereira et al. 2007).
- Provide support to Portuguese public policy on the use of natural carbon sinks.
- Publish a special number of "Philosophical Transactions of the Royal Society of London B" with results on the DEB Theory, with two papers by ISR (Theme issue 'Developments in dynamic energy budget theory and its applications', compiled and edited by Tânia Sousa, Tiago Domingos, Jean-Christophe Poggiale and Bas Kooijman ; 365 (1557) : 3413 - 3590).
- Publish a book on the theory and measurement of Carbon Responsibility (Rodrigues, J., A. Marques, T. Domingos (2010). Carbon Responsibility and Embodied Emissions - Theory and measurement. Routledge Series in Ecological Economics, Taylor and Francis, London).

Group Productivity

Publications in peer review Journals

Paulo, A. C., M. Correia-Neves, T. Domingos, A. G. Murta, J. Pedrosa (2010). Influenza Infectious Dose May Explain the High Mortality of the Second and Third Wave of 1918–1919 Influenza Pandemic. PLoS ONE 5(7): e11655.

Vieira, R., P. Canaveira, A. Simões, T. Domingos (2010). Industrial hemp or eucalyptus paper? An environmental comparison using life cycle assessment. International Journal of Life Cycle Assessment 15: 368–375. (DOI 10.1007/s11367-010-0152-y)

Lorena, A., G. M. Marques, T. Sousa, S. A. L. M. Kooijman (2010). Stylized facts in microalgal growth - interpretation in a dynamic energy budget context. Philosophical Transactions of the Royal Society of London B 365, 3509-3521.

Sousa, T., T. Domingos, J. C. Poggiale, S. A. L. M. Kooijman (2010). DEB Theory restores coherence in Biology. Philosophical Transactions of the Royal Society of London B 365: 3413-3428.

Mota, R., T. Domingos, V. Martins (2010). Analysis of genuine saving and potential green net national income: Portugal 1990 - 2005, Ecological Economics 69(10) 1934-1942.

Rodrigues, A., G. Pita, J. Mateus, C. Kurz-Besson, M. Casquilho, S. Cerasoli, A. Gomes, J. Pereira (2010),

Eight years of continuous carbon fluxes measurements in a Portuguese eucalypt stand under two main events: drought and felling, Agricultural and Forest Meteorology (aceite para publicação em 2010/12/16).

Wiesmann, D. ; Azevedo, I., Ferrão, P., Fernández, J. (2011) "Residential Electricity Consumption in Portugal: Findings from top-down and bottom-up models". Energy Policy.

Alves, C., A. Dias, A. Diogo, P. Ferrão, S. Luz, A. Silva, L. Reis and M. Freitas (2010) " Eco-Composite: the effects of the superficial treatments of jute fibers on the mechanical and environmental performance of the composite materials" . J. Composite Materials. DOI: 10.1177/0021998310376111.

S.M. Luz, Gonçalves, A. R., DelÁrco, A. P., Leão, A. L., Ferrão, P., Rocha, G.J. (2010) "Thermal Properties of Polypropylene Composites Reinforced with Different Vegetable Fibers". Advanced Materials Research, 123-125, pp. 1199-1202. doi:10.4028/www.scientific.net/AMR.123-125.1199.

S.M. Luz, Caldeira-Pires, A., Ferrão, P.(2010) "Environmental benefits of substituting talc by sugarcane bagasse fibers as reinforcement in polypropylene composites: Ecodesign and LCA as strategy for automotive components". Resources, Conservation and Recycling, 54, pp. 1135–1144.

C. Alves, Ferrão, P., Silva, A. J., Reis, L.G., Freitas M., Rodrigues L.B., Alves, D.E. (2010) "Ecodesign of automotive components making use of natural jute fiber composites". J. Cleaner Production, 18, (4), pp. 313-327.

S.M. Luz, Ferrão, P., Alves, C., Freitas, M., Caldeira-Pires A. (2010) "Ecodesign Applied to Components Based on Sugarcane Fibers Composites". Materials Science Forum, 636-637, pp. 226-232. doi:10.4028/www.scientific.net/MSF.636-637.226.

I. Costa and Ferrão, P. (2010) "A case study of industrial symbiosis development using a middle-out approach". J. Cleaner Production, 18, (10-11), pp. 984-992.

D. Livengood, F. C. Sim Sim, C. Ioakimidis & R.Larson, 'Responsive Demand in Isolated Energy Systems', Published on WIT Transactions on the Ecology and the Environment (ISSN:1743-3541), International Journal of Sustainable Development and Planning, Vol. 130, pages 197-208, (2010).

J.Borges, C.S. Ioakimidis, P. Ferrão, 'Fast charging stations for Electric Drive Vehicles infrastructure', Published on WIT Transactions on Ecology and the Environment (ISSN:1743-3541), International Journal of Sustainable Development and Planning, Vol. 130, p. 275-284, (2010).

H. Gerbelova, C.S. Ioakimidis, P. Ferrão, Paper 'A Techno-economical study of the CO2 capture technologies in the energy sector in Portugal' to be published to Journal 'Energy Procedia', (2010), p.8.

C.S. Ioakimidis, H. Gerbelova, S. Casimiro, A. Chatzimichali, P. Ferrão, Paper 'A Qualification study and assessment of the CO2 storage capacity, siting and costs in Portugal' to be published to Journal 'Energy Procedia', (2010), p.8.

H. Gerbelova, A. André, S. Casimiro, C. S. Ioakimidis, M. Melo, P. Ferrão, Paper 'Assessment of Carbon Capture and Storage Opportunities: Portuguese Case Study' to be published to Journal 'Energy Procedia', (2010), p. 8.

Group Productivity

Christos Ioakimidis, Sergio Casimiro, 'Technology Transfer Approaches for Early Stage Desalination Technologies', submitted to 'International Journal of Innovation and Regional Development (IJIRD)', Special Issue on: "Innovative Entrepreneurship: Sources of Innovation, Policies and Learning", (2010).

C.S. Ioakimidis, A. Pina, P. C. Ferrão, 'The Introduction and integration of Plug-in Hybrid Electric Vehicles in the energy and fleet mixture in the island of São Miguel' submitted to 'Energy Policy', (2010). (Impact Factor 2.436).

G. Mendes, C.S.Ioakimidis, P.C.Ferrão, 'A Review on Optimization Methods for Distributed Generation Planning' submitted to 'Renewable and Sustainable Energy Reviews', (2010). (Impact Factor 4.842).

C. Silva, P. Baptista, C.Camus, J. P. Lopes, P.Rocha, F. Soares, C.S. Ioakimidis, F. Sim Sim, A. Pina, 'Évaluation of electric vehicles introduction and cost/benefits analysis in a small island', in submission to the scientific journal 'Environmental Science and Technology', (beginning of 2011). (Impact Factor: 4.363).

C.S.Ioakimidis, J. Borges, P. C. Ferrão, 'Fast Charging Stations and Risk Analysis', in submission to the scientific journal 'Energy Policy' (till December 20th, 2010). (Impact Factor 2.436).

C.S. Ioakimidis, L.Oliveira, 'Prediction of wind conditions for a micro-wind turbine at a residential location as part of the Energy Box Management Decision Tool', submitted on 'Renewable Energy', (2010). (Impact Factor: 2.226).

C. S. Ioakimidis, N. Koukoulas, A. Chatzimichali, G. Itskos, Working Paper 'Strategic planning of CCS implementation in Greece', submitted to 'Energy Policy', (2010). (Impact Factor 2.436.)

Other international publications

- Gonçalves, A., A. Serrenho, T. Domingos, T. Sousa (2010), An evaluation of EPPA, a growth model, International Society of Ecological Economics 2010-11th Biennial Conference, 22 – 25 August, Oldenburg and Bremen, Germany.

- Gonçalves, A., T. Domingos (2010). Urban Growth and Its Impact on Development. 50th Anniversary European Congress of the Regional Science Association International, 19-23 August, Jonkoping, Sweden.

- Marta, C., G. M. Marques, T. Domingos (2010), Estimating demand for Guaranteed Sustainability labeled beef, 119th European Association of Agricultural Economists Seminar, June 30-July 2, Capri, Naples (Italy).

- Mota, R., T. Domingos (2010). Assessing green accounting theoretical predictions: Does the data meet the theory? IV AERNA Congress 2010, 2-5 July Gran Canaria, Spain.

- Pita, G., A. Rodrigues, J. Mateus, J. Pereira (2010), Net Ecosystem Carbon Exchange and Evapotranspiration after the felling of an Eucalyptus forest. ESA-iLEAPS-EGU Joint Conference on Earth Observation for Land-Atmosphere Interaction Science, 3-5 November, Frascati (Rome, Italy).

- Pita, G., A. Rodrigues, J. Mateus, J. Pereira (2010). Net Ecosystem Carbon Exchange and Evapotranspiration before and after the felling of an Eucalyptus forest. Mixed and Pure Forests in a Changing World 2010, IUFRO Conference, 6-8 Outubro, Vila Real.

- Pita, G., A. Rodrigues, J. Mateus, J. S. Pereira (2010). Impact of tree felling and drought in carbon fixation over a Portuguese Eucalyptus site. EGU General Assembly 2010, 02 - 07 May, Vienna, Austria.

- Ramalho, R., T. Domingos (2010). Environmental Assessment of Power Systems: Integrating Life Cycle Assessment and Operational Requirements. 23th International Conference on Efficiency, Cost, Optimization, Simulation and Environmental Impact of Energy Systems, June 14-17, Lausanne, Switzerland.

- Rodrigues, J., A. Marques, T. Domingos (2010). Carbon Responsibility and Embodied Emissions - Theory and measurement. Routledge Series in Ecological Economics, Taylor and Francis, London.

- Serrenho, A., A. Gonçalves, T. Domingos, T. Sousa (2010). Growth models: An evaluation of IPCC's assumptions on the role of energy. International Society of Ecological Economics 2010-11th Biennial Conference, 22 – 25 August, Oldenburg and Bremen, Germany.

- Teixeira, R., T. Domingos (2010). Preliminary Assessment of the Plot Level Carbon Budget of Natural and Sown Biodiverse Grasslands. Actas da IV Reunião Ibérica de Pastagens e Forragens. Zamora e Miranda do Douro, 3 a 6 de Maio.

- Costa I, Massard G, Agarwal A. 2010. Waste management policies for industrial symbiosis development: case studies in European countries, Journal of Cleaner Production, Volume 18, Issue 8, May 2010, Pages 815-822;

- Costa I, Ferrao P. 2010. A case study of industrial symbiosis development using a middle-out approach, Journal of Cleaner Production, Volume 18, Issues 10-11, July 2010, Pages 984-992;

- Costa I.2010. Developing Industrial Symbiosis: a Portuguese case study. Energy Manager, Volume 3, Issue 4, October-December 2010, Pages 34-40; D. Livengood, F. C. Sim Sim, C. Ioakimidis & R.Larson, 'Responsive Demand in Isolated Energy Systems', Published on WIT Transactions on the Ecology and the Environment (ISSN:1743-3541), International Journal of Sustainable Development and Planning, Vol. 130, pages 197-208, (2010).

- J.Borges, C.S. Ioakimidis, P. Ferrão, 'Fast charging stations for Electric Drive Vehicles infrastructure', Published on WIT Transactions on Ecology and the Environment (ISSN:1743-3541), International Journal of Sustainable Development and Planning, Vol. 130, p. 275-284, (2010).

- H. Gerbelova, C.S. Ioakimidis, P. Ferrão, Paper 'A Techno-economical study of the CO2 capture technologies in the energy sector in Portugal' to be published to Journal 'Energy Procedia', (2010), p.8.

C.S. Ioakimidis, H. Gerbelova, S. Casimiro, A. Chatzimichali, P. Ferrão, Paper 'A Qualification study and assessment of the CO2 storage capacity, siting and costs in Portugal' to be published to Journal 'Energy Procedia', (2010), p.8.

H. Gerbelova, A. André, S. Casimiro, C. S. Ioakimidis, M. Melo, P. Ferrão, Paper 'Assessment of Carbon Capture and Storage Opportunities: Portuguese Case Study' to be published to Journal 'Energy Procedia', (2010), p. 8.

Other national publications

Group Productivity

Domingos, T., T. Sousa (2010). The analogy between equilibrium thermodynamics and neoclassical microeconomics. Actas da Workshop Perspectivas em Econofísica II, Universidade de Évora, 22 de Novembro de 2010.

Marques, A., J. Rodrigues, T. Domingos (2010), Responsabilidade de Carbono, Revista CAIS, 152, pp. 26-27.

Valada, T. (2010), Pegada Ecológica, Revista CAIS 151, pp. 26-27-

Mota, R., T. Domingos (2010), Indicadores económicos de sustentabilidade e bem-estar, Revista CAIS.

Teixeira, C., T. Domingos (2010), A Biodiversidade e a Agricultura, Revista CAIS.

Teixeira, R., T. Domingos (2010). Sequestro de carbono em pastagens, Revista CAIS.

Marta, C., T. Domingos (2010), O caso de Castro Verde, Revista CAIS, Outubro 2010, pp. 14-15.

Valada, T., T. Domingos (2010), Biocombustíveis, Revista CAIS.

Serrenho, A., T. Domingos (2010), Energia na Economia, Revista CAIS.

Baptista P., Pina A. , Lurdes Ferreira, "No ambiente e nos incentivos está o ganho", Artigo no Suplemento "Carro Eléctrico" do Jornal Público do dia 16 de Setembro de 2010

Ferrão P., Silva C. "O projecto Green Islands: Ponte para o futuro". Açoriano Oriental, 18 de Novembro de 2010.

Silva C. "Energia e TIC: Serviços de Energia e Eficiência Energética" Executive Digest, Setembro 2010.

Niza, S., Câmara Pereira, F. 2010. A modelação integrada de sistemas de Transportes e de Energia no programa MIT Portugal. In: Climatização, N.º 68, Março/Abril 10.

Ph.D. thesis completed

- Teixeira, R. (2010). Sustainable Land Uses and Carbon Sequestration: the Case of Sown Biodiverse Permanent Pastures Rich in Legumes. Dissertação para obtenção do Grau de Doutor em Engenharia do Ambiente. Instituto Superior Técnico, Universidade Técnica de Lisboa.

- Duarte Correia . Desenvolvimento e implementação de técnicas tomográficas para a análise de escoamentos com combustão. Doutoramento em Engenharia Mecânica, IST . Data de conclusão: Outubro de 2010

- Maria João Rodrigues . Building integrated photovoltaics (BiPV) technology diffusion into Portuguese urban areas . Doutoramento em Engenharia Mecânica, IST . Data de conclusão: 2010

- Cristiano Alves . Ecodesign based on the use of natural fibers based composites. Doutoramento em Engenharia Mecânica, IST . Co-orientador: Prof. Manuel Freitas . Data de conclusão: 2010

Organization of conferences

Workshop Lançamento do Projecto ResiSt - Promoção da Resiliência Urbana através da gestão dos stocks de recursos urbanos Kick off Workshop of ResiSt – promoting urban resilience through the management of urban stock resources], 22 April 2010.http://lisboaenova.org/index.php?option=com_content&task=view&id=1299&Itemid=482

1st Workshop "Modelação e Planeamento de Sistemas Energéticos Sustentáveis", 8 de Janeiro de 2010, IST

2nd Annual MIT-Portugal Conference: Creating Values through Systems Thinking. FEUP, Porto, 28 de Setembro de 2010

Industry contract research

Consulting services for the compensation of environmental impacts of printing and sending electricity invoices – contract with EDP – Energias de Portugal, S. A.

Consulting services for the evaluation of environmental services of the "Cascata da Serra da Estrela" – contract with EDP – Energias de Portugal, S. A. in consortium with two other organizations.

Consulting services for the evaluation, reporting, reduction and compensation of emissions of greenhouse gases – contract with Chamartin Imobiliária and Sustentare, Consultoria de Sustentabilidade, Lda.

Consulting services for the evaluation of sustainability of marine salt production - contract with Necton, S. A.

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Consulting services for the compensation of greenhouse gas emissions - contract with Ecoprogresso, S. A.

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Internationalization

Participation in the European Research Group AquaDEB (www.ifremer.fr/aquadeb).

Government/Organization contract research

Services of continuous evaluation of the Rural Development Program for Continental Portugal 2007-2013 - contract with the Ministry of Agriculture in consortium with two other organizations (2009-2015).

Group Description	
Title of Research Group:	(RG-LVT-50009-3584) Laboratory of Thermofluids, Combustion and Energy Systems, at IN+ Center for Innovation, Technology and Policy Research
Principal Investigator:	Antonio Luis Nobre Moreira
Main Scientific Domain:	Engenharia Mecânica
Group Host Institution:	Instituto Superior Técnico - Universidade Técnica de Lisboa

Funding, source, dates	
Funding, source, dates	<p>"15th International Symposium on Applications of Laser Techniques to Fluid Mechanics", Projecto de financiamento próprio, Instituto Superior Técnico, 2009-2010.</p> <p>"Advanced Intermittent Spray Cooling Systems", Projecto PTDC/EME-MFE/69459/2006, Instituto Superior Técnico, 2007-2010.</p> <p>"Fundamental Studies on MULTIJET Spray Technology", Projecto PTDC/EME-MFE/099040/2008, Instituto Superior Técnico, 2010-2013.</p> <p>"Desenvolvimento da técnica de quimiluminiscência para a detecção directa da composição de misturas de combustíveis em chamas laminares. FCT- PTDC/EME/-MFE/68830/2006-2010</p> <p>"Chamas incidentes-modelação matemática e experimental do seu comportamento instável" FCT-PDTC/EME-NFE/68829/2006-2010</p> <p>"Aether" Aero-acoustical and thermo-acoustical coupling in energy processes", Marie Curie Program MRTN-CT-2006-035713 – 2006-2010</p>

Objectives & Achievements	
Objectives	<p>The core goal of fundamental research is the innovation of new engineering concepts and is addressed as a driving force for new technologies.</p> <p>Fundamental research builds the scientific knowledge necessary to give function a sustainable and human-oriented form, thus harmonizing technology with the environment, at the same time that application studies chase the functionality of advanced technologies and their results (products and services) from a user perspective. In this context, research at the Laboratory of Thermofluids, Combustion and Energy Systems Design is aimed at improving knowledge in advanced fields of strategic technologies with emphasis on principles of thermodynamic transport phenomena. The final goal is to bring together multidisciplinary knowledge to develop new procedures and technologies, as well as to carry out research to gain the fundamental knowledge needed to solve new problems in the topic of system conversion energy.</p> <p>The work essential covers the system optimization of input/output of energy and pollutant, ranging from large scale units to micro-systems with special emphasis on lean burning processes (for NO_x control), ignition and instabilities aspects of flames, fundamentals of fluid atomization, enhanced heat transfer processes, and experimental and physical modelling of forest fire phenomena, covering interdisciplinary scientific fields, such as Thermal-fluid-dynamics, Combustion and Advanced Techniques for Flow Measurements, Control Engineering, Materials Engineering, Transport and Thermophysical Properties of Materials, Electronics and Microsystems.</p> <p>The activities are organized on the basis of projects which provide the necessary external funding, namely from national and international funding agencies and/or private companies from which research areas emerge.</p>

Main Achievements	
Main Achievements	<p>The work essentially covered the system optimization of input/output of energy and pollutant, ranging from large scale units to more recently micro-systems with special emphasis on lean burning processes (for NO_x control), ignition and instabilities aspects of flames In general the main achievements can be resumed as</p> <ul style="list-style-type: none"> -International collaborative research – e.g. University of Lulea-Sweden, Institute of Physics and Mathematics-Russia, UCambridge, and a large consortium (over 50 institutions) -Organization of a thematic workshop -International collaboration at the student graduation level (Graduation-University of Lulea-Sweden)

Group Productivity	
Publications in peer review Journals	<p>"Transient analysis of intermittent multijet sprays", October 2010, M. R. O. Panão, A. L. N. Moreira and D. F. G. Durão. Submitted to Experiments in Fluids.</p> <p>"Scaling the effects of surface topography in the secondary atomization resulting from droplet/wall interactions", October 2010, by A. S. Moita and A. L. N. Moreira. Submitted to Experiments in Fluids.</p> <p>"Analysis of heat transfer during drop impact onto a hot dry rigid substrate", A. S. Moita, A. L. N. Moreira and I. V. Roisman. Submitted to the journal Physical of Fluids, Review E, May 2010.</p> <p>"Spray-Wall Impact", A L N Moreira and M R O Panão, to appear in the Handbook of Atomization and Sprays: Theory and Applications ,</p>

Group Productivity

Springer, 2010.

"Droplet-Wall Interactions", A L N Moreira and A S Moita, to appear in the Handbook of Atomization and Sprays: Theory and Applications , Springer, 2010.

"Thermal-fluid assessment of multijet atomization for spray cooling applications", 2010, M. R. O. Panão, A. L. N. Moreira and D. F. G. Durão. Energy, 10.1016/j.energy.2010.05.042.

"Advances and Challenges in Explaining Fuel Spray Impingement: How Much of Single Droplet Impact Research is Useful?", 2010, A L N Moreira, A S Moita and M R O Panão. Progress in Energy and Combustion Science 36 (2010) 554–580

Experimental Methods in Thermo-Acoustics , E.C.Fernandes, J.G. mericia, T.trindade, (2010) Chapter in Basics of Aeroacoustics and Thermoacoustics, von Karman Institute for Fluid Mechanics , Ed. J. Christophe Schram

Rayleigh Criterion- Theory and Experiments ,(2010) E.C.Fernandes, I.D.V. Leitão, Chapter in Basics of Aeroacoustics and Thermoacoustics, von Karman Institute for Fluid Mechanics , Ed. J. Christophe Schram

Other international publications

"Physical Analysis of multimodality in atomization processes", M.R.O. Panão, L. Radu and A.L.N. Moreira, 23rd Annual Conference on Liquid Atomization and Spray Systems, Brno, Czech Republic, September 2010.

"Heat transfer mechanisms at droplet/wall interactions: experiments and theory", A. S. Moita, I. V. Roisman and A. L. N. Moreira, 23rd Annual Conference on Liquid Atomization and Spray Systems, Brno, Czech Republic, September 2010

"On the assessment of heat transfer measurements at droplet/wall interactions: relation with the impact conditions", A. S. Moita and A. L. N. Moreira, 23rd Annual Conference on Liquid Atomization and Spray Systems, Brno, Czech Republic, September 2010

"Heat Transfer during drop impact onto a heated solid substrate", A. S. Moita, A. L. N. Moreira and I. Roisman, International Heat Transfer Conference, August 8 – 13, 2010, Washington, USA.

"Heat transfer investigations in micro-channel flows", V. Silvério, A. L.N. Moreira, V. Semião, C. N. Carvalho, G. Lavareda, P. Parreira and A. Amaral, 15th Int. Symp. On Applications of Laser Techniques to Fluid Mechanics, Lisbon, 5-8 July, 2010.

"Analysis of the transient atomization characteristics of intermittent multiple impinging jets", M.R.O. Panão, A.L.N. Moreira and D.F.G. Durão, 15th Int. Symp. On Applications of Laser Techniques to Fluid Mechanics, Lisbon, 5-8 July, 2010.

"Scaling the effects of surface topography in the secondary atomization resulting from droplet/wall interactions", A. S. Moita and A. L. N. Moreira, 15th Int. Symp. On Applications of Laser Techniques to Fluid Mechanics, Lisbon, 5-8 July, 2010.

Simultaneous pressure and heat release measurements in a 150kW powder burner, Göktepe B. a*, Gebart R.b, Leitão N.c, Leitão I. V.c, Merícia J. G.c, Fernandes E. C., SPEIC10: Towards Sustainable Combustion – Tenerife (Spain) 16-18 June 2010

The influence of local stretch rate on flame C2*/CH* chemiluminescent ratio, T. Trindade*, E. C. Fernandes, SPEIC10: Towards Sustainable Combustion – Tenerife (Spain) 16-18 June 2010

The influence of moisture on premixed flame spark ignition, Rato, R. and Fernandes E. C., SPEIC10: Towards Sustainable Combustion – Tenerife (Spain) 16-18 June 2010

The design of pressure probe sensor for combustion chambers, N. Leitão*, E. C. Fernandes, SPEIC10: Towards Sustainable Combustion – Tenerife (Spain) 16-18 June 2010

Detailed Analysis of Flame Chemiluminescence, Filipa Ferro, Edgar C. Fernandes, João Sanches, SPEIC10: Towards Sustainable Combustion – Tenerife (Spain) 16-18 June 2010

Characteristics of Unsteady Lean Premixed Impinging Laminar Flames, Merícia J. G., Fernandes E. C., SPEIC10: Towards Sustainable Combustion – Tenerife (Spain) 16-18 June 2010

Flame Transfer Function of a Low Swirl Burner Leitão I. V., Fernandes E. C., SPEIC10: Towards Sustainable Combustion – Tenerife (Spain) 16-18 June 2010

CHARACTERIZATION OF HELICAL INSTABILITIES IN SWIRL FLOWS MAKING USE OF ACOUSTICS PROBES AND CROSS-CORRELATION ANALYSIS, S.V. Alekseenko^{1, 2}, E.C. Fernandes³, I.V. Litvinov², S.I. Shtork^{1, 2}, International Conference on Methods of Aerophysical Research, ICMAR 2010

Alekseenko S.V., Fernandes E.C., Litvinov I.V., Shtork S.I. Characterization of helical instabilities in swirl flows making use of acoustics probes and cross-correlation analysis. Proc. 15th International Conference on the Methods of Aerophysical Research (ICMAR 2010), November 1 - 6, 2010, Akademgorodok, Novosibirsk, (10 p., CD). (Oral presentation). <http://www.itam.nsc.ru/icmar2010/ENG/index.php>

Alekseenko S.V., Fernandes E.C., Litvinov I.V., Shtork S.I. Characterization of helical instabilities in swirl flows making use of acoustics probes and cross-correlation analysis. Abs. 15th International Conference on the Methods of Aerophysical Research (ICMAR 2010), November 1 - 6, 2010, Akademgorodok, Novosibirsk, Part 1, pp. 13-14.

Shtork S.I., Fernandes E.C. Diagnostics of unsteady vortex flow in a model low emission combustion chamber. Abs. Second National (All-Russian) Scientific-Practical Conference with International Participation "Innovative Energy - 2010", Novosibirsk State Technical University, November 10-12, 2010, Novosibirsk, pp. 49-52 (in Russian). (Oral invited presentation) <http://www.itp.nsc.ru/conferences/ie.htm>

Mendes-Lopes, J M C, Ventura, J M P, Santos, N M G, Guijarro, M, Madrigal, J, and Marino, E: "Comparison of surface fire propagation studies at two laboratory scales: a case study of interaction with a tree trunk", 6th Int. Conf. Forest Fire Research, paper 79, Coimbra, November 2010

Ventura, J M P, Mendes-Lopes, J M C, and Santos N M G: "Development of an instrumented tree trunk to work autonomously collecting temperature information in surface fire propagation", 6th Int. Conf. Forest Fire Research, paper 209, Coimbra, November 2010

Ph.D. thesis completed

Group Productivity

Estudo de camadas de dupla difusão- aplicação a casos de lagos solares, Célia Tavares, IST, (2010) Supervisor: Edgar Fernandes

"Influência recíproca de um tronco de árvore e de propagação de fogo em leito florestais"; Virgílio Manuel Ferreira Figueiredo, MEMec, IST, 2010 (supervisor JMC Mendes Lopes, co supervisor J Ventura)

Organization of conferences

15th International Symposium on Applications of Laser techniques to Fluid Mechanics, 05-08 July 2010, Lisbon, Portugal

Organization of Conferência Internacional SPEIC10: Towards Sustainable Combustion – Tenerife (Spain) 16-18 June 2010

Internationalization

"Aether" Aero-acoustical and thermo-acoustical coupling in energy processes", Marie Curie Program MRTN-CT-2006-035713

Group Description	
Title of Research Group:	(RG-LVT-50009-3585) Laboratory of Technology Policy and Management of Technology, at IN+ Center for Innovation, Technology and Policy Research
Principal Investigator:	Rui Miguel Loureiro Nobre Baptista
Main Scientific Domain:	Economia e Gestão
Group Host Institution:	Instituto Superior Técnico - Universidade Técnica de Lisboa
Funding, source, dates	
Funding, source, dates	
<p>"CORPORATE R&D PRODUCTIVITY", 151460-2009 AO8-PT; EUROPEAN COMMISSION, 29/09/2009</p> <p>"CAPITAL HUMANO, CARREIRAS EMPREENDEDORAS E NOVAS EMPRESAS DE BASE TECNOLÓGICA", CMU-PT/ETECH/0036/2008; FCT, 01/04/2009</p> <p>Universidades e Criação de Empresas", PTDC/ESC/71125/2006; FCT, 01/01/08</p> <p>"Diversificação", PTDC/GES/71174/2006; FCT, 01/09/07</p> <p>"Mudança Tecnológica e Inovação", CMU-PT/0014/2007; FCT, 01/07/07</p>	
Objectives & Achievements	
Objectives	
<p>The main objectives of the "Technology Policy and Management of Technology" Laboratory are:</p> <ul style="list-style-type: none"> - To develop and use advanced research methodologies for the analysis of techno-economic systems; - To promote the exchange of knowledge in advanced technologies and the management of technology and innovation for the optimization of industrial processes, as a way to promote competitive advantages at the corporate level; - To derive science and technology policies, and innovation and entrepreneurship strategies leading to socio-economic development. <p>The emphasis on innovation and entrepreneurship draws on recent conceptual approaches to economic growth in which the accumulation of knowledge and entrepreneurial activity are the fundamental driving forces behind growth. This fact is reflected in the trend in developed economies towards an increasing investment in advanced technology and the development of entrepreneurial capabilities. Concepts such as learning ability, creativity, and entrepreneurial human capital gain greater importance as guiding principles for the conduct of individuals, institutions, nations and regions. The research carried out focuses on a variety of issues surrounding the creation and diffusion of knowledge as well as of human capital capable of learning and developing commercial applications for that knowledge. These issues include:</p> <ul style="list-style-type: none"> - Systems and Policies for Knowledge Creation, Diffusion and Usage; - Higher Education Policy and Management; - The Learning Economy; - Technology and Economic Inequality; - The impact of Entrepreneurship on Regional and National Economic Development; - Innovation and Firm Productivity; - Technology Management and Collaborative Innovation; - Education, Human Capital and Entrepreneurship; - Globalization, Diversification and Technology Capacity in the Auto Parts Sector; - Mobilizing Information and Communication Technologies: Implications for Regional Development. 	
Main Achievements	
<p>The development of competencies in the areas of entrepreneurship, and science, technology and innovation policy has been carried out successfully according to the following main lines of development:</p> <ol style="list-style-type: none"> i) The promotion of master degree programs in "Engineering Policy and Management of Technology" (from 1998) and in "Engineering Design" (from 2002), with the aims of training young engineering graduates in new areas of education, and promote new links with Portuguese companies; ii) The promotion of a new Ph.D. program in technological change and entrepreneurship (from 2007), developed jointly with Carnegie Mellon University (and leading to a dual degree by IST and CMU), with the aim of providing advanced training to young researchers, and developing international research projects involving students and faculty across the Atlantic; iii) Active participation by faculty and research students in international conferences and workshops, and the organization of the International Conferences on Technology Policy and Innovation, which were launched in July 1997 and are carried out in close collaboration with a number of leading research groups worldwide. iv) Activities promoting technology-based entrepreneurship through extra-mural programs of entrepreneurship education and new venture 	

Objectives & Achievements

development.

The Laboratory has obtained funding for the development of research projects in a variety of fields related with its main objectives, including:

- Technological change and economic development;
- Education and Entrepreneurial Human Capital;
- Higher Education Policies;
- Universities and Technology-based Entrepreneurship;
- Innovation and Firm Productivity;
- Diversification and Entrepreneurial Entry by Small Firms.

Group Productivity

Publications in peer review Journals

Baptista, R. e J. Mendonça (2010), "Proximity to Knowledge Sources and the Location of Knowledge Based Start-ups", *The Annals of Regional Science*, Volume 45, Number 1, Pages 5-29, Springer.

Ortega-Argilés, R. and A. Brandsma (2010) EU-US differences in the size of R&D intensive firms: Do they explain the overall R&D intensity gap?, *Science and Public Policy*, 37(6), 429-441.

Ortega-Argilés, R.; M. Piva; L. Potters and M. Vivarelli (2010) Is corporate R&D investment in high-tech sectors more effective? Some guidelines for European Research Policy, *Contemporary Economic Policy*, 28(3), July, 353-365.

Ortega-Argilés, R.; M. Vivarelli and P. Voigt (2009) R&D in SMEs: A Paradox?, *Small Business Economics*, 33(1), 3-11.

Other international publications

Baptista, R. (2010), "Culture, political institutions and the regulation of entry", em *Entrepreneurship and Culture*, A. Freytag and R. Thurik (eds.), Pages 55-77, Springer.

Baptista, R. e M.T. Preto (2010), "Long Term Effects of New Firm Formation by Type of Start-up", *International Journal of Entrepreneurship and Small Business*, Vol. 11: No. 4, pp. 382 – 402, InderScience (indexed in Scopus).

Baptista, R. e J. Leitão, Eds. (2009), *Public Policies for Fostering Entrepreneurship: Perspective*, Series: International Studies in Entrepreneurship, Vol. 22 Julho de 2009, ISBN: 978-1-4419-0248-1 Springer

Leitão, J. & R. Baptista (2009). 'Inward FDI and ICT: Are They a Joint Technological Driver of Entrepreneurship?', *International Journal of Technology Transfer and Commercialization*, Forthcoming (indexed in ABI/Inform). Kumbhakar, Subal C.; Ortega-Argilés, Raquel; Potters, Lesley; Vivarelli, Marco; Voigt, Peter (2010) "Corporate R&D and Firm Efficiency: Evidence from Europe's Top R&D Investors," IPTS Working Papers on Corporate R&D and Innovation, num. 11/2010, European Commission, Institute for Prospective Technological Studies Technical Report.

Cincera, M., Hernández, H., Moncada-Paternò-Castello, P., Tuebke, A., Ortega-Argilés, R. and P. Voigt (2010) *Analysis of the 2008 EU Industrial R&D Investment Scoreboard*, European Commission, Institute for Prospective Technological Studies Technical Report

Ortega-Argilés, R and R. Moreno (2009) Differences in survivor functions according to different competitive strategies, In: C. Karlsson, B. Johansson and R. Stough (eds.), *Innovations and Entrepreneurship in Functional Regions*, Cheltenham, Edward Elgar Publishers Limited, pp. 448.

Ortega-Argilés, R, Moreno, R., and J. Suriñach (2009) Agency Control Mechanisms and Innovative Effort, In: B. Johansson, C. Karlsson, and R. Stough (eds.), *Innovation, Agglomeration, and Regional Competition*, Cheltenham, Edward Elgar Publishers Limited In press

Kumbhakar, Subal C.; Ortega-Argilés, Raquel; Potters, Lesley; Vivarelli, Marco; Voigt, Peter (2009) *Corporate R&D and Firm Efficiency: Evidence from Europe's Top R&D Investors*, IZA Discussion Papers 4657, Institute for the Study of Labor (IZA).

Ortega-Argilés, R.; M. Piva; L. Potters and M. Vivarelli (2009) Is corporate R&D investment in high-tech sectors more effective? *Jena Economic Research Papers*, n. 2009 – 038, ISSN 1864-7057

Other national publications

Ortega-Argilés, R. and R. Moreno (2009) Evidence on the role of ownership structure on Firm's Innovative Performance, *Investigaciones Regionales*, 15, 231-250.

Ortega-Argilés, R. and R. Moreno (2009) Evidence on the role of ownership structure on Firm's Innovative Performance, *Research Institute of Applied Economics IREA Working Paper Series*, num. 2009/09

Internationalization

[Collaborative publication, Research, Graduate Training Networks or other forms of participation of the Research Group at the international level.]

Group Description	
Title of Research Group:	(RG-LVT-50009-3589) Centre of Mineral Resources, Mineralogy and Crystallography of the Faculty of Science of Lisbon University (CREMINER)
Principal Investigator:	Fernando José Arraiano de Sousa Barriga
Main Scientific Domain:	Ciências da Terra e do Espaço
Group Host Institution:	Fundação da Faculdade de Ciências - Faculdade de Ciências da Universidade de Lisboa
Funding, source, dates	
Funding, source, dates	
<p>Funding from FCT, 2010: Financiamento da Unidade (FCT-LA/Creminer) PTDC/CTE_GEX/82678/2006 EUROMARC/00001/2007 PTDC/CTE_GIN/67027/2006 PTDC/CTE-GIX/097946/2008/</p>	
Objectives & Achievements	
Objectives	
<p>Given the continuing extremely high demand for natural resources, and raising concerns on environmental impacts, Creminer continues devoted to research and development in Earth and Space Sciences related to geochemical systems and to the genesis, evolution and use of crustal resources, from land and the ocean floors, with emphasis in fluid-rock interaction processes and Mineralogy and Crystallography and their applications, including environmental management. Creminer is starting a new, large research effort in uranium deposits, related not only to the strategic character of this energy resource but also to the uranium mining impacts.</p> <p>Studying the sea floor continues dominant in Creminer. Among the infrastructures under the responsibility of Creminer there are the Stable Isotope Laboratory, AmbiTerra, and the Mobile Lab. We need easier access to ships equipped for earth science research, with multi-beam bathymetry, multi-channel seismics and specialised vehicles and samplers such as AUVs, ROV's and TV Grabs. Scientific subjects to be developed by Creminer, in addition to current research, in the next few years, include i) Geology of the Deep Biosphere; ii) Geoarchaeology; iii) Uranium exploration and environmental issues. Our expertise in soil science and our ability to analyse low temperature rocks and soils for nutrients and pollutants shall contribute to find essential links between the deep biosphere and rock evolution, from soft sediments to hard rock. We are applying this expertise to studies in the Azores Sea and in the Arctic near 74°N.</p> <p>Another strategic objective of Creminer is to contribute to strengthen the notion that Earth sciences and mineral resources are, more than ever, essential components of sustainable development.</p> <p>The integration of researcher Ana Isabel Janeiro greatly expands our analytical capabilities, including in I&D activities to support the national industry including, for example, biodiesel research</p> <p>In line with our expertise in erosion products and use of dam lake sediments, Project RECOVER - Reversing desertification in volcanic terrains, under a semiarid climate, through the reuse of erosion products was presented to, and is under consideration of the Government of Cape Verde.</p> <p>READE will soon start new projects, on the characterization and environmental recovery of important areas of Minas Gerais (Paraopeba Basin and São Francisco River near Três Marias)</p> <p>Creminer (and CCV Lousal) will lead the installation of the Lousal Laboratory of Metallogeny Applied to Exploration and Environmental Geochemistry (METALpro) with QREN funding</p> <p>Other objectives are (a) strengthening the international relationships with the partners in the submitted projects in the areas of mineralogy of uranium minerals and kinetics of mineral dissolution; (b) perform synchrotron experiments with the materials used in Cu adsorption and validate the obtained theoretical models; and (c) undertake a research program on computational mineralogy and geochemistry supporting the existing experimental work, and develop models of metal adsorption onto clay edge surface sites, which are still unexplored by the scientific community.</p>	
Main Achievements	
<p>The group has achieved internationally recognized success with its studies on i) ore-forming processes and resource characterization on land, including metallic and non-metallic resources (with noteworthy involvement in publication of mineral resource maps); ii) submarine hydrothermal resources and the deep biosphere, and iii) experimental and geochemical modelling of low-temperature processes related with environmental impacts due to heavy metal contamination in landfills and old mining areas. Study the kinetics and mechanisms of adsorption of transition metals and radionuclides onto phyllosilicates and study the geochemical conditions and mineralogical controls in the formation of uranyl-bearing phosphates. There are already very significant (published) results. The main components of these studies are mineralogy and geochemistry, including isotopic geochemistry. Combination of i) and ii) led to original proposals for the exploration for submarine massive</p>	

Objectives & Achievements

sulphide deposits, ready to be tested in actual seafloor and subseafloor exploration campaigns. Our participation in the discovery of the Loki's Castle Arctic hydrothermal field (and study of Jan Mayen) speak eloquently for our level of involvement in sea floor studies. Work continues with comparisons with the Azores MoMAR examples, and more general studies including the behaviour of platinum group elements serpentinization and energy balance. The main limiting factor, for Creminer as for other research institutions in Portugal, is access to shiptime and submersible use.

Creminer led the Portuguese part of a new consortium with Brazil, for environmental studies, Rede Luso-Brasileira de Remediação e Reabilitação de Ambientes Degradados (READE), created in 2009. Great advances (including new members of the READE network, both in Portugal and in Brazil) will soon lead to active co-operative research and doctoral level education.

Public outreach efforts have strengthened further, largely related to the Centro Ciência Viva Mina de Ciência (Mine of Science Live Science Centre), part of the national network of science centres) already acclaimed as a landmark of capacity for the original production of scientific contents in hands-on exhibits. J Relvas and A Pinto are directors of the Centre.

Concerning the new experimental facilities, the Stable Isotope lab is now installed and, as of 2011, a highly qualified researcher (Ana Isabel Janeiro) was hired by FCUL and charged with running the isotope lab. She is integrated in Creminer. AmbiTerra (run by R Fonseca) gained expertise and general recognition as a top quality laboratory for soils and sediments, including marine sediments, for which AmbiTerra may already be a leading national laboratory. These labs are beginning to perform analyses not only for Creminer's research but also in the framework of external contracts for applied studies and surveys.

The Mobile Lab has been used extensively for outreach activities, especially with the Cascais municipality, which has developed a close relationship with LA-ISR and Creminer.

Group Productivity

Publications in peer review Journals

Abreu, M.; Batista, M.J.; Magalhães, M.C.F.; Matos, J.X. (2010) Acid Mine Drainage in the Portuguese Iberian Pyrite Belt. Cap. II In Mine Drainage and Related Problems Book, Editor Brock C. Robinson, Nova Science Publishers, ISBN: 978-1-60741-285-4, New York, USA, 51pp

Andrade E., Madruga M.J., Bobos I., Paiva M.I., Maia F., Mateus A., Trindade R., Freitas M.C. and Gonçalves M.A. (2010). Characterization of Portuguese Geomaterials, the Clay Component of Rañas, as Potential Liners for Low and Intermediate Radioactive Disposal Sites. *Journal of Radioanalytical & Nuclear Chemistry* 286: 777–783. DOI 10.1007/s10967-010-0715-1

Candeias, C.; Silva, E.F.; Salgueiro, A.R.; Pereira, H.G.; Matos, J.X.; Ávila, P.H. (in press) The use of multivariate statistical analysis of geochemical data for assessing the spatial soil contamination by potentially toxic elements in the Aljustrel mining area (Iberian Pyrite Belt, Portugal). *Applied Geochemistry*, 21pp

Candeias, C.; Silva, E.F.; Salgueiro, A.R.; Pereira, H.G.; Reis, A.P.; Patinha, C.; Matos, J.X.; Ávila, P.H. (2010) Assessment of soil contamination by potentially toxic elements in the Aljustrel mining area in order to implement soil reclamation strategies. *Land Degradation & Development*, n/a. DOI:10.1002/ldr.1035

Dias Á S , Mills R A, Ribeiro da Costa I, Costa R, Taylor R N, Cooper M, and Barriga F J A S, (2010). Tracing fluid-rock reaction and hydrothermal circulation at the Saldanha hydrothermal field. *Chemical Geology*, 273(3-4): 168-179. doi:10.1016/j.physletb.2003.10.071

Dias Á S, Früh-Green G L, Bernasconi, Barriga, F J A S, Seahma cruise team and Charles Darwin 167 cruise team (2011) Geochemistry and stable isotope constraints on high-temperature activity from sediment cores of the Saldanha hydrothermal field. *Marine Geology*. V279: 1-4, 15, 128-140. doi:10.1016/j.margeo.2010.10.017

Fonseca RMF, FJAS Barriga, PIST Conceição, 2010. Clay minerals in sediments of Portuguese reservoirs and their significance as weathering products from over-eroded soils: a comparative study of the Maranhão, Monte Novo and Divor Reservoirs (South Portugal). *Int J Earth Sci (Geol Rundsch)* (2010) 99:1899–1916 DOI 10.1007/s00531-009-0488-3

Fouquet Yves, Pierre Cambon, Joël Etoubleau, Jean Luc Charlou, Hélène Ondréas, Fernando J. A. S. Barriga, Georgy Cherkashov, et al, 2010. Geodiversity of Hydrothermal Processes Along the Mid-Atlantic Ridge–Ultramafic-Hosted Mineralization: A New Type of Oceanic Cu-Zn-Co-Au Volcanogenic Massive Sulfide Deposit. In: P Rona, C Devey, J Dymont, and B Murton, Eds, *Diversity of Hydrothermal Systems on Slow Spreading Ocean Ridges American Geophysical Monograph* 188, 440p

Gammoudi, S. ; Frini-Srasra, N.; Goncalves, M. A. and Srasra, E. (2011). Acid-base and adsorptive properties of Tunisian Smectite. *Desalination and Water Treatment*, 26: 266-278.

Huston, D, Relvas, JMRS, Gemmell, B, Drieberg, S., 2011. The role of granites in volcanic-hosted massive sulphide ore-forming systems: an assessment of magmatic-hydrothermal contributions to the ores. *Mineralium Deposita* DOI 10.1007/s00126-010-0322-7

Malafaia E., F. Ortega, F. Escaso, P. Dantas, N. Pimentel, J. M. Gasulla, B. Ribeiro, F. Barriga, J. L. Sanz, 2010. Vertebrate fauna at the Allosaurus fossil-site of Andrés (Upper Jurassic), Pombal, Portugal. *Journal of Iberian Geology* 36 (2): 193-204 doi:10.5209/rev_JIGE.2010.v36.n2.7

Marques AFA, Scott SD, Sodhi R (2010) Determining major and trace-element composition in exposed melt inclusions using ToF-SIMS. *Surface Interface Analysis* 43:436-442 (doi: 10.1002/sia.3594)

Martins, L.; Matos, J.X. (2010) Mining heritage in Portugal – the Iberian Pyrite Belt as tourist attraction. *Bergau Folge Landschaft Konferenzdokumentation, Int. Bauausstellung Fürst-Pückler-Land 2000-2010 (Hrsg JOVIS Ed.)*, ISBN 978-3-86859-043-2, pp. 55-61.

Mateus, A.; Pinto, A.; Alves, L.C.; Matos, J.X.; Figueiras, J.; Neng, N. (in press, aceite) Roman and modern slag at S. Domingos mine (IPB, Portugal): compositional features and implications for their long-term stability and potential re-use. *International Journal of Environment and Waste Management Inderscience Publishers Ltd*, 39pp.

Neiva, A.M.R., & Ramos, J.M.F. (2010) – Geochemistry of granite aplite-pegmatite sills and petrogenetic links with granites, Guarda-Belmonte area, central Portugal. *Eur. J. Mineral*, 22, págs 837-854

Pedersen RB, HT Rapp, IH Thorseth, M Lilley, FJAS Barriga, T Baumberger, G Bernasconi-Green, K Flesland, R Fonseca, SL Jorgensen, 2010.

Group Productivity

- Discovery of a black smoker vent field and a novel vent fauna at the Arctic Mid-Ocean Ridges. *Nature Comm* 1:126 DoI: 10.1038/ncomms1124
- Pinto AJ, Ruiz-Agudo E, Putnis CV, Putnis A, Jimenez A, Prieto M (2010). AFM study of the epitaxial growth of brushite (CaHPO₄·2H₂O) on gypsum cleavage surfaces, *American Mineralogist*, 95: 1747-1757
- Reiser, Fiona K. M. , Rosa, Diogo R. N. , Pinto, Álvaro M. M. , Carvalho, João R. S. , Matos, João X. , Guimarães, Fernanda M. G. , Alves, Luís C. and de Oliveira, Daniel P. S.(2010). Mineralogy and geochemistry of tin- and germanium-bearing copper ore, Barrigão re-mobilized vein deposit, Iberian Pyrite Belt, Portugal. *International Geology Review*, First published on: 13 May 2010 (iFirst) DOI: 10.1080/00206811003683168
- Rosa, CJP, Mcphie, J, Relvas JMRS. 2010. Type of volcanoes hosting the massive sulphide deposits of the Iberian Pyrite Belt. *Journal of Volcanology and Geothermal Research*, 194: 107-126.
- Searle, R.C., Murton, B.J., Achenbach, K., LeBas, T., Tivey, M., Yeo, I., Cormier, M.H., Carlut, J., Ferreira, P., Mallows, C., Morris, K., Schroth, N., van Calsteren, P. and Waters, C. (2010) Structure and development of an axial volcanic ridge: Mid-Atlantic Ridge, 45°N. *Earth and Planetary Science Letters*, 299, (1-2), 228-241. (doi:10.1016/j.epsl.2010.09.003).
- Shearer C.K., Burger P.V., Neal C., Sharp Z., Spivak-Birndorf L., Borg L., Fernandes V.A. , Papike J.J., Karner J., Wadhwa M., Gaffney A., Shafer J., Geissman J., Atudorei N-V., Herd C. , Weiss B.P., and King P. (2010): Non-basaltic asteroidal melting during the earliest stages of solar system evolution. A view from Antarctic achondrites Graves Nunatak 06128 and 06129. *Geochimica et Cosmochimica Acta*, 74, 1172-1199.
- Shuster D.L., Balco G., Cassata W. S., Fernandes V.A., Garrick-Bethell I., Weiss B.P. (2010) A record of impacts preserved in the lunar regolith. *Earth and Plan. Sci. Lett.* doi:10.1016/j.epsl.2009.12.016.
- Smith D. K., N. Exon, F. J. A. S. Barriga, Y. Tatsumi, 2010. Ocean Drilling: Forty Years of International Collaboration. EOS, Transactions, American Geophysical Union, 91:393-395

Other international publications

- Andrade E., M. J. Madruga, I. Bobos, I. M. Paiva, F. Maia, A. Mateus, R. Trindade, M. C. Freitas, M. A. Gonçalves (2010) Characterization of Portuguese Geomaterials, the Clay Component of Rañas, as Potential Liners for Low and Intermediate Radioactive Disposal Sites, *Proceedings of RADCHEM 2010*, Marianske Lazne, Czech Republic, April 2010, pp S30
- Barriga FJAS, , Carvalho C, Cruz MI, Dias ÁS, Fonseca R, Relvas JM, Pedersen R (2010) Preliminary Results on Mineralogy and Geochemistry of Loki's Castle Arctic Vents and Host Sediments. *Geophysical Research Abstracts Vol12*, EGU2010-11970, EGU General Assembly 2010
- Barriga FJAS, Fonseca R, Dias ÁS, Cruz MI, Carvalho C, Relvas JM, Pedersen R (2010) Mineralogy and Acid-Extractable Geochemistry from the Loki's Castle Hydrothermal Field, Norwegian Sea at 74 degrees N (South Knipovich Ridge). *American Geophysical Union, Fall Meeting 2010*, San Francisco
- Barriga, F. J. A. S., C. Carvalho, I. M. Cruz, Á. S. Dias, R. Fonseca, J. M. R. Relvas, and R. B. Pedersen (2010), Mineralogy and geochemistry of Loki's Castle Arctic vents and host sediments: preliminary results, paper presented at European Geosciences Union General Assembly (EGU), Vienna, Austria.
- Brilha J, and 70 other, incl Barriga F, Matos J, Relvas J, 2010. The national inventory of geosites in Portugal. *Abstracts Book of the International Conference on Geoevents, Geological Heritage and the Role of IGCP (First Meeting of ProGEO Regional Working Group SW Europe)*, Ayuntamiento de Caravaca de la Cruz, Spain, 15-18 Setembro 2010, pp. 18-24.
- Carvalho J., Gaspar M., Archer C., 2010. Copper Isotopic Data from Ancient Copper Metallurgy in Ingadanais, (Vila Velha de Ródão) Portugal. *38th International Symposium on Archaeometry*, 10-14 Maio, Tampa, Florida. USA.
- Dias AS, I Cruz, R Fonseca, FJAS Barriga, RB Pedersen, 2010. Mineralogy and Geochemistry from Trollveggen Vent Field Chimneys and Metalliferous Sediments (Mohns Ridge, West Jan Mayen Fracture Zone at 71°N). *AGU Fall Meeting*, San Francisco
- Fernandes V. A. S. M. and Fritz J. P. (2010) Need to re-evaluate the age of the Popigai Crater and the relevance for the Eocene/Oligocene boundary. *The first Moscow Solar System Symposium (1M-S3)*, Splinter-meeting Popigai.
- Fernandes V. A. S. M., Abreu N. M., Fritz J., Knapmeyer M., Smeenk L., ten Kate I. L. and Trüninger M. (2010) Proposal for revisions of the United Nations Moon Treaty. *COSPAR 2010*, Abst. #5593.
- Fernandes V. A. S. M., Fritz J. P. , Wünnemann K., Hornemann U. (2010) K-Ar ages and shock effects in lunar meteorites. *European Planetary Science Congress 2010*, EPSC2010-237.
- Fernandes V. A. S. M., Fritz J. P. , Wünnemann K., Hornemann U. (2010) Lunar meteorites: shock effects vs. 40Ar-39Ar ages. *Nördlingen 2010: The Ries Crater, the Moon, and the Future of Human Space Exploration*, abst.#7033.
- Fernandes V.A.S.M. and Shearer C.K. (2010) 40Ar-39Ar ages of metamorphism preserved in the Achondrite GRA 06129. *LPSC XLI*, abst.# 1008 (CD-ROM)
- Fonseca, R.; Barriga, F.J.A.S.; Theodoro, S. ; Morais, M. 2010. A influência da mineralogia das argilas na geoquímica das fases solúveis e de troca dos sedimentos de um lago artificial na Bacia Amazónica. *Congresso Brasileiro de Geologia*, 27 Setembro a 2 de Outubro 2010, Belém, Pará, Brasil, PAP002275.
- Fonseca, R.; Patinha, C.; Morais, M.; Theodoro, S.; Barriga, F.J.A.S. 2010. Geoquímica de elementos metálicos em sedimentos superficiais do reservatório de Tucuruí, Pará, Brasil. *Congresso Brasileiro de Geologia*, 27 Setembro a 2 de Outubro 2010, Belém, Pará, Brasil, PAP002277.
- Gaspar, M. and Carvalho, J., 2010. Mineralogy and chemistry of copper ores and slags from Ingadanais mines: implications for ancient mining, 1º Congresso Internacional Povoamento e Exploração de Recursos Mineiros na Europa Atlântica Ocidental. 10-11 Dez, Braga
- Gerbelová H, S Casimiro , C Ioakimidis, M Melo, CAC Almeida, FJAS Barriga, P Ferrão, 2010. Assessment for Carbon Capture and Storage Opportunities: Portuguese Case Study. *GHGT-10 - 10th International Conference on Greenhouse Gas Control Technologies*, Amsterdam, September 2010
- Gonçalves, M. A. and Azevedo, T. M. (2010). Geochemistry of Trace Elements and the Fingerprints of Environmental Change in Core Sediments of the Tagus River. *Macla*, 13: 105-106.
- Leya I., Fernandes V. A. and Wurz P. (2010) A critical comparison: in-situ and laboratory instruments. *The first Moscow Solar System Symposium*

Group Productivity

(1M-S3), abstr.# 1MS3-PS-46.

Marques, AFA, Scott, SD, Relvas, JMRS, Rosa, C, Guillong, M., 2010. The potential for magmatic metals sources in the Iberian Pyrite Belt. IMA Conference 2010, Budapest

Marques AFA, Scott SD, Relvas JMRS, Rosa C, Guillong M (2010) The potential for magmatic metal sources in the Iberian Pyrite Belt. IMA 2010, Budapest. Acta Mineralogica-Petrographica, Abst. Ser. 6.

Noronha, F., Sousa, M., Carvalho, C., Moura, A.C., Moura, Ramos, J.M.F.(2010) - "Schistose rocks as a resource"- Actas Global Stone Congress – Alicante Sessão I Exploration and Quarry., Págs 1 a 5

Pereira, Z., Matos, J.X., Fernandes, P., Oliveira, J.T., 2010. Palynostratigraphic study of the Caveira mine (NW Sector of The Iberian Pyrite Belt, Portugal). Abstracts. CIMP Poland 2010, General Meeting, 57

Pedersen RB, IH Thorseth, MD Lilley, FJAS Barriga, GF-G, K Nakamura, 2010. Loki's Castle: Discovery and geology of a black smoker vent field at the Arctic Mid-Ocean Ridge. AGU Fall Meeting, San Francisco, Session OS26 (Deep-Sea Hydrothermal Systems: New Knowledge from New Discoveries and New Technology)

Reis M., M.C. Freitas, I. Paiva, L. Silva, I. Dionísio, H. Manh Dung, M.J. Madruga, P. Duarte, M. A. Gonçalves (2010). Characterization of Geomaterials from the NE of Portugal using Instrumental Neutron Activation Analysis (INAA) and Gamma Spectrometry, Proceedings of the IV International Symposium on Nuclear Analytical Chemistry, Mumbai, India, November de 2010.

Salgueiro, R., Inverno, C., and Mateus, A., 2010 (já on-line; em impressão), Main characteristics and genesis of the Vale de Pães iron skarn (Cuba-Vidigueira, Ossa Morena Zone): Estudios Geológicos (Spain), v. 66 (1), p. 65-74

Santos VF, Barriga FJAS, Galopim de Carvalho AM, Mergulhão LM, Monteiro C, Silveira SC, Fernandes MJ, Alho JM, Coelho R. 2010. Dinosaur track sites from Portugal and its significance as natural heritage. In: V. Mügge-Bartolovic, H.-G. Röhlings & V. Wrede (Eds.), Abstract Book, 6th International Symposium on Conservation of Geological Heritage, Hagen, Germany, 29 May - 2 June, 2010, p. 125

Theodoro, S.; Leonardos, O.; Fonseca, R. 2010. Rochagem a construção do link entre a mineração e a agricultura. Congresso Brasileiro de Geologia, 27 Setembro a 2 de Outubro 2010, Belém, Pará, Brasil, PAP003144.

Theodoro, S.; Macedo, I.; Fonseca, R.; Rego, K.; Rocha, E. 2010. Rochagem uma tecnologia de reparação de áreas erodidas ou de risco no entorno de reservatórios. Congresso Brasileiro de Geologia, 27 Setembro a 2 de Outubro 2010, Belém, Pará, Brasil, PAP002572.

Other national publications

Barriga FJAS (2010) New hints for seafloor massive sulphides. Ciência 2010. FCT

Barriga FJAS, R Fonseca, A Dias, I Cruz, A Pinto, C Carvalho, J Relvas, 2010. The Role of Portugal in the Characterization of Loki's Castle, the northernmost hydrothermal field (74°N). Second Portuguese Meeting on Polar Sciences. 26 April 2010, Lisbon Geography Society

Barriga FJAS, RS Santos (2010). Recursos minerais marinhos, metálicos, não metálicos e energéticos: potencial e impactos ambientais. In: Políticas Públicas do Mar, Coord N Vieira Matias, V Soromenho Marques, J Falcato, AG Leitão, pp 86-95. Ed Esfera do Caos, Lisboa, 297p

Batista; M.J.; Locutura, J.; Matos, J.X.; De Oliveira, D.; Bel-Lan, A.; L. Martins (2010) Mobilidade do Pb nos sedimentos do sector inferior da bacia do rio Guadiana. VIII Cong. Nac. Geologia, Rev. Ciências da Terra (v.e.) ISSN 1645-0388, v. 18, nº 18, GEOTIC/SGP, 4pp

Brilha J and 70 others, incl Barriga F, Matos J, Relvas J, 2010. O inventário nacional do património geológico: abordagem metodológica e resultados. VIII Congresso Nacional de Geologia (Univ. do Minho). e-Terra, 18(1), <http://e-terra.geopor.pt>

Cruz MI, Barriga FJAS, Carvalho C, Dias AS, Fonseca R, Relvas JMRS, Pedersen R (2010) Loki's Castle Arctic vents and host sediments: Arctic large scale hydrothermal fields. Ciência 2010. FCT

Ferraz, P., Rodrigues, B.C., Oliveira, A., Ramos, J.F., (2010) – Resultados da campanha de prospecção do jazigo de Sn-Li de Argemela. Actas do VIII Congresso Nacional de Geologia, Vol.20, Nº5, 4 págs

Fonseca, R.; Barriga, F.J.A.S. 2010. Agrogeologia: um conceito geológico de rejuvenescimento de solos degradados. VIII Congresso Nacional de Geologia 2010, e-Terra, Revista Electrónica de Ciências da Terra, 4 pp

Fonseca, R.; Simões, C.; Barriga, J.A.S., Theodoro, S.; Morais, M. 2010. Temporal variability of nutrients in an artificial lake under a dry tropical climate. X Congr de Geoq Países Língua Portuguesa - XVI Semana de Geoquímica, 11 pp

Matos, J. X. (2010) – Carta Geológica de Portugal 1/50000, Folha 39 B Escoural, sector abrangido pela Zona Sul Portuguesa, LNEG/UI.GCG, UI.RMG

Matos, J.X.; Barriga, F.; Relvas, J.; Pereira, Z.; Oliveira, J.T. (2010) PROGEO Framework: Iberian Pyrite Belt Portuguese sector (South Portuguese Zone) – Univ. MINHO Project. PROGEO Braga meeting, Portugal

Matos, J.X.; Mateus, A.; Martins, A.; Pinto, A.; Figueiras, J. (2010) Roman slag characteristics and distribution in the Portuguese segment of the Iberian Pyrite Belt. VI SIMPÓSIO MINERAÇÃO E METALURGIA SW EUROPEU, Vila Velha de Rodão

Matos, J.X.; Oliveira, J.T.; Pereira, Z.; Relvas, J.S.; Barriga, F.J.A.S.; Martins, L.P. (2010) A Rota da Pirite, uma rede de sítios geológicos e mineiros dedicada ao património e história da Faixa Piritosa Ibérica. VIII Cong. Nac. Geologia, Rev. Ciências da Terra (v.e.) ISSN 1645-0388, v. 18, nº 18, GEOTIC/SGP, 4pp.

Matos, J.X.; Pereira, Z.; Amaro, J.; Oliveira, J.T. (2010) Iberian Pyrite Belt mining and geological heritage protection and valorization, the ATLANTERRA Project strategy. VI SIMPÓSIO MINERAÇÃO E METALURGIA SW EUROPEU, Vila Velha de Rodão

Matos, J.X.; Pereira, Z.; Fernandes, P.; Rosa, D.; Oliveira, J.T. (2010) Contribuição para o estudo da estrutura de Aljustrel (Faixa Piritosa Ibérica) com base em novos dados palinoestratigráficos do Complexo Vulcano-Sedimentar e da Formação de Mértola. VIII Cong. Nac. Geologia, Rev. Ciências da Terra (v.e.) ISSN 1645-0388, v. 18, nº 18, GEOTIC/SGP, 4pp

Moreira N, Machado G, Fonseca PE, Silva JC, Jorge RCGS, Mata J (2010) The Odivelas Paleozoic volcano-sedimentary sequence: Implications for the geology of the Ossa-Morena Southwestern border. Comunicações Geológicas, 97:129-146, ISSN:1647-581X

Noronha, F., Sousa, M., Carvalho, C., Ribeiro, M.A., Moura, A.C., Ramos, J.F.(2010) – Rochas xistentas de Trás-os-Montes como recurso. Actas do

Group Productivity

VIII Congresso Nacional de Geologia , Vol.20, Nº17, 4 págs.

Ferreira P, Bramley Murton & Clive Boulter (2010). The nature of the local mantle enrichment beneath Lucky Strike Segment, 37°N on the Mid-Atlantic Ridge. e-Terra. Vol: 13-nº 1, VIII Congresso Nacional de Geologia. Braga, 9-16 Julho

Pereira, Z.; Matos, J.X.; Fernandes, P.; Jorge, R.; Oliveira, J.T. (2010) Qual a idade mais antiga da Faixa Piritosa? Nova idade Givetiano inferior para o Grupo Filito-Quartzítico (Anticlinal de S. Francisco da Serra, Faixa Piritosa). VIII Cong. Nac. Geol., Rev. Ciências da Terra (v.e.) ISSN 1645-0388, v. 18, nº 18, GEOTIC/Soc. Geol. Portugal, 4pp

Póvoas, L., C. Lopes, P. Dantas, E. Malafaia, and F. J. A. S. Barriga (2010), A exposição "Allosaurus: um dinossáurio, dois continentes?"- Divulgar o método científico para promover a literacia científica - VIII Congresso Nacional de Geologia, Braga

Ramos, J.M.F., - Principais Recursos Minerais dos Concelhos de Chaves, Montalegre, e Boticas. Capítulo 3 do livro "Mineração e Povoamento na Antiguidade no Alto Trás-os-Montes Ocidental". Publ do Centro de Investigações Transdisciplinares Cultura, Espaço e Memória. pp 27-45

Ramos, J.M.F., & Moura, A.C., (2010) – Alguns aspectos do contributo da geologia no estudo e caracterização de maciços para exploração de Rochas Ornamentais. Ciências Geológicas. Ensino, Investigação e sua História. Publ Ano Internacional do Planeta Terra. Volume II, Capítulo I – Geologia e recursos geológicos, pp 131-141

Ramos, J.M.F., Neiva, J.M.C., (2010) - Algumas características geológicas e geotécnicas do território de Macau. Recursos Geológicos. Ciências Geológicas. Ensino, Investigação e sua História. Publ Ano Internacional do Planeta Terra. Volume III.. Capítulo III- Geologia das Ex- colónias da Ásia e Oceânia, Macau. pp 267-277

Ramos, J.M.F. (2010),-Aplitopegmatitos com mineralizações de metais raros de Seixo Amarelo – Gonçalo. O recurso Geológico. Ciências Geológicas. Ensino, Investigação e sua História. Pub Ano Internacional do Planeta Terra. Volume II, Capítulo I – Geologia e recursos geológicos pp 121-130

Ribeiro da Costa, I. & Barriga, F.J.A.S. (2010) – O manto superior subjacente à Crista Média Atlântica no sector dos Açores. Comunicações Geológicas, 2010, t. 97: 23-34

Ribeiro, M.L., Ramos, J.M.F., Pereira, E., Dias, R., (2010) – Macau- Evolução do conhecimento Geológico. Ciências Geológicas. Ensino, Investigação e sua História. Publ Ano Internacional do Planeta Terra. Volume III.. Capítulo III- Geologia das Ex- colónias da Ásia e Oceânia, Macau. pp 259-266

Rosa, D., Salgueiro, R., Inverno, C., and Oliveira, D., 2010. Occurrence and origin of alluvial xenotime from Central Eastern Portugal (Central Iberian Zone/ Ossa Morena Zone): Comunicações Geológicas, INETI/LNEG, 97:63-70

Santos VF, Barriga FJAS, Galopim de Carvalho AM, Mergulhão LM, Monteiro C, Silveira SC, Fernandes MJ, Alho JM, Coelho R. 2010. Seguindo os passos dos dinossáurios do Mesozóico Português: valor excepcional de jazidas icnológicas a preservar. In: A. Santos et al, Eds, Actas III Congresso Ibérico de Paleontologia / XXVI Jornadas de la Sociedad Española de Paleontologia, Lisboa, 7 – 10 Julho 2010, pp. 37-39

Ph.D. thesis completed

Jorge, Raul CGS, 2010. Caracterização petrográfica, geoquímica e isotópica dos reservatórios metalíferos crustais, dos processos de extracção de metais e dos fluidos hidrotermais envolvidos em sistemas mineralizantes híbridos na Faixa Piritosa Ibérica. Doctoral Thesis, Universidade de Lisboa, 2010. Advisor Jorge MRS Relvas

Industry contract research

Many studies for industry, on petrography, mineralogy and geochemistry, in Portugal and abroad, for resource evaluation, engineering geology and environmental protection. Creminer's participation is noteworthy through READE (Minas Gerais, Brasil) and in Angola (contract with GeniusMineira Lda) the former devoted to environmental studies and the latter on mineral resources associated to West Congo Proterozoic belts, with emphasis on iron, IOCG-type (iron-oxide, Cu, Au) deposits, copper, rare-earth elements (including also the natural actinides uranium and thorium) and niobium-tantalum resources. Some quite interesting results have already been produced.

Internationalization

Nearly all of Creminer's scientific activity is largely international, with co-operation with researchers and institutions from many countries.

Some noteworthy leadership positions occupied by Creminer members are

- Portuguese delegate in the IODP Council and IWG+, Integrated Ocean Drilling Program (F Barriga)
- Portuguese delegate in ECORD Council, European Consortium for Ocean Research Drilling (F Barriga)
- Portuguese delegate in IMA, International Mineralogical Association (F Barriga)
- Member of the SGA Council, Society for Geology Applied to Mineral Deposits (J Relvas)
- Portuguese delegate in "InterRidge Steering Committee", International Cooperation in Ridge-Crest Studies (P Ferreira)
- Member of InterRidge Working Group on Submarine Mineral Deposits (F Barriga)
- Portuguese co-ordinator of READE Rede Luso-Brasileira de Remediação e Reabilitação de Ambientes Degradados (R Fonseca)
- Co-ordinator of LNEG in project "PROMINE – Nano-particle products from new mineral resources in Europe" (C Inverno)
- Editor of Boletim Geologico y Minero, ITGE, Espanha (J Relvas)
- Rocks for Crops Association – IRCA (R Fonseca, F Barriga)
- European Science Foundation (program EuroMARC) project, "Ultraslow spreading and hydrogen-based deep biosphere: a site survey proposal for zero-age drilling of the Knipovich Ridge". Individual Project (Portuguese team): Sulfide Petrology, Ore Genesis and the Deep

Group Productivity

Biosphere at Knipovich Ridge (F Barriga, PI)

Government/Organization contract research

Creminer is involved in significant activities of assessment of the government and local authorities on mineral resources, environmental protection and land use. This includes participation in the Ciência 2010 FCT meeting as advisers for the announced program for assessment of the deep sea floor resources of the enlarged Portuguese continental Platform. Also, work in shale resources of Northern Portugal; Lithium resources; resources of Marco de Canavezes and Mondim de Basto; special clays of Meirinhas (Pombal).

A Creminer researcher (F Marques) has intense activity with EMAM (Estrutura de Missão para os Assuntos do Mar) as a Marine Geologist and ROV trainee.

Projects funded by FCT include:

- H2Deep – EuroMarc /0001/2007 (part of an European ESF consortium) “Ultraslow spreading and hydrogen-based deep biosphere: a site survey proposal for zero-age drilling of the Knipovich Ridge”. Individual Project (Portuguese team): Sulfide Petrology, Ore Genesis and the Deep

Biosphere at Knipovich Ridge (F Barriga, national PI);

- KADRWaste - PTDC/CTE-GEX/82678/2006, Study of the adsorption mechanisms and kinetics in geomaterials and their structural characterisation: implications for processes of natural attenuation of heavy metal contamination and radioactive wastes confinement (MA Gonçalves, PI)

- INCA (PTDC/CTE-GIN/67027/2006) Characterisation of crucial mineral resources for the development of renewable energy technologies: The Iberian Pyrite Belt ores as a source of indium and other high-technology elements (D Rosa, PI)

- MELT KP5 (PTDC/MAR/65197/2006) Mantle melting and crust production in the Mid-Atlantic Ridge under influence of Azores hotspot: a case of study at KP-5 segment (~37.5°N) P Ferreira, PI)

The following were selected for funding and will start in April 2011:

- ZHINC (PTDC/CTE-GIX/114208/2009) – Zinc Ores and High Tech Strategic Metals in the Neves-Corvo Deposit, starts in April 2011 (J Relvas, PI)

- TerRiftic (PTDC/MAR/111306/2009) Unraveling melting processes and volcanism on the Terceira Rift, Azores: a melt inclusion and vesicle study (F Marques, PI)

- METMOB (PTDC/CTE-GIX/116204/2009) Element and isotopic mobility and diffusion in metamorphic minerals from granite contact aureoles (starts in April 2011; Isabel R Costa, PI)

Group Description	
Title of Research Group:	(RG-LVT-50009-3853) Intelligent Robots and Systems
Principal Investigator:	Pedro Manuel Urbano de Almeida Lima
Main Scientific Domain:	Engenharia Electrotécnica e Informática
Group Host Institution:	Instituto Superior Técnico - Universidade Técnica de Lisboa

Funding, source, dates	
Funding, source, dates	
<ul style="list-style-type: none"> • ITER TCS/ATS - Activities related to the development of an Air Transfer System prototype and Cask Transfer System Virtual Mockup –F4E-2008-GRT-016 (MS-RH), funded by Fusion for Energy (F4E), Mar/2009-Jun/2010 [together with Instituto de Plasmas e Fusão Nuclear(IPFN)/IST]. • DecPUCS: Decentralized Planning Under Uncertainty for Cooperative Systems, PTDC/EEA-ACR/73266/2006 (FCT funding), Oct/2007-Sep. 2010 (extended until Dec.). • MAIS-S - Multiagent Intelligent Surveillance System, FCT - CMU-PT/SIA/0023/2009, Sept.2010-August 2013. • Perception-Driven Coordinated Multi-Robot Motion Control, FCT PTDC/EEA-CRO/100692/2008, Jan. 2010-Dec.2012. • BioInstBots - From Bio-Inspired to Institutional-Inspired Collective Robotics, FCT - PTDC/EEA-CRO/104658/2008, Feb. 2010-Jan.2013. • FCT Base component of the pluriannual funding (for 8 ETI). 	

Objectives & Achievements	
Objectives	
<p>In 2010 this new group resulted from the merger of the previous Intelligent Systems Lab and Mobile Robotics Lab.</p> <p>The driving theme of the Intelligent Robots and Systems Group is wide in scope. Its members approach complex systems from a holistic standpoint, rather than focusing on some of the subsystems. The topic of cooperation (among agents and/or robots, among robots and humans) arises naturally from this viewpoint. The historic background of the lab senior researchers has lead us to use Artificial Intelligence concepts (e.g., sequential decision making, learning, task planning, cognitive systems) driven by formal approaches that stem from Systems and Control Theory and from Operations Research (e.g., mathematical modeling, analysis and synthesis, optimization, path planning, navigation, localization, discrete-event systems, estimation theory, simulation, queuing theory, Markov systems). Our research is often driven by practical applications, as we strongly believe it is very important to apply our methodologies to practical domains, as challenging real-life problems provide richer sources of inspiration. Therefore, we have been exploring the application of our research on (cooperative) navigation, sensor fusion, planning under uncertainty, dynamic modeling, non-smooth systems, human-robot interaction, discrete event systems, bio-inspired approaches, cognitive architectures, to networked robot systems, remote handling systems, kinematically complex robots, field robots and soccer robots, humanoid robots, scheduling of queuing networks, and management of health systems, to name but a few.</p> <p>Our distinctive feature is that we bring together people with a common background on systems theory, but different approaches to modeling, analysis and synthesis of intelligent systems, mainly coming from:</p> <ul style="list-style-type: none"> • artificial intelligence, with a focus on decentralized and distributed methods, and with specific interest in planning under uncertainty, organizational issues, neurosciences-, biology- and social sciences-inspired robot architectures and methods; • systems and control, with a focus on complex systems consisting of a large number of interconnected embedded systems, e.g., navigation of autonomous systems, sensor and robot networks, institutional management systems, biological systems, and specific interest on modeling, analysis and synthesis methods. 	

Main Achievements	
<p>In 2010, the group main achievements were:</p> <ul style="list-style-type: none"> • We formalized the representation of single and multi-robot plans by Petri nets, and used those models to design plans for real robots applied to the soccer domain. The model is based on a closed-loop between the Petri net plan and a Petri net model of the environment surrounding the robot(s), and its stochastic Petri net view enables studying quantitative properties of the system model in closed form, solving Markov chains. The parameters of the environment model Petri net are identified by an estimation algorithm. • We have also developed a hybrid approach to robot task planning, learning and control under uncertainty that combines supervisory control of DES and Reinforcement Learning (RL). System models and supervisors are represented by finite state automata. RL is used to determine the optimal robot behavior (plan), within the subset of behaviors allowed by the supervisor, iteratively, online and along the robot course of action. Our approach reduces the size of the RL problem and speeds up the convergence to the optimal controller policy. Some events are unobservable by the supervisor and controller. We address this problem by building an environment observer that supports the decision-making process. • We made significant progress in scaling up multiagent planning under uncertainty techniques, by speeding up the one-step decision problem 	

Objectives & Achievements

in Dec-POMDPs with up to 10 orders of magnitude on some benchmark problems (AAMAS2010). Furthermore, a key strength of the IRS group research team working on these topics is the focus on techniques that are applicable in real-world systems such as multi-robot systems. For instance, we explicitly take into account the limitations of intra-robot communication (ICRA 2010), designing techniques that allow robots to exploit communication when available, but not critically depend on it. Another key aspect of multi-robot systems is that they are embedded in physical environment, which means their interactions are often local only, which we take advantage of when planning their joint task.

- We devised an algorithm that handles Cooperative Perception problems under a common Bayesian framework, based on particle filters, for moving targets and observer sensors. We have also published work on cooperatively improving the localization of robots in a team by using information on the position of an object visually shared by the robots
- We published a paper comparing how Institutional Robotics principles and Swarm Robotics principles handle a problem of transportation between two sides of a scenario connected by a narrow corridor was published. The paper concludes that IR principles (in this case the robots create the traffic-controller institution) are superior to SR principles (simple behaviors and rules of interaction to avoid collisions in the corridor) when the number of robots and the length of the corridor increase.
- We have also started an FCT project joining biologists, philosophers, computer scientists and engineers on related topics.
- We started a research project in the CMU-Portugal program (MAIS-S), which addresses the problem of planning in decentralized multiagent systems in the context of intelligent surveillance networks. The project involves research teams at INESC-ID, IST/ISR, Carnegie Mellon University, and at Observit.
- In the project ITER TCS/ATS, complete studies on manoeuvres and parking of the TCS in the Tokamak and Hot Cell buildings of ITER (The International Thermonuclear Experimental reactor) were conducted. The specification of a test facility for a TCS (mobile vehicle) prototype was carried out, including the required area, and the building and equipment requirements. Update of the Trajectory and Evaluator Software tool (TES) aiming at providing, in CATIA format, the volume occupied by the TCS vehicle when following a 2D path.

Group Productivity

Publications in peer review Journals

1. Optimized trajectories of the transfer cask system in ITER, F. Valente, Alberto Vale, D. Fonte, Isabel Ribeiro, Fusion Engineering and Design, Elsevier, in press, <http://dx.doi.org/10.1016/j.fusengdes.2010.12.027>, 2010
2. Tracking objects with generic calibrated sensors: an algorithm based on color and 3D shape features, Matteo Taiana, João Santos, José Gaspar, Jacinto Nascimento, Alexandre Bernardino, Pedro Lima, Robotics and Autonomous Systems, special issue on Omnidirectional Robot Vision, Vol. 58, Issue 6, 30 June, pp. 784-795, 2010
3. Coordinated Learning in Infinite Markov Games, Francisco Melo, Isabel Ribeiro, Autonomous Agents and Multiagent Systems, Vol. 21, N° 3, November 2010, pp.321-367, 2010
4. ITER Transfer Cask System: Status of design, issues and future developments, C. González Gutiérrez, C. Damiani, M. Irving, J-P. Friconeau, A. Tesini, Isabel Ribeiro, Alberto Vale, Fusion Engineering and Design 85(2010), 2295-2299, 2010
5. A Novel Metric for Bone Marrow Cells Chromosome Pairing, Artem Khmelinskii, Rodrigo Ventura, João Sanches, IEEE Transactions on Biomedical Engineering (in press), 2010
6. Robust band profile extraction using constrained nonparametric machine learning technique. Shadab Khan, João Sanches, Rodrigo Ventura. IEEE Transactions on Biomedical Engineering, 57(10):2587–2591, October 2010.
7. Emotions and empathy: A bridge between nature and society? Rodrigo Ventura. International Journal of Machine Consciousness, 2(2):343–361, 2010.
8. Petri Net Plans: A Framework for Collaboration and Coordination in Multi-Robot Systems, V. A. Ziparo, L. Iocchi, Pedro Lima, D. Nardi, P. F. Palamara, Autonomous Agents and Multiagent Systems, in press, <http://dx.doi.org/10.1007/s10458-010-9146-1>
9. Alberto Sanfeliu, Juan Andrade-Cetto, Marco Barbosa, Richard Bowden, Jesús Capitán, Andreu Corominas, Andrew Gilbert, John Illingworth, Luis Merino, Josep M. Mirats, Plinio Moreno, Aníbal Ollero, João Sequeira, and Matthijs T. J. Spaan. Decentralized Sensor Fusion for Ubiquitous Networking Robotics in Urban Areas. Sensors, 10(3):2274–2314, 2010.
10. Porfírio Silva, Javier Bustamante, "Sociedades Humanas, Sociedades Artificiais: Perspectivas da Convergência", in Trajectos, 16 (Primavera 2010), pp. 7-18
11. Porfírio Silva, O elo perdido das ciências do artificial (ou Da Economia como uma das Ciências do Artificial), in Revista da Faculdade de Letras da Universidade do Porto - Série de Filosofia, II Série, XXV-XXVI, 2008/2009, pp. 149-162

Other international publications

1. Fault-tolerant Probabilistic Sensor Fusion for Distributed Multi-Agent Systems, Abdolkarim Pahlani, Matthijs Spaan, Pedro Lima, Proc. of IROS 2010 - IEEE/RSJ International Conference on Intelligent Robots and Systems, Taipei, Taiwan, 2010
2. Coordination Through Institutional Roles in Robot Collectives, José N. Pereira, A. L. Christensen, Porfírio Silva, Pedro Lima, Proc. of AAMAS 2010 - 9th International Conference on Autonomous Agents and Multiagent Systems, Toronto, Canada, 2010
3. Active Cooperative Perception in Networked Robot Systems Using POMDPs, Matthijs Spaan, Tiago Veiga, Pedro Lima, Proc. of IROS 2010 - IEEE/RSJ International Conference on Intelligent Robots and Systems, Taipei, Taiwan, 2010
4. Cooperative Localization Based on Visually Shared Objects, Pedro Lima, J. Santos, P. Santos, R. Oliveira, Aamir Ahmad, Proc. of RoboCup2010 Symposium, Singapore, 2010
5. A motion planning methodology for rhomib-like vehicles for ITER remote handling operations, D. Fonte, F. Valente, Alberto Vale, Isabel Ribeiro, Proc. of IAV2010 – 7th IFAC Symposium on Intelligent Autonomous Vehicles, Lecce, Italy, 2010
6. Multi-robot planning under uncertainty with communication: a case study, João Messias, Matthijs Spaan, Pedro Lima, AAMAS 2010 Workshop

Group Productivity

on Multi-Agent Sequential Decision Making in Uncertain Domains, Toronto, Canada, 2010

7. Multirobot Coordination by Auctioning POMDPs, Matthijs Spaan, Nelson Gonçalves, João Sequeira, Proc. of ICRA 2010 - IEEE International Conference on Robotics and Automation, Anchorage, Alaska, 2010

8. A Bayesian Game based Adaptive Fuzzy Controller for Multiagent POMDPs, Rajneesh Sharma, Matthijs Spaan, Proc. of FUZZ IEEE 2010 - International Conference on Fuzzy Systems, Barcelona, Spain, 2010

9. Heuristic Search for Identical Payoff Bayesian Games, F. Oliehoek, Matthijs Spaan, J. S. Dibangoye, C. Amato, Proc. of AAMAS 2010 - 9th International Conference on Autonomous Agents and Multiagent Systems, Toronto, Canada, 2010

10. Online event segmentation in active perception using adaptive strong anticipation, Bruno Nery, Rodrigo Ventura, Proceedings of the First International Conference on Biologically Inspired Cognitive Architectures (BICA-2010), 2010.

11. Optimizing range finder sensor network coverage in indoor environment. João Ferreira, Alberto Vale, and Rodrigo Ventura, Proceedings of IFAC Symposium on Intelligent Autonomous Vehicles (IAV-10), 2010.

12. Classifier- assisted metric for chromosome pairing. Rodrigo Ventura, Artem Khmelinskii, and J. Miguel Sanches, Proceedings of EMBC 2010 - 32nd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, September 2010

13. Longitudinal Dynamics Modeling of the RIOL Robot, João Sequeira, 2010 1st International Conference on Applied Robotics for the Power Industry, Montreal, Canada, October 5-7, 2010.

14. Reachability Analysis of the RIOL Robot, João Sequeira, 2010 1st International Conference on Applied Robotics for the Power Industry, Montreal, Canada, October 5-7, 2010.

15. Transmission Line Inspection Robots: Design of the Power Supply System, João Caxias, Fernando Alves da Silva, João Sequeira, 2010 1st International Conference on Applied Robotics for the Power Industry, Montreal, Canada, October 5-7, 2010.

16. Mixing Differential Inclusions with Markov Decision Processes, Nelson Gonçalves, João Sequeira, 2010 IEEE/RSJ Int. Conf. on Intelligent Robots and Systems, IROS 2010, Taipei, October, 2010

17. Robust Multi-robot Task Assignment in Surveillance, Nelson Gonçalves, João Sequeira, 7th IFAC Symposium on Intelligent Autonomous Vehicles, IAV 2010, Lecce, Italy, September 2010

Ph.D. thesis completed

1. Gonçalo Neto, "Planning, Learning and Control Under Uncertainty Based on Discrete Event Systems and Reinforcement Learning", Ph.D. Thesis, Instituto Superior Técnico, UniversidadeTécnica de Lisboa, 2010

2. Hugo Costelha, "Robotic Tasks Modelling and Analysis Based on Discrete Event Systems", Ph.D. Thesis, Instituto Superior Técnico, UniversidadeTécnica de Lisboa, 2010

Organization of conferences

Matthijs Spaan:

- Organizing committee: AAMAS'10 workshop on "Multi-agent Sequential Decision Making in Uncertain Domains"
- Organizing committee (chair): "POMDP Practitioners Workshop: solving real-world POMDP problems"

Industry contract research

Grupo

- EU F4E-2008-GRT-016 ITER ATS: Activities Related to the Development of an Air Transfer System Prototype and Cask Transfer System Virtual Mock-up, Leader: ISR/IST, Other Partners: ASTRIUM (F), CIEMAT (S), IPFN/IST (P)
- QREN QuadMission: Desenvolvimento de um Sistema Automático e Inteligente para Aeronave Não Tripulada - Plataforma QuadCopter U4, Leader: UAVision

Internationalization

• Publications with foreign authors:

o Tracking objects with generic calibrated sensors: an algorithm based on color and 3D shape features, M. Taiana, J. Santos, J. Gaspar, J. Nascimento, A. Bernardino, P. Lima, Robotics and Autonomous Systems, special issue on Omnidirectional Robot Vision, Vol. 58, Issue 6, 30 June, pp. 784-795, 2010

o ITER Transfer Cask System: Status of design, issues and future developments, C. G. Gutiérrez, C. Damiani, M. Irving, J-P. Friconneau, A. Tesini, I. Ribeiro, A. Vale, Fusion Engineering and Design 85(2010), 2295-2299, 2010

o Robust band profile extraction using constrained nonparametric machine learning technique. S. Khan, J. Sanches, R. Ventura. IEEE Transactions on Biomedical Engineering, 57(10):2587-2591, October 2010.

o Petri Net Plans: A Framework for Collaboration and Coordination in Multi-Robot Systems, V. A. Ziparo, L. Iocchi, Pedro Lima, D. Nardi, P. F. Palamara, Autonomous Agents and Multiagent Systems, in press.

o A. Sanfeliu, J. Andrade-Cetto, M. Barbosa, R. Bowden, J. Capitán, A. Corominas, Andrew Gilbert, John Illingworth, Luis Merino, Josep M. Mirats, Plinio Moreno, A. Ollero, J. Sequeira, and M. Spaan. Decentralized Sensor Fusion for Ubiquitous Networking Robotics in Urban Areas. Sensors, 10(3):2274-2314, 2010.

o P. Silva, J. Bustamante, "Sociedades Humanas, Sociedades Artificiais: Perspectivas da Convergência", in Trajectos, 16 (Primavera 2010), pp. 7-18

Group Productivity

- o Heuristic Search for Identical Payoff Bayesian Games, F. Oliehoek, M. Spaan, J. S. Dibangoye, C. Amato, Proc. of AAMAS 2010 - 9th International Conference on Autonomous Agents and Multiagent Systems, Toronto, Canada, 2010
- o Heuristic Search for Identical Payoff Bayesian Games, F. Oliehoek, M. Spaan, J. S. Dibangoye, C. Amato, Proc. of AAMAS 2010 - 9th International Conference on Autonomous Agents and Multiagent Systems, Toronto, Canada, 2010
- Projects:
 - o CMU-PT/SIA/0023/2009 MAIS-S: Multiagent Intelligent Surveillance System (with CS Department at CMU, Prof. Manuela Veloso, and INESC-ID)
 - o EU F4E-2008-GRT-016 ITER ATS: Activities Related to the Development of an Air Transfer System Prototype and Cask Transfer System Virtual Mock-up, (with ASTRIUM (F), CIEMAT (S), IPFN/IST (P))
 - o P. Lima: member of the Board of Trustees of the RoboCup Federation
 - o P. Lima: 6-month Chair of Excellence awarded by U. Carlos III de Madrid Board of Governors, Feb-Jul 2010.

Group Description	
Title of Research Group:	(RL-EEI-LA09-133) Robotic Monitoring and Surveillance
Principal Investigator:	Jose Alberto Rosado Santos Victor
Main Scientific Domain:	Engenharia Electrotécnica e Informática

Objectives & Achievements

General Objectives

Our goal is to (i) develop new methods, algorithms and systems for robotic monitoring & surveillance by autonomous, heterogeneous sensor and robot networks and (ii) to demonstrate their use in realistic applications.

These networks can be used in multiple domains and adjust to the dynamic characteristics of the environment, observed phenomena or human activity. Each node can act or reconfigure the network to improve perception and uncertainty, interact with humans or re-establish communications. The desired autonomous, unsupervised operation requires de-centralized decision-making.

We consider 3 hierarchical levels:

- Cooperative/single robot navigation, formation control & decentralized decision making
- Vision-based activity recognition and cooperative perception in camera/robot networks
- Development of cognitive robot assistants (network nodes) that interact socially with humans

Finally, we nurture the emergent and strongly multidisciplinary area of biologically inspired systems and bioengineering, encompassing links to neuroscience, psychology or social sciences.

Main Achievements

Research activities are structured in 3 application areas of public interest, with networks of heterogeneous robots intervening at different hierarchical levels, and an emergent area in bioengineering. The achievements are both theoretical and application-driven, developed in the context of large international projects.

General achievements

- High internationalization and involvement in international Projs (FIRST-MM, ROBOSOM, ITER)
- Multidisciplinary research with neuroscience, psychology, biology, medicine and social sciences
- Coordination sessions to prepare proposals to FCT/EU calls

(i) Search and rescue, field and urban robotics:

- (Muti-)robot task plan using discrete event systems
- Decision-theoretic approach to decentralized planning under uncertainty
- Development of middleware and experimental test-bed for networked robot systems (ISRobotNet)
- New FCT projs

+ Perception-driven Formation control (PCMMC)

+ Social sciences/bio-inspired approaches to collective robotics (BioInstBots)

(ii) Surveillance:

- New CMU-PT project MAIS-S: Multiagent Intelligent Surveillance System [IRSGroup, VisLab, SPLab]
- New FCT proj. surveillance (ARGUS)
- Gesture and activity understanding from video
- Representation of complex activities with bank of visual motion fields
- Calibration of distributed cameras with different geometries

(iii) Cognitive robotic assistant:

- New EU Projs (ROBOSOM, FIRST-MM)
- Extend bio-inspired models of affordances w/ relational learning
- Grasp Learning with anthropomorphic hands
- iCub robot fully operational [Vislab]
- Tracking and software developments, deployed in the iCub repository.

(iv) Bio-inspired methods, bioengineering

- New FCT projs: ADDI (skin lesions); HEARTRACK; ADIAR (Alzheimer);

Objectives & Achievements

DYNIMAG (Neuroimaging, Epilepsy) [Laseeb, SPLab]

NEUROIMAGIOLOGY (Brain learning mechanisms) [Laseeb, SPLab]

- Collaborations: IMM, Hospitals Sta. Maria and Luz; Inst. Gulbenkian Ciência; Centre d'Imagerie

Biomédicale, EPFL; Institute of Neurology, Univ College London.

Research Line Output

Collaborative Publications in peer review Journals

- Tracking objects with generic calibrated sensors: an algorithm based on color and 3D shape features, Matteo Taiana, João Santos, José Gaspar, Jacinto Nascimento, Alexandre Bernardino, Pedro Lima, Robotics and Autonomous Systems, special issue on Omnidirectional Robot Vision, Vol. 58, Issue 6, 30 June, pp. 784-795, 2010 [VisLab + IRSGroup]

- A Novel Metric for Bone Marrow Cells Chromosome Pairing, Artem Khmelinskii, Rodrigo Ventura, João Sanches, IEEE Transactions on Biomedical Engineering (in press), 2010 [SigProLab + IRSGroup]

- Robust band profile extraction using constrained nonparametric machine learning technique. Shadab Khan, João Sanches, Rodrigo Ventura. IEEE Transactions on Biomedical Engineering, 57(10):2587–2591, October 2010. [SigProLab + IRSGroup]

- Alberto Sanfeliu, Juan Andrade-Cetto, Marco Barbosa, Richard Bowden, Jesús Capitán, Andreu Corominas, Andrew Gilbert, John Illingworth, Luis Merino, Josep M. Mirats, Plinio Moreno, Aníbal Ollero, João Sequeira, and Matthijs T. J. Spaan. Decentralized Sensor Fusion for Ubiquitous Networking Robotics in Urban Areas. Sensors, 10(3):2274–2314, 2010. [VisLab + IRSGroup]

Other highly multidisciplinary publications

• The iCub humanoid robot: an open-systems platform for research in cognitive development, G. Metta, L. Natale, Francesco Nori, Giulio Sandini,

David Vernon, Luciano Fadiga, Claes von Hofsten, Kerstin Rosander, Manuel Lopes, José Santos-Victor, Alexandre Bernardino, Luis Montesano, Neural Networks, 23(8-9), Oct-Nov 2010.

Collaborative Other Publications

- Classifier- assisted metric for chromosome pairing. Rodrigo Ventura, Artem Khmelinskii, and J. Miguel Sanches, Proceedings of EMBC 2010 - 32nd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Sep. 2010 [IRSGroup + SigProLab]

- Joint fMRI brain activation detection and segmentation using Level Sets”, Margarida Silveira, Patrícia Figueiredo, 32th IEEE EMBS Annual Intl Conference, Buenos Aires, Sep. 2010.

- Joint fMRI brain activation detection and segmentation using level sets, Silveira M, Figueiredo P. Proc. 32nd Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC 2010); Aug 31-Sept 4, Buenos Aires. [Laseeb + SigProLab]

- Multiple-Model Set-Valued Observers: A new tool for HRF model selection in fMRI, Silvestre C, Figueiredo P, Rosa P. Proc. 32nd Annual International Conf. of the IEEE Engineering in Medicine and Biology Society (EMBC 2010); Aug 31-Sept 4 Buenos Aires. [Laseeb + SigProLab]

- On the distinguishability of HRF models in fMRI, Silvestre C, Figueiredo P, Rosa P. Proc. 32nd Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC 2010); 1:5677-80, Buenos Aires. [Laseeb + DSOR]

- Bayesian optimization of perfusion and transit time estimation in PASL-MRI, Santos N, Sanches JM, Figueiredo P Proc. 32nd Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC 2010); Buenos Aires, [Laseeb + SigProLab]

- Nonlinear HRF model identification using multiple model set valued observers, Figueiredo P, Silvestre C, Rosa P. Proc. 16th Annual Meeting of the Organization for Human Brain Mapping (HBM 2010), June 2010, Barcelona. [Laseeb + SigProLab]

- Parameter free Bayesian activity detection in fMRI, Afonso D, Figueiredo P, Sanches J. Proc. 16th Annual Meeting of the Organization for Human Brain Mapping (HBM 2010), June 2010, Barcelona. [Laseeb + SigProLab]

- Bayesian Fisher Information Criterion for Sampling Optimization in ASL-MRI, Sanches J, Sousa I, Figueiredo P Proc. 10th IEEE International Symposium on Biomedical Imaging (ISBI 2010), 14-17 April, Rotterdam. [Laseeb + SigProLab]

PhD thesis completed

This Thematic Areas is highly involved in international projects concerning both research and advanced training. These activities are described below:

IST-EPFL Joint Doctoral Initiative – the thematic area is involved I two Focus Areas:

- Distributed and Cognitive Robotics, with about 6 students already enrolled

- Biomedical and Biological Imaging

Examples of ongoing theses

o Pedro Fazenda, “Management of Energy Consumption in Buildings”, MIT-Portugal Sustainable Energy Systems Doctoral program

o José Nuno Pereira, “Institutional and Swarm Robotics”, IST/EPFL Joint Doctoral Initiative

Research Line Output

- o Bruno Nery, "Binding perception to action: a cognitive architecture for robots"
- o Sébastien Gay, "The role of vision for locomotion control"
- o Ricardo Beira, "Surgical robots"

CMU-Portugal Program

- One student supervised in the area of computer and robot vision

Dual Master Program with KTH – Stockholm

- An agreement on a dual master scheme in Systems, Decision and Control has been established for students active in the area of robotics.

Other multidisciplinary projects

EU Project ROBOTCUB - ROBotic Open-architecture Technology for Cognition, Understanding, and Behaviour, developed the iCub humanoid robot that is the most sophisticated Humanoid Robot worldwide, considering the number of degrees of freedom. The consortium included partners from Neurophysiology (University of Ferrara) and Developmental Psychology (Un. Uppsalla).

EU Project ROBOSOM – "Robotic Sense of Movement", focusing on the role of vestibular information for locomotion control in humans and humanoids. This research project was evaluated as the best EU project proposal in the area of cognitive systems and involves partners from Neuroscience (Collège de France) and robotics from Europe (IST, Scuola superior Sant'Anna) and Japan (Waseda university)

EU Project HANDLE - "Developmental pathway towards autonomy and dexterity in robot in-hand manipulation". This project aims to model the way how humans perform in-hand manipulation from experiments involving human subjects and instrumented objects. These models are used to transfer these skills to anthropomorphic articulated hands.

We have also been involved in the proposal of an EU-coordinated Action, "Coordination Action for the design and description of the FET Flagship candidate Robot Companions for Citizens" CA-RoboCom that was recently approved and will conduct preparatory work for a FET Flagship Project in this area to be proposed in 2012.

Group Description	
Title of Research Group:	(RL-EME-LA09-137) Sustainable Technologies and Environmental Systems
Principal Investigator:	Paulo Manuel Cadete Ferrao
Main Scientific Domain:	Engenharia Mecânica

Objectives & Achievements

General Objectives

The objective is undertaking multidisciplinary research to develop and evaluate emerging and alternative complex engineering systems for sustainability.

Technologies will be developed and assessed under a systems view, comprising the environmental implications of materials, energy, and products in modern societies. To achieve these objectives, research and development activities involve assessing advanced systems, but also analyzing the global carbon bio-geochemical cycle and materials flows in the economy

Main research areas:

Sustainable energy systems modeling and integration of energy technologies integrations making use of ICT

Eco-design for sustainability

Advanced integrated combustion and thermal systems

Total life-cycle energy chain and environmental impact assessment

Carbon cycle analysis

Economy material flows

Techno-economic assessment, technological change and systems integration

Development of industrial ecology models applied to economic systems with emphasis on national and urban systems

Main Achievements

The activities developed within this topic were multidisciplinary, linking basic and applied research to technology development, and focused on the issues of sustainability, namely in terms of the needs to secure the quality of the environment, together with the management of energy resources and economic development.

In this context, the Laboratory of Environmental Systems has been able to:

- Support a PhD Program on Sustainable Energy Systems, in the context of the MIT-Portugal Program
- Develop a set of advanced energy systems models, including energy use in buildings and its interaction with electric vehicles, national energy systems modeling including high time resolution or wind energy synthetic data models.
- Develop major methodologies and tools that bring together economy and environment in the assessment and the design of new products (Eco-design tools) and new policies (e.g.: National Integrated framework for Residues Management, Hybrid Economic Input-Output-Life Cycle Assessment or Life Cycle Activity Analysis).
- Support entrepreneurial initiatives in Industrial Ecology in Portugal, such as the design of a variety of new companies aimed at recycling and further processing end-of-life products or the design and implementation of an Eco-Industrial park at Chamusca.
- Create a network for sustainability in Portuguese agriculture, comprising close to 100 farmers, occupying 0.7% of Portugal, and close to 30 partners, including universities, NGOs and private firms.
- Provide support to Portuguese public policy on the use of natural carbon sinks (including geological carbon sequestration).
- Demonstrate the use of natural fiber based composites for auto-components
- Develop new urban metabolism models.

Research Line Output

Collaborative Publications in peer review Journals

The research conducted within some of the groups of this thematic area is intrinsically highly multidisciplinary, combining e.g. engineering disciplines with natural sciences, economy and management. Joint, trans-disciplinary collaboration is starting to appear. New work developed together with MIT is bringing the group of sustainable energy and the research team on artificial intelligence, for example through the PhD thesis of Pedro Janela.

Collaborative Other Publications

Gerbelová H, S Casimiro , C Ioakimidis, M Melo, CAC Almeida, FJAS Barriga, P Ferrão, 2010. Assessment for Carbon Capture and Storage Opportunities: Portuguese Case Study. GHGT-10 - 10th International Conference on Greenhouse Gas Control Technologies, Amsterdam, September 2010

PhD thesis completed

Research Line Output

Inês Costa (2010) "O Desafio das Simbioses Industriais: Um contributo científico para o desenvolvimento de simbioses industriais; caso de estudo Português" Doutoramento em Engenharia do Ambiente, IST-UTL.

Cristiano Alves (2010) "Sustainable design of Automotive components through jute fiber composites", Doutoramento em Eng. Mecânica, IST

Group Description	
Title of Research Group:	(RL-EEI-LA09-145) Signal Processing for Communicatio Networks and Multimedia
Principal Investigator:	Joao Paulo Salgado Arriscado Costeira
Main Scientific Domain:	Engenharia Electrotécnica e Informática

Objectives & Achievements

General Objectives

The main focus of thematic area D is on the development of computational methodologies for a set of fundamental problems in two major application contexts: a) Large Scale Distributed Sensing and b) Content Based Image and Video Understanding.

As a foundational assumption this research perspective looking at cross-cutting methodologies, imposes a clear multidisciplinary environment combining specific domain knowledge (e.g. Image Processing, wireless communications) with fundamental disciplines in Signal Processing (Estimation, Optimization) "down" to deep mathematics-rooted disciplines (Algebra, Differential Geometry, Probability Theory). Though artificial, these three levels will help interpreting today's achievements as a result of strategic options taken many years ago. These decisions are reflected both in the recruiting policy (hiring a mathematician to be merged in an "engineering environment") and in the formal/informal partnerships established over the years (Carnegie Mellon-Portugal program, joint projects, collaborative papers).

Main Achievements

Breakthroughs that produced theorems for some relevant problems:

A1- Minimization of a Quadratic function on Smooth Manifolds – A unified framework to factorize matrices constrained to special manifolds (e.g. Stiefel)

A2- Minimization of a singular value of a partially prescribed matrix – Optimal "filling" of missing entries of a low rank approximation of a given matrix.

A3 - Integer 0-1 problems: A unique solution of a 0-1 (permutation) problem over a convex set .

Main contributions for "enabling methodologies":

B1-Reconstruction of non-rigid objects from video sequences – Representations/frameworks and algorithms to obtain the 3D reconstruction of non-rigid and "flexible" objects from video sequences - direct consequence of A1 .

B2- Image matching for object recognition – An object recognition framework for image-to-object matching - direct consequence of A3 a

B3 – Distributed consensus and detection in Sensor Networks – New methods to design optimal weights for distributed consensus algorithms running over networks with random topologies. Distributed hypothesis testing in SN with random links.

B4 - Localization and tracking in sensor Networks- A centralized algorithm that jointly estimates sensor and target positions from range measurements with resilience to outliers and little information on anchor position.

This downstream scientific flow disembogues in cutting-edge technological developments with impact on society at the industrial, services, cultural and policy levels. Main "themes":

C1 Pollution monitoring using a bus fleet – New sensor platforms to measure 5 gases. Distributed event detection system for the pollution field. Pollution dynamics modelling and simulation of urban. A case study with Lisbon and Pittsburgh is under development.

C2 Image retrieval and recognition in large scale databases of images

New random-walk image and label retrieval. Label probability and pictorial information from partial information. Direct development from A1/A2. Localization of objects in images from weakly labelled data (coupled to A3/B2).

Though the core of A1,A2,A3 are mostly SIPG/ISR's all accomplishments are carried out withing partnerships (Carnegie Mellon-Portugal, CELC-FCUL) and involving SIPG, VISLAB,DSOR/ISR

Research Line Output

Collaborative Publications in peer review Journals

As explained in the previous section, the ongoing activities within thematic area D stretch along a several "methodological" directions. This is made possible by the heterogeneous background of the researchers involved but also to the cooperative and "networked" environment under which research is done. Publications reflect the inter-group interactions and the intense co-development with external partners involved in tight working links through co-advisorship of PhD students and/or projects.

D. Jakovetic, J. Xavier and J. M. F. Moura, "Weight optimization for consensus algorithms with correlated switching topology", IEEE Transactions on Signal Processing, vol. 58, no.7, pp. 3788-3801, July 2010

M. Dodig, Marko Stošić, "Combinatorics of Column Minimal Indices and Matrix Pencil Completion Problems", SIAM Journal on Matrix Analysis and Applications, Vol. 31, Issue 5, pp. 2318-2346, 2010.

M. Stosic, M. Marques, J.P. Costeira: Convex solution of a permutation problem, Linear Algebra and its Applications 434 (Jan2011). Published online 2010-Key doc for A3.

Research Line Output

During 2010, 5 other submissions to major journals in Computer Vision and Signal Processing were done with 3 already accepted and 2 still under review (2 years average time until accepted).

Collaborative Other Publications

P. Oguz-Ekim, J. Gomes, J. Xavier, P. Oliveira, "A convex relaxation for approximate maximum-likelihood 2D source localization from range measurements", Proceedings of the IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP'10), Dallas, USA, March 2010.

G. Carneiro, The Automatic Design of Feature Spaces for Local Image Descriptors using an Ensemble of Non-linear Feature Extractors, CVPR2010

A. del Bue, J. Xavier, L. Agapito and M. Paladini, Bilinear factorization via Augmented Lagrange Multipliers 11th European Conference on Computer Vision - ECCV'10, Crete, Greece, September 2010

D. Jakovetic, J. Xavier and J. M. F. Moura Consensus in correlated random topologies: weights for finite time horizon IEEE International Conference on Acoustics, Speech and Signal Processing - ICASSP'10, Dallas, Texas, USA, March 2010

D. Bajovic, D. Jakovetic, J. Xavier, B. Sinopoli and J. M. F. Moura Distributed detection over random networks: a large deviations analysis 48th Allerton Conference on Communication, Control, and Computing, Illinois, USA, October 2010

PhD thesis completed

URBISNET – Real time monitoring of pollution gas field in large cities – Spun by an FCT funded project this “theme” became a central topic of research. Planned as a technological endeavour whereby data collected by a network of moving sensors (buses with sensors) is fused to produce a dense pollution map, became one instrument in a broader public-policy driven initiative. This reshaping resulted from joint co-advisorships of dual-degree PhD students from Carnegie Mellon’s ECE Department and Engineering and Public Policy Department and funded under the Carnegie Mellon-Portugal program. The objective is to model, simulate and measure pollution fields so that policy is done based on sound physical data. [SIGPLab,DSOR and Center for Atmospheric Particle Studies@CMU].

Novel information processing methodologies for intelligent sensor Networks - Started in late 2010 as a result of a CMU-Portugal project call, its broad objectives address key issues in large sensing and actuation infrastructures. Framed in the commonly known as Cyber Physical Systems domain, the goal is to study and innovate around the following main issues having Wireless Sensor Networks at its core: Sensor Selection, Secure Communications and Secure Control of Cyber Physical Systems. Industrial partners will deploy several testbeds with CMU’s Sensor Andrew as the main experimental leverage [SPIGLab CENSCIR@CMU]

PRINTART (<http://printart.isr.ist.utl.pt>) Content and Ontology based Art Image Annotation and Retrieval – Image retrieval is a major issue on today’s networked world. Here we teamed up with Art Historians from University of Lisbon to frame a large scale retrieval system. We focused on the original Portuguese Tile Panels (Azulejo) which frequently result from compositions of famous paintings and prints. The objective is to trace the roots of the Azulejo and identify the original paintings it came from. The main challenges are quite coincident in the fundamental research proposals namely the huge data dimension, the nonlinear/combinatorial character and ultimately the need for distributed search [SIGP, Coral-Group@CMU and external partner Fac Letras UL].

Group Description	
Title of Research Group:	(RL-EEI-LA09-151) Technologies for Ocean Exploration
Principal Investigator:	António Manuel dos Santos Pascoal
Main Scientific Domain:	Engenharia Electrotécnica e Informática

Objectives & Achievements

General Objectives

The main goal of thematic area A is to carry out research and development in advanced marine science and technology to better understand ocean phenomena and to explore the deep mineral and biological deep seafloor resources. The area brings to the core of its R&D activities research groups with different expertise and encompasses a wide spectrum of activities that touch upon theoretical and practical issues in marine science and technology. The program targets the Azores as a natural laboratory for the study of a number of challenging scientific issues in the fields of biological, chemical, geological, and physical oceanography. At a technological level we aim to bring advances in robotics, communications, and systems and information theory to bear on the development of advanced marine platforms (including autonomous vehicles) and sensor systems that will afford marine scientists far more efficient tools than available today to study the ocean and its frontiers. Conversely, strong cooperation links established with marine scientists impact on the definition of new theoretical and technological problems that are motivated by challenging mission scenarios.

Main Achievements

Engineering:

Development of new methodologies and software/hardware architectures for: a) multiple vehicle cooperative motion planning, navigation, and control, b) optimal networked sensor placement for underwater target positioning, and c) sensor-based control for unmanned air vehicles.

Science:

IMAR-DOP/UAz has become a leading research center for integrated studies on seamounts and hydrothermal vents, thorough its involvement in 8 projects of the FP6 and 4 of the FP7; IMAR has also become the world leading research center on the study of the deep-sea chemo-synthetic mussel *Bathymodiolus* and the 10th Web of Knowledge ranked institution on the study of hydrothermal vent extreme ecosystems (2006-2010); recently, IMAR also came to the fore with the installation of a new laboratory (Corallab), dedicated to the husbandry and experimentation with cold-water corals, making possible the study of certain aspects of the biology and physiological processes of cold-water corals and associated fauna, which are difficult in situ. Ongoing experiments at Corallab include studies on gene expression analysis of relevant genes known to be directly involved in immune and stress responses to the presence of pathogens and or environmental stressors.

From an Earth Sciences point of view, Creminer is completing a major study on Arctic hydrothermal systems, with great emphasis on the deep biosphere and on comparison with the Azores hydrothermal fields. Public outreach through Creminer continued to be particularly noteworthy, with involvement in the National Museum of Natural History and in the setting-up of the Lousal "live science" center in Southern Portugal. Analytical facilities, including the new Stable Isotope Lab, the Soil and Sediment Lab AmbiTerra and the Mobile Lab are all equipped and starting to be extensively used.

Bridging the gap between science and technology:

A Showcase of Science and Technology in the Azores in the scope of the FREESUBNET Workshop, July 2010, Horta, Faial, co-organized by IMAR and ISR –advanced robots and marine equipment were used intensively at sea by a large group of European researchers to: i) map the habitat around a newly found of a hydrothermal vent field, and ii) to perform acoustic telemetry and tracking of fish carrying acoustic emitters

Research Line Output

Collaborative Publications in peer review Journals

The research work carried out by the members of Thematic Area A covers a large spectrum of issues that stand at the crossroads of engineering and science. The following representative list of publications reflects this fact and describes work that either involved different research groups or is the outcome of intensive cooperation links with external co-authors.

Dias Á S , Mills R A, Ribeiro da Costa I, Costa R, Taylor R N, Cooper M, and Barriga F J A S, (2010). Tracing fluid-rock reaction and hydrothermal circulation at the Saldanha hydrothermal field. *Chemical Geology*, 273(3-4): 168-179. doi:10.1016/j.physletb.2003.10.071

Fouquet Yves, Pierre Cambon, Joël Etoubleau, Jean Luc Charlou, Hélène Ondréas, Fernando J. A. S. Barriga, Georgy Cherkashov, et al, 2010. Geodiversity of Hydrothermal Processes Along the Mid-Atlantic Ridge–Ultramafic-Hosted Mineralization: A New Type of Oceanic Cu-Zn-Co-Au Volcanogenic

I. Kaminer, A. Pascoal, E. Xargay, N. Hovakimyan, C. Cao, and V. Dobrokhodov, Path Following for Unmanned Aerial Vehicles using L1 Adaptive Augmentation of Commercial Autopilots, *Journal of Guidance, Control, and Dynamics*, Vol. 33, NO. 2, pp. 550-565, March-April 2010.

Morato T., et al. 2010. Can we protect seamount for research? A call for conservation. *Oceanography*, 23(1): 190-199.

Morato, T., et al. 2010. Seamounts are hotspots of pelagic biodiversity in the open ocean. *Proceedings of the National Academy of Science US* 107(21): 9707-9711.

Research Line Output

Pedersen RB, HT Rapp, IH Thorseth, M Lilley, FJAS Barriga, T Baumberger, G Bernasconi-Green, K Flesland, R Fonseca, SL Jorgensen, 2010. Discovery of a black smoker vent field and a novel vent fauna at the Arctic Mid-Ocean Ridges. *Nature Comm* 1:126 DoI: 10.1038/ncomms1124

Quartau, R., A et al. 2010. Modelling the Development of a Volcanic Island Shelf by Erosion: Faial Island in the Azores Archipelago. *Marine Geology*, 275 (1-4): 66-83.

Riou, V., et al. (2010). The mixotrophic side of the deep sea hydrothermal, dual endosymbiotic, mytilid *Bathymodiolus azoricus*: assimilation of dissolved and particulate organic matter. *Marine Ecology Progress Series* 405:187-201.

Smith D. K., N. Exon, F. J. A. S. Barriga, Y. Tatsumi, 2010. Ocean Drilling: Forty Years of International Collaboration. *EOS, Transactions, American Geophysical Union*, 91:393-395

Collaborative Other Publications

The following list of representative publications describes work that either involved different research groups or is the outcome of strong cooperative links with external co-authors.

Barriga FJAS, RS Santos (2010). Recursos minerais marinhos, metálicos, não metálicos e energéticos: potencial e impactos ambientais. In: *Políticas Públicas do Mar*, Coord N Vieira Matias, V Soromenho Marques, J Falcato, AG Leitão, pp 86-95. Ed Esfera do Caos, Lisboa, 297p.

Barriga FJAS, Carvalho C, Cruz MI, Dias ÁS, Fonseca R, Relvas JM, Pedersen R (2010) Preliminary Results on Mineralogy and Geochemistry of Loki's Castle Arctic Vents and Host Sediments. *Geophysical Research Abstracts Vol12, EGU2010-11970, EGU General Assembly 2010*.

Carreiro-Silva M, E Giacomello, A Braga-Henriques, J Jakobsen, K Jakobsen, G Menezes, T Morato, FM Porteiro, F Tempera and RS Santos (2010). Sea-based and land-based observatories: new approaches for the integrated study of biodiversity and ecosystem function on seamounts. *MARS Newsletter no.9*.

G. Indiveri, G. Antonelli, A. Caiti, G. Casalino, A. Birk, A. Pascoal, A. Caffaz, The CO3AUVs (Cooperative Cognitive Control for Autonomous Underwater Vehicles) Project: overview and current progress", in *Proc. IAV 2010 Conference, Lecce, Italy, Sept. 2010*.

D. Moreno, A. Pascoal, A. Alcocer, and J. Aranda, "Optimal Sensor Placement for Underwater Target Positioning with Noisy Range Measurements," in *Proc. CAMS 2010 Conference, Rostock, Germany, Sept. 2010*.

Pedro J. Sanz, Pere Ridao, Gabriel Oliver, Claudio Melchiorri, Giuseppe Casalino, Carlos Silvestre, Yvan Petillot, Alessio Turetta, TRIDENT: A Framework for Autonomous Underwater Intervention Missions with Dexterous Manipulation Capabilities, 7th IFAC Symposium on Intelligent Autonomous Vehicles, IAV 2010, Lecce, Italy, September, 2010.

Vecchione V., Odd Aksel Bergstad, Ingvar Byrkjedal, Tone Falkenhaus, Andrey V. Gebruk, Olav Rune Godø, Astthor Gislason, Mikko Heino, Åge S. Høines, Gui M. M. Menezes, Uwe Piatkowski, Imants G. Priede, Henrik Skov, Henrik Søliland, Tracey Sutton, Thomas de Lange Wenneck *Life Chapter 6*: pp. 103-121.

PhD thesis completed

1. PhD Thesis that have an interdisciplinary character and are co-supervised by foreign experts

Virginie Riou - MoMARNET (FP6-RTN/2003/505026) Marie Curie Fellowship 2005: Trophic ecology of the hydrothermal vent mussel *Bathymodiolus azoricus*. (co-tutela: PhD awarded by the University of the Azores, Portugal and by the Université Libre de Bruxelles, Belgium). (Approved 14 of January 2010) [supervised by Ricardo Serrão Santos and Ana Colaço]

Daphne Cuvelier - MarBEF (FP6-GOCE-CT-2003-505446) fellowship DeepSets 2006 & SFRH/BD/47301/2008: Temporal variations of the Mid-Atlantic hydrothermal vent communities from the Lucky Strike vent field. (PhD to be awarded by University of the Azores. In collaboration with University of Southampton-UK, MNH-UK, IFREMER-France, AWI-Germany). (submitted for evaluation June 2010) [supervised by Ricardo Serrão Santos and Ana Colaço]

2. The following multidisciplinary projects have fostered intensive cooperative work between the DSORL, IMAR, and the Signal and Image Processing Group at both National and European levels. All projects address issues that require a strong symbiosis between engineering and marine science.

[1] EU "FREESUBNET- Marie Curie Research Training Network". The purpose of FREESUBNET is to provide a European-wide excellence in quality training to young and experienced researchers in the emerging field of Cooperative Autonomous Intervention Underwater Vehicles (AUVs), which are steadily becoming the tool par excellence to carry out scientific and commercial missions at sea without tight human supervision.

Research Groups: DSORL, IMAR, Signal and Image Processing Group

URL: <http://www.freesubnet.eu/>

[2] "NAV-Development and Application of Advanced Nonlinear Control Techniques for the Coordination and Motion Control of a Network of Autonomous Vehicles": the goal of this project is to develop, implement and test advanced robust control strategies for the coordination and cooperative motion a network of autonomous vehicles (NAV). The research work is driven by the high-impact field of marine robotics. It is expected that the methodologies and techniques developed in NAV-Control will contribute to the development of important tools for ocean exploration and exploitation.

Research Groups: DSORL and IMAR

URL: <http://users.isr.ist.utl.pt/~pedro/NAV>

Research Line Output

[3] "OBSERVFLY-Uninhabited Aircraft for Marine Science Applications": the project aims to develop a versatile UAV prototype that can take-off and land either on an opportunity airstrip (using the landing gear) or on a bay or harbor (as a seaplane). The aircraft will be designed for marine science applications with special emphasis on the location and tracking of marine mammals and commercially important or threatened pelagic species such as the Atlantic Tuna.

Research Groups: DSORL and IMAR