Report 2005 and Plan 2006

NIAD&R, Faculdade de Engenharia da Universidade do Porto

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Contents

Introductory Note

This report has also been included in the Global LIACC 2005 report and Plan for 2006.

1 LIACC Organization

LIACC is organized as a set of three groups all of them under coordination of professors of the University of Porto:

- NCC — Computer Science Group coordinated by Prof. Miguel Filgueiras and Prof. Luís Damas;
- NIA&AD — Artificial Intelligence and Data Analysis Group coordinated by Prof. Pavel Brazdil;
- NIAD&R — Distributed Artificial Intelligence & Robotics Group coordinated by Prof. Eugénio Oliveira.

2 Reports and Plans

2.1 NIAD&R: the Distributed AI & Robotics Group

Team

Name	Position
Eugénio Oliveira	Senior Researcher
Ana Paula Rocha	PhD Researcher
Luís Paulo Gonçalves dos Reis	PhD Researcher
Rui Camacho Ferreira da Silva	PhD Researcher
Rosaldo Rossetti	PhD Researcher
Henrique Daniel Lopes Cardoso	Researcher
Andreia Malucelli	Researcher
Luís Miguel Martins Nunes	Researcher
António Manuel Correia Pereira	Researcher
Célia Talma Pinho Valente	Researcher
Nuno José da Silva Trindade Duarte	Researcher
Luís António Diniz Morais Sarmento	Researcher
Alexessander da Silva Couto Alves	Researcher
Francisco António Fernandes Reinaldo	Researcher
Luis Henrique Ramilo Mota	Researcher
Carlos Alberto de Sousa Leão	Researcher
Pedro Miguel Faria	Researcher
Daniel Cardoso Moura	Research Assistant
Hugo Gravato Marques	Research Assistant
Nuno Miguel Tavares de Sousa	Research Assistant
Sónia Alexandra Sousa Rocha	Research Assistant
David Palzer	Research Assistant
Nuno Sousa	Research Assistant
António Castro	Research Assistant
Rui Neves	Research Assistant
Paulo César Basto Cardoso	Research Assistant
External Collaborators	
Fernando Mouta	PhD Researcher
José Luís Pinto	Research Assistant
Miguel Luís da Silva Rentes	Student
João Pedro Bugalho Certo	Student
Nuno Miguel Ferreira Cordeiro	Student

2.1.1 Results of research

Publications

Theses

1. Nunes, Luis, Learning from Multiple Sources in Heterogeneous Groups of Agents, PhD Thesis in Computer Science and Engineering, Faculty of Engineering at the University of Porto, October 2005.

Chapter in book edited

2. Balsa, João; Moniz, Luís; Reis, Luís Paulo (eds.) Chapter 8 - "Multi-Agent Systems: Theory and Applications" (MASTA 2005), In Carlos Bento, Amílcar Cardoso, Gaël Dias (Eds.): Progress in Artificial Intelligence, 12th Portuguese Conference on Artificial Intelligence, EPIA 2005, Vol. 3808, pp. 485-595. Springer LCNS, 2005, ISBN 3-540-30737-0.

3. Reis, Luís Paulo; Lau, Nuno; Carreto,Carlos; Silva, Eduardo (eds.); Chapter 7 - "IROBOT 2005: Intelligent Robotics", In Carlos Bento, Amílcar Cardoso, Gaël Dias (Eds.): Progress in Artificial Intelligence, 12th Portuguese Conference on Artificial Intelligence, EPIA 2005, Vol. 3808, pp. 395-484, Lecture Notes in Artificial Intelligence, Springer, 2005, ISBN 3-540-30737-0.

4. Pinto, Sofia; Malucelli, Andreia; Freitas, Fred; Tempisch, Cristoph (eds.); Chapter 4- BAOSW- Introduction to Building and Applying Ontologies for the Semantic Web Workshop, in Proceedings of EPIA 2005 -12th Portuguese Conference on Artificial Intelligence, 2005, Amilcar Cardoso, Carlos Bento, Gael Dias (eds.) p. 205-231, Lecture Notes in Artificial Intelligence, V.3808, Springer , Berlin 2005.

5. Paiva, Ana; Martinho, Carlos; Oliveira, Eugénio (eds.); Chapter 2- AC 2005- Introduction to Affective Computing Workshop, in Proceedings of EPIA 2005, 12th Portuguese Conference on Artificial Intelligence, 2005, Amilcar Cardoso, Carlos Bento, Gael Dias (eds.) p. 101-140, Lecture Notes in Artificial Intelligence, V. 3808, Springer, Berlin 2005.

6. Balsa, João; Moniz, Luís and Reis, Luís Paulo (eds.) Chapter 8 - MASTA05: 3rd Workshop on Multi-Agent Systems: Theory and Applications, In C. Bento, A. Cardoso and G. Dias (eds.) Proc. Portuguese Conference on Artificial Intelligence, IEEE - Institute of Electrical and Electronics Engineers, Inc., University of Beira Interior, Covilhã, Portugal, p. 272-328, December, 2005.

7. Reis, Luís Paulo; Carreto, Carlos; Silva, Eduardo and Lau, Nuno (eds.) Chapter 7 - IROBOT05: 1st International Workshop on Intelligent Robotics, In C. Bento, A. Cardoso and G. Dias (eds.) Proc. Portuguese Conference on Artificial Intelligence, IEEE - Institute of Electrical and Electronics Engineers, Inc., University of Beira Interior, Covilhã, Portugal, p. 224-271, December, 2005.

Chapter in book

8. Cardoso, Henrique Lopes; Oliveira, Eugénio; Virtual Enterprise Normative Framework within Electronic Institutions, in M.-P. Gleizes, A. Omicini & F. Zambonelli (eds.), Engineering Societies in the Agents World V, Lecture Notes in Artificial Intelligence V. 3451, Springer, pp.14-32, 2005.

9. Rocha, Ana Paula; Cardoso, Henrique Lopes; Oliveira, Eugénio; Contributions to an Electronic Institution supporting Virtual Enterprises life cycle, in G. D. Putnik & M. M. Cunha (eds.), Virtual Enterprise Integration: Technological and Organizational Perspectives, Idea Group Inc., ISBN 1-59140-406-1, pp. 229-246, 2005.

10. Rossetti, R.J.F., Liu, R., "Activity-based analysis of travel demand using cognitive agents", Chapter 7 in Progress in Activity-Based Analysis,H. Timmermans (ed.), pp.139-160. Elsevier, Oxford, 2005.

11. Nunes, Luís and Oliveira, Eugénio; "Advice-Exchange Between Evolutionary Algorithms and Reinforcement Learning Agents: Experiments in the Pursuit Domain", in Adaptive Agents and Multi-Agent Systems III: Adaptation and Multi-Agent Learning, Daniel Kudenko, Dimitar Kazakov, Eduardo Alonso (eds.), Lecture Notes in Computer Science, V. 3394, pp.185-204, 2005.

12. Pedro Duarte, A. J. Hawkins and António Pereira. "How does Estimation of Environmental Carrying Capacity for Bivalve Culture Depend upon Spatial and Temporal Scales?". in R. F. Dame and S. Olenin (eds.), The Comparative Roles of Suspension-Feeders in Aquatic Ecosystems, pp. 121-135. Springer, Dordrecht, The Netherlands, 2005.

Papers in international journal with referees (edited abroad or in Portugal)

13. Rossetti, R.J.F.; Liu, R. "An agent-based approach to assess drivers interaction with pre-trip information systems". Journal of Intelligent Transportation Systems: Technology, Planning, and Operations, V.9, n.1, pp.1-10, 2005.
14. Malucelli, Andreia; Palzer, Daniel; Oliveira, Eugénio; "Ontology-based Services to help solving the heterogeneity problem in e-commerce negotiations". in Journal of Electronic Commerce Research and Applications - Special Issue Electronic data engineering: the next frontier in e-commerce. Vol. 5(3), Elsevier. 2006 (to be published) Special Issue on "Electronic Institutions and Legal Theory".

Publications in series reviewed by the Science Citation Index or published by major international houses.

15. Malucelli, Andreia; Oliveira, Eugénio; "Using Similarity Measures for an Efficient Business Information-Exchange", Proc. of the IEEE/WIC/ACM International Conference on Intelligent Agent Technology, Compiègne, France, IEEE Computer Society, pp. 234-237, September 2005.
16. Cardoso,Henrique Lopes; Oliveira, Eugénio, Towards an Institutional Environment using Norms for Contract Performance, in M. Pechoucek, P. Petta & L. Z. Varga (eds.), Multi-Agent Systems and Applications IV - 4th International Central and Eastern European Conference on Multi-Agent Systems (CEEMAS 2005), Lecture Notes in Artificial Intelligence, V. 3690, Springer, ISBN 3-540-29046-X, pp. 256-265, 2005.
17. Malucelli, Andreia; Palzer, Daniel; Oliveira, Eugénio; "Combining Ontologies and Agents to Help in Solving the Heterogeneity Problem in E-Commerce Negotiations". Proc. of the International Workshop on Data Engineering Issues in E-Commerce. Tokyo, Japan, IEEE Computer Society, Los Alamitos, CA, pp.26-35. April 2005.
18. Malucelli, Andreia; Cardoso, Henrique Lopes; Oliveira, Eugénio; "Enriching a MAS Environment with Institutional Services", In: Danny Weyns, Van Parunak, Fabien Michel (eds.), Environments for Multiagent Systems II, Lecture Notes in Computer Science, V. 3830, Springer, Berlin, 2005.
19. Fonseca, Nuno; Silva, Fernando; Costa, Vítor; Camacho, Rui; Strategies to paralilize ILP systems, in Proceedings of 15th International Conference on Inductive Logic Programming (ILP 2005), Bonn, Germany, August 2005, Springer, Lecture Notes in Artificial Intelligence, V. 3625, pp 136-153, (best paper ILP 2005)
20. Reinaldo, Francisco Antonio Fernandes; Certo, João; Cordeiro, Nuno; Reis, Luís Paulo; Camacho, Rui; Lau, Nuno. Applying Biological Paradigms to Emerge Behaviour in RoboCup Rescue Team. In: EPIA 2005 -12th Portuguese Conference on Artificial Intelligence, 2005, Amilcar Cardoso, Gael Dias and Carlos Bento (eds.) pp. 422-434, Springer-Verlag, Berlin 2005.
21. Cardoso, Henrique Lopes; Malucelli, Andreia; Rocha, Ana Paula; Oliveira,Eugénio; "Institutional Services for Dynamic Virtual Organizations", In: Luís Camarinha-Matos, Hamidesh Afsarmanesh, Angel Ortiz (eds.), Collaborative Networks and Their Breeding Environments - 6th IFIP Working Conference on Virtual Enterprises, Valencia, Springer, p. 521-528, 2005.

22. Pinto, Sofia; Malucelli, Andreia; Freitas, Fred; Tempisch, Cristoph; Introduction to Building and Applying Ontologies for the Semantic Web Workshop, in Proceedings of EPIA 2005 - 12th Portuguese Conference on Artificial Intelligence, 2005, Amilcar Cardoso, Carlos Bento, Gael Dias (eds.) p. 205, Springer-Verlag, Berlin 2005.

23. Balsa, João; Moniz, Luís; Reis, Luís Paulo; Introduction to MASTA 2005. In Carlos Bento, Amílcar Cardoso, Gaël Dias (Eds.): Progress in Artificial Intelligence, 12th Portuguese Conference on Artificial Intelligence, EPIA 2005, Covilhã, Portugal, Springer LCNS, Vol. 3808, p. 487. 2005.

24. Reis, Luís Paulo; Lau, Nuno; Carreto, Carlos; Silva, Eduardo; Introduction to IROBOT 2005, In Carlos Bento, Amílcar Cardoso, Gaël Dias (Eds.): Progress in Artificial Intelligence, 12th Portuguese Conference on Artificial Intelligence, EPIA 2005, Covilhã, Portugal, Springer LCNS, Vol. 3808, p. 397. 2005.

25. Paiva, Ana; Martinho, Carlos; Oliveira, Eugénio; Introduction to Affective Computing Workshop, in Proceedings of EPIA 2005 -12th Portuguese Conference on Artificial Intelligence, 2005, Amilcar Cardoso, Carlos Bento, Gael Dias (eds.) p. 101, Springer-Verlag, Berlin 2005.

Communications in proceedings of scientific meetings (with referees).

26. Pereira, António; Duarte, Pedro; Reis, Luís Paulo; "ECOLANG - A Communication Language for Simulations of Complex Ecological Systems", Proc. of the 19th European Conference on Modelling and Simulation, Y.Merkuryev, R.Zobel, E.Kerckhoffs (eds.), Riga, Latvia, pp. 493-500, ISBN: 1-84233-112-4, June 2005.

27. Cardoso, Henrique Lopes; Oliveira, Eugénio; Assisting and Regulating Virtual Enterprise Interoperability through Contracts, in K. Fischer, A. Berre, K. Elms & J. P. Muller (eds.), Proceedings of AAMAS2005 Workshop Agent-based Technologies and applications for enterprise interOPerability (ATOP), pp. 1-12, Utrecht, The Netherlands, July 25th 2005.

28. Nunes, Luis and Oliveira, Eugénio; "Communicating During Learning", in Proceedings of the Cooperative Multi-Agent Learning Workshop, M.Someren, N.Vlassis (eds.), pp.63-74, Porto 2005.

29. Castro, António; Oliveira, Eugénio; "A Multi-Agent System for Intelligent Monitoring of Airline Operations", Proceedings of the 3rd European Workshop on Multiagent Systems, Brussels, Belgium, M. P. Gleizes, G. Kaminka, A. Nowé, S. Ossowski, K. Tuyls, K. Verbeeck (eds.), pp. 91-102, December 2005.

30. Lau, Nuno; Reis, Luís Paulo; Reinaldo, Francisco; FC Portugal 2005 Rescue Team Description: Adapting Simulated Soccer Coordination Methodologies to the Search and Rescue Domain, CD Proceedings of the RoboCup International Symposium, 2005.

31. Oliveira, Eugénio; Duarte, Nuno; "Making Way for Emergency Vehicles", Proeedings of European Simulation and Modelling 2005, J.Feliz-Teixeira, A.Brito (eds.), pp. 128-135, EUROSIS-ETI, October 2005.

32. Pereira, David; Oliveira, Eugénio; Moreira, Nelma; Sarmento, Luís; "Towards an Architecture for Emotional BDI Agents", in IEEE Proceedings of EPIA, Amilcar Cardoso, Carlos Bento, Gael Dias (eds.), pp. 40-46, Covilhã, December 2005.

33. Oliveira, Eugénio "Quatro Proposições e três Teses sobre Universidade e Investigação" in "Universidade & Desenvolvimento", Actas do Primeiro Encontro de Dare, UNTL, Timor Lorosae, 2005.

34. Reinaldo, Francisco; Roisenberg, Mauro; Barreto,Jorge Muniz; Camacho, Rui; Reis, Luís Paulo . A Tool for fast development of Modular and Hierarchic Neural Network-based Systems. In J. M. Feliz-Teixeira and A. E. Carvalho Brito (eds.) Proceedings of ESM2005 - European Simulation and Modelling Conference 2005, EUROSIS-ETI,Porto, Portugal, 2005.

35. Reinaldo, Francisco Antonio Fernandes. Aplicando Novos Paradigmas Biológicos para Emergir Comportamentos em um Sistema Autónomo. In: II Seminário de Investigadores e Estudantes Brasileiros em Portugal - II SIEBRAP, 2005, Porto. 2005.

36. Camacho, Rui; Fonseca, Nuno; Magalhães, Alexandre; Applying Inductive Logic Programming in a Study of Protein alpha-helices Structures in Proceedings of KDB2005 -Bioinformatics: Knowledge Discovery in Biology. (eds) Francisco M. Couto, Mario J. Silva e Pedro Fernandes, ISBN 972-9348-12-10, Lisboa, Portugal, pp 63-67

37. Magalhes, Alexandre; Camacho, Rui; Fonseca,Nuno; Propensoes Locais De ResiDuos De Aminoacido Em Sub-Estruturas Helicoidais de Proteínas, in Proceedings of XXXI Congreso de Quimicos Teoricos de Expresion Latina, QUITEL 2005, Caracas, Venezuela 2005.

38. Rossetti, R.J.F.; Liu, R. A dynamic network simulation model based on multi-agent systems. In Klügl, F.; Bazzan, A.L.C.; Ossowski, S. (eds.) Applications of Agent Technology in Traffic and Transportation, pp.181-192. Berlin: Birkhäuser, 2005.

39. Lau, Nuno; Reis, Luís Paulo; "FC Portugal 2005 Team Description Paper", In I. Noda, A. Jacoff, A. Bredenfeld and Y. Takahashi (eds.) CD Proceedings of the RoboCup International Symposium, 2005.

40. Lau, Nuno; Reis, Luís Paulo; Corrente, Gustavo; "FC Portugal 2005 Team: Coordination, Action Selection and Basic Skills for the 3D Simulator", In I. Noda, A. Jacoff, A. Bredenfeld and Y. Takahashi (eds.) CD Proceedings of the RoboCup International Symposium, 2005.

41. Okun, Oleg; Prisiilau, Helen; Alves, Alexessander; "Non-Negative dimensionality Reduction for Protein Fold Recognition", in Proceedings of the European Conference of Machine Learning Porto. Springer Verlag, 2005.

42. Alves, Alexessander; Zagoruiko, Nikolay; Okun, Oleg; Kutnenko, Olga; Borisova, Irina; "Predictive Analysis of Gene Expression Data from Human SAGE Libraries", in Proceedings of the Discovery Challenge of the European Conference of Machine Learning. Porto, 2005.

43. Reis, Luís Paulo; and Lau, Nuno; "FC Portugal Coach 2005: Soccer Intelligent Game Analysis", in I. Noda, A. Jacoff, A. Bredenfeld and Y. Takahashi (eds.) CD Proceedings of the RoboCup International Symposium, 2005

44. Castro, António; Oliveira, Eugénio; "A Multi-Agent System for Intelligent monitoring of Airline Operations", in Proceedings of the Third European Workshop on Multi-Agent Systems, Ed. M.P.Gleizes, G.Kaminka, A. Nowe, S. Ossowski, K.Tuyls, K.Verbeeck, pp. 91-102, Brussels, December 2005.

45. Dias, Hugo; Rocha, João; Silva, Paulo; Leão, Carlos; Reis, Luís Paulo; "Distributed Surveillance System", In C. Bento, A. Cardoso and G. Dias (eds.) Proc. Portuguese Conference on Artificial Intelligence, IEEE - Institute of Electrical and Electronics Engineers, Inc., University of Beira Interior, Covilhã, Portugal, pp. 257-261, December, 2005.

46. Reis, Luís Paulo; Carreto, Carlos; Silva, Eduardo; and Lau, Nuno; "IROBOT05: 1st International Workshop on Intelligent Robotics", In C. Bento, A. Cardoso and G. Dias (eds.) Proc. Portuguese Conference on Artificial Intelligence, IEEE - Institute of Electrical and Electronics Engineers, Inc., University of Beira Interior, Covilhã, Portugal, p. 225, December, 2005.

47. Balsa, João; Moniz, Luís; and Reis, Luís Paulo; "MASTA05: 3rd Workshop on Multi-Agent Systems: Theory and Applications", In C. Bento, A. Cardoso and G. Dias (eds.) Proc. Portuguese Conference on Artificial Intelligence, IEEE - Institute of Electrical and Electronics Engineers, Inc., University of Beira Interior, Covilhã, Portugal, p. 273, December, 2005.

accepted for publication in international journals

48. Cardoso, Henrique; Oliveira, Eugénio; "Institutional Reality and Norms: Specifying and Monitoring Agent Organizations", submitted to International Journal of Cooperative Information Systems (IJCIS), Special Issue on "Emergent Agent Societies".

49. Cardoso,Henrique Lopes and Oliveira, Eugénio; "Electronic Institutions for B2B: Dynamic Normative Environments", submitted to Artificial Intelligence and Law.

Other publications

50. Marques, Hugo; Lau, Nuno; Reis, Luís Paulo; "Architecture and Basic Skills of the FC Portugal 3D Simulation Team", Revista Electrónica e Telecomunicações, Vol. 4, N?4, University of Aveiro, pp. 478-485, 2005.

51. Palzer, Daniel; "Ontology-based Services in Multi-Agent Systems" (supervision, Blasius, K.H. and Oliveira, Eugénio), Diploma Thesis, Fachbereich Design und Informatik, Fachhochschule Trier, University of Applied Sciences, Germany, February 2005.

52. Marques, Hugo Gravato; (supervised by I. Aleksander and E. Oliveira), "3D Vision using Neural Networks at Imperial College", Report FEUP-LEIC, 2004.

53. Moura, Daniel; "Creating and Monitoring Contracts in Virtual Enterprises", Technical Report, DEEC/FEUP, 2004.

Prototypes

In all cases LIACC is the entity responsible for the certification.

- ForEV V.2.0: Virtual Enterprise Formation Platform. ForEV is an Agent-based tool and platform enabling multi-attribute, adaptive negotiation between enterprises aiming at forming a temporary consortium. A.P. Rocha, H.L.Cardoso, E.Oliveira, 2005.
- PyroSim V.1.3. A simple Graphical Simulator for "Emotion-like" based Agents evolving in Fire Combat scenaria. L. Sarmento, D. Moura, 2005.
- BIAS- Brokerage in Insurance: An Agent-based System. BIAS is a tool including a Broker Agent suitable for the Insurance products domain. V1.2, 2004. Nogueira, Luís.
- FC Portugal 2D - Simulation 2D League Team - RoboCup - Version 2005. L. P. Reis and IEETA/UA.
- FC Portugal 3D - Simulation 3D League Team - RoboCup - Version 2005. L. P. Reis and IEETA/UA.
- DSS - Distributed Surveillance System, July 2005. H. Dias, J. Rocha, P. Silva and L. P. Reis.
- SIGA - Soccer Intelligent Game Analysis System. July 2005, A. Sousa, S. Torres, J. Bento and L. P. Reis.
- EcoDynamo - Agent Based Coastal Ecosystems Simulator. CEMAS/UFP and A. Pereira, L. P. Reis.

- FC Portugal Rescue Team, July 2005, J. Certo, N. Cordeiro, F. Reinaldo and L. P. Reis and EETA/UA.
- FCPx - Rescue Teams Evaluation Tool, December 2005. N. Cordeiro, J. Certo and L. P. Reis.
- PyramidNet Tool - Developing a Modular and Hierarchic Neural Network-based Systems, December 2005. F. Reinaldo, R. Camacho,L. P. Reis.
- Virtual 3D: a Multi-Agent System for Visualizing RoboCup simulation League Games with Intelligent Camera Control. 2004. S. Louro.
- MARCS- Multi-Agent System for Train Traffic Control, 2004. H. Proença.

Theses supervised

Doctoral theses completed

1. Nunes, Luis, "Learning from Multiple Sources in Heterogeneous Groups of Agents", PhD Thesis in Computer Science and Engineering, Faculty of Engineering at the University of Porto, October 2005.

Doctoral theses in preparation

1. Malucelli, Andreia, "Agent-mediated Electronic Institutions", (Supervisor Eugénio Oliveira).
2. Cardoso, Henrique Lopes,"Agent-based Electronic Institutions enabling Automatic Electronic Contracts for Virtual Organisations", (Supervisor Eugénio Oliveira).
3. Pereira, António Manuel, "Agent-Based Intelligent Simulation of Coastal Ecossystems ", (Supervisor Luís Paulo Reis).
4. Reinaldo, Francisco Antonio Fernandes, "Learning Methodologies for Autonomous Agents: Apllications in RoboCup Rescue / Métodos de Aprendizagem para Agentes Autónomos: Aplicações no RoboCup Rescue", (Co-Supervision Rui Camacho and Luís Paulo Reis).
5. Valente, Célia Talma, "Methodologies for Business Processes and Distributed Workflows in Inter-Organisational Environments", (Co-supervision Ana Paula Rocha and A. Lucas Soares).
6. Moreira, Pedro Miguel do Vale "Intelligent 3D Visualization of Urban Scenarios / Visualização 3D Inteligente de Cenários Urbanos", (Co-supervision Augusto Sousa and Luis Paulo Reis).
7. Leão, Carlos Alberto de Sousa, "Distributed System for Object Tracking and Performance Analysis: Applications in Industry and Sports / Sistema Distribuído de Detecção, Seguimento e Análise de Desempenho no Trabalho: Aplicações na Indústria e Desporto",(Co-Supervision Luis Paulo Reis).
8. Mota, Luis Henrique Ramilo, "Common Framework for Cooperative Robotics: Applications in RoboCup / Arquitectura Genérica para Robótica Cooperativa: Aplicações no RoboCup",(Co-Supervisor Luis Paulo Reis).
9. Pedro Miguel Faria, "Multimedia Interface with an Intelligent Wheelchair / Interface Multimédia com uma Cadeira de Rodas Inteligente", (Supervisor Luis Paulo Reis)

Master theses in preparation

1. Castro, António "A Multi-Agent System for Intelligent Monitoring of Airline Operations". Supervisor Eugénio Oliveira).
2. Pinto, João Luís "An Electronic Market for trading Electrical Energy". (Supervisor Eugénio Oliveira).
3. Moura, Daniel Cardoso, "Learning Capabilities of Emotion-based Agents". (Supervisor Eugénio Oliveira)
4. Rocha, Sónia Alexandra, "Agent-based Web Information Retrieval". (Supervisor Eugénio Oliveira).
5. Lomba, Cristina Alice, "Negotiation Methodologies in Virtual Enterprises Formation" (Supervisor Ana Paula Rocha).
6. Pereira, Guilherme, "Agent-mediated Travel Agency". (Supervisor Eugénio Oliveira)
7. Almeida, Rui, "Opponent Behavior Prediction in Simulated Robotic Soccer / Previsão de Comportamentos de Adversários no Domínio do Futebol Robótico Simulado", (Co-supervisor Luis Paulo Reis) .
8. Restivo, André Monteiro de Oliveira, "Generic Simulation Optimization and Multi-Scenario Analysis / Optimização de Simulações Genéricas", (Co-supervision Eugénio Oliveira and Luis Paulo Reis).
9. Cardoso, Paulo César Basto, "Personal Assistant for Selecting VoIP Services / Assistente Pessoal para Selecção de Serviços VoIP", (Co-supervisor Luis Paulo Reis).
10. Miranda, José Carlos, "Real Time Robotic Vision" Supervisor Luis Paulo Reis).
11. Sousa, Nuno, "Emotion-based Facilitator Agents". (Supervisor Eugénio Oliveira)
12. Pereira, David, "Logic Formalization Emotion-based Agent Architectures / Formalização Lógica de emoções em arquitecturas de Agentes" (Co- supervision Eugénio Oliveira and Nelma Moreira)
13. Darya Alexandrovna Barteneva, "Visual Programming of Small Robots", (Co-supervisor Luis Paulo Reis).

Organization of scientific meetings

Workshop Chair:

- IROBOT2005 - 1st International Workshop on Intelligent Robotics, EPIA - Portuguese Conference on Artificial Intelligence, Covilhã, Portugal, December, 2005 (Luís Paulo Reis).
- MASTA2005 - 3rd Workshop on Multi-Agent Systems Theory and Applications, EPIA - Portuguese Conference on Artificial Intelligence, Covilhã, Portugal, December,2005 (Luís Paulo Reis).
- BAOSW- Introduction to Building and Applying Ontologies for the Semantic Web, EPIA - Portuguese Conference on Artificial Intelligence, Covilhã, Portugal, December,2005 (Andreia Malucelli).

Participation in Organization Committees:

- (Vice-Chair)IEEE/WIC/ACM International Conference on Intelligent Agent Technology, WIC-IAT, Compiègne, France, September, 2005. (Eugénio Oliveira).

- AC 2005- Workshop on Affective Computing, EPIA - Portuguese Conference on Artificial Intelligence, Covilhã, Portugal, December,2005 (Eugénio Oliveira).

Participation in Programme Committees:

- AAMAS'05- Fourth Int. Joint Conference on Autonomous Agents and Multi-Agent Systems, Utrecht, The Netherlands, July 2005.(Senior Program Committe). (E. Oliveira)
- EUMAS05- Third European Workshop on Multi-Agent Systems, Brussels, 2005 (Advisory Board). (E. Oliveira)
- Multi-Agent Learning Workshop, collocated with AAAI 2005-The Twentieth National Conference on AI, Pittsburgh, USA, July 2005. (E. Oliveira)
- ATOP- Agent-based technologies and Applications for Enterprise interoperability, collocated with AAMAS05, Utrecht, The Netherlands, July 2005. (E. Oliveira)
- ETFA- 10th IEEE International Conference on Emerging Technologies and Factory Automation, Catania, September 2005. (E. Oliveira)
- Agent-Based Simulation 6, Erlangen, Germany, September 2005. (E. Oliveira)
- AIS-ADM05- First Int. Workshop on Autonomous Intelligent Systems- Agents and Data Mining, St Petersburg, June 2005. (E. Oliveira)
- 5th European Workshop on Adaptive Agents and Multi-Agent Systems, Paris 2005. (E. Oliveira)
- CEEMAS-Forth Int. Central European Conference on Multi-Agent Systems, Budapest, September 2005. (E. Oliveira)
- CSCWD- Int. Conference on Cooperative Support Computer Work in Design, Coventry, May 2005. (E. Oliveira)
- ESAW05- Engineering Societies in Agent Worlds, Kusadasi, Turkey, October 2005. (E. Oliveira)
- Cooperative Multi-Agent Learning, com ECML-PKDD Conference, Porto, October 2005. (E. Oliveira)
- BAOSW-Building and Applying Ontologies for the Semantic Web, EPIA Workshop, Covilhã, December, 2005. (E. Oliveira)
- MASTA2005 - 3rd Workshop on Multi-Agent Systems Theory and Applications, EPIA Workshop, Covilhã, Portugal, December 2005. (E. Oliveira)
- MASTA2005 - 3rd Workshop on Multi-Agent Systems Theory and Applications, EPIA Workshop, Covilhã, Portugal, December, 2005. (L. P. Reis)
- IROBOT2005 - 1st International Workshop on Intelligent Robotics, EPIA Workshop, Covilhã, Portugal, December, 2005. (L. P. Reis)
- Scientific Meeting (Encontro Científico) Robótica 2005 - Portuguese Robotics Open, Coimbra, Portugal, April, 2005 (L. P. Reis)
- CeNPLf2005, Portuguese National Logic and Functional Programming Contest, Bragança, May, 2005. (L. P. Reis)

Editorial Boards

- Member of the Editorial Board of the International Journal "Autonomous Agents and Multiagent Systems" Kluwer Academic Publishers (E. Oliveira).
- Member of the European Board for the IOS and Ohmsha Ltd. "Frontiers in AI and its Applications" sub-series for promoting world wide outstanding dissertations in Artificial Intelligence (E. Oliveira).

- International Journal of Computational Intelligence, Enformatika, ISSN 1304-2386, (Luís Paulo Reis).
- Tékhne - Revista de Estudos Politécnicos / Polytechnical Studies Review, (Luís Paulo Reis).

Advanced and post-graduate courses

- Artificial Intelligence and Intelligent Systems Masters Course, Faculty of Engineering and Faculty of Economics, University of Porto 2004-5. (E. Oliveira, R. Camacho, Ana P. Rocha, Luís P.Reis).
- Informatics Engineering Master Course, Faculty of Engineering, University of Porto, 2003-4. (E. Oliveira, R. Camacho, A.P.Rocha).
- Multi-Agent Systems, Coordination, Robotics and RoboCup Advanced Course, Universidad Autónoma de Yucatán, México, April 23-28, 2005 (L. P. Reis)
- RoboCup: Artificial Intelligence Meets Robotics to Create Soccer Playing Teams, Mexican Robotics Conference, Instituto Tecnologico de Merida, Yucatan, México, April, 26, 2005 (L. P. Reis)
- Erasmus student supervision: Daniel Palzer, Germany (E. Oliveira).
- Erasmus student supervision: António Calo, Spain (E. Oliveira).

Awards

- Simulation League - Portuguese Robotics Open - Champions - Team FC Portugal, April, 2005 (L.P. Reis in collaboration with IEETA/UA).

Science in education

- Introductury Course on Artificial Intelligence, University of Dili, East Timor, January-March 2005. (Eugénio Oliveira).
- "Electronic Institutions for B2B: Dynamic Normative Environments", Virtual Institutions Meeting, AgentLink, Barcelona, July 2005.
- Emotion-based Agent Architectures: why should software Agents have Emotions?, Workshop Cognitive Sciences at the University of Porto; Challenges and Future Needs, Porto, Fevereiro 2005. (L. Sarmento).
- "Quatro Proposições e Três Teses sobre Universidade e Investigação", 1**?** Encontro de Dare "Universidade & Desenvolvimento, Dare, February 2005. (E. Oliveira).
- "Inteligência Artificial- Uma perspectiva heterodoxa", Universidade Nacional de Timor Leste, March 2005. (E. Oliveira).
- Robots Demos at the Centro de Reabilitação da Granja, 2005. (M. Rentes).

Participation in the following scientific competitions:

- Autonomous Driving/Condução Autónoma - Portuguese Robotics Open, Coimbra, April, 2005 (Luis Paulo Reis + students)
- Ciber-Mouse, University of Aveiro, May, 2005(Luis Paulo Reis + students)
- Micro-Mouse, University of Aveiro, May, 2005 (Luis Paulo Reis + students).
- Robotic Firefighting/Robot Bombeiro, Inst. Politécnica da Guarda, June 2006 (Luis Paulo Reis + students).
- RoboCup Legged League, Osaka, Japan, July 2005 (Luis Paulo Reis, Miguel Rentes).

- RoboCup Simulation League 2D, Osaka, Japan, July 2005 (Luis Paulo Reis).
- RoboCup Simulation League 3D, Osaka, Japan, July 2005 (Luis Paulo Reis).
- RoboCup Rescue League, Osaka, Japan, July 2005 (Luis Paulo Reis, João Certo, Nuno Cordeiro, Francisco Reinaldo).

Participation in the following scientific events:

- Science and Robotics Exhibition, Arrábida Shopping, Gaia, November 2004 (Luis Paulo Reis).
- FEUP Open Week to Students, FEUP, Porto, March 2005 (Luis Paulo Reis, Miguel Rentes).
- University of Porto Science Education and Innovation Exhibition - Pav. Rosa Mota, Porto, April 2005 (Luis Paulo Reis, Miguel Rentes).
- LIACC Research demonstration at EPIA 2005, Covilhã, December 2005.

2.1.2 Plan for 2006

Scientific Goals

NIAD&R (Distributed Artificial Intelligence & Robotics Group) is LIACC's group belonging to the Faculty of Engineering at the University of Porto. Our team includes 5 PhD (one Senior), 11 Researchers including PhD students(10 working in part-time), 8 other MSc's students and 2 external collaborators. NIAD&R is the smallest LIACC's group and is mostly devoted to the research in Distributed Artificial Intelligence and Agent-based Systems. More precisely, both the theoretical and practical aspects of Autonomous Agents as well as Multi-Agent Systems have been the broad areas of interest for our research. Our main motivation relies on improving models for agent-based systems interoperability coordination and applications. We can further identify specific topics inside these areas as shown below: (i) Electronic Institution for agent-based B2B trading, (ii) Agents' Adaptation, Learning and Emotions; (iii) Multi-Agent teams' coordination and simulation; (iv) Multi-agent Systems applications and Text Mining. In the following subsections a more detailed description of the work we intend to pursue is presented

2.1.2.1 Electronic Institution for agent-based B2B inter-Operability

Eugénio Oliveira, Ana Paula Rocha, Henrique L. Cardoso, Andreia Malucelli, Célia Valente, P.Leitão (Collab.)
Coordinator: Eugénio Oliveira
Research direction: Research in the context of this issue aims at developing an Electronic Institution for safe and trustable agent-based business operations. This objective includes the development of appropriate models for B2B Negotiation and Monitoring processes as well as to provide platforms, tools and frameworks enabling Agents' interaction in the context of Virtual Enterprises Life Cycle.

Electronic Contracts *Research goals: Our main concern is to define a computational representation of electronic contracts suitable to automatic monitoring procedures executed by an Electronic Institution. An electronic contract includes a set of norms that contractual agents agree upon. Electronic contracts should make it possible to represent Virtual Organization/Enterprise settings, defined in terms of consortiums aggregating the efforts of different organizations.*

Recent work (2005):

- A normative framework has been developed, considering the Electronic Institution as a background supporting norms that facilitate the establishment of electronic contracts. Concepts

from contract law theory have been adopted, such as the notion of default rules.

- A representation formalism for norms and contracts has been defined, taking inspiration on deontic logic and founded on a rule-based approach. An implementation of norms and contracts has been achieved, using the rule-based expert system shell JESS.
- An institutional service for contract monitoring and enforcement has been developed and partially implemented using the JESS shell. More specifically, institutional norms and institutional rules for monitoring contracts have been defined. Furthermore, institutional procedures have been defined that allow for a responsive operation of the contract monitoring service (through notifications), and that permit the application of different approaches for norm enforcement (namely sanction and reputation mechanisms).

Current and future work:

- Conceiving and modelling generic Contract templates for dynamic instantiation through negotiation. Specification of Electronic Contracts representing Virtual Organization/Enterprise settings is being pursued. The current model considers a simplified scenario where partners commit to a certain cooperation effort consisting on the supply of a given resource.
- We are also studying now, the interfaces between contracts and inter-organizational workflow definitions, in order to expand contract monitoring further to the shop-floor level.

Electronic Institution Platform *Research goals:To deliver a web-based Electronic Institution comprising services assisting agents interaction in the Virtual Enterprise life-cycle. More specifically, the Electronic Institution should provide services such as negotiation mediation, ontology mapping, contract drafting, contract monitoring and enforcement, and reputation indexes.* Recent work (2005):

- The implemented services of the Electronic Institution have migrated to the JADE framework. A model of the institutional services was developed, taking into account the Electronic Institution platform as a whole.
- Ontology-based services have been implemented and tested over some simplified scenarios.
- A first experiment was made in the field of contract drafting, using contract templates for establishing the outcome of the negotiation stage.
- Contract monitoring and enforcement services have been implemented using the JESS shell.
- A theoretical model of "institutional reality" (based on J.Searl ideas) was developed, taking into account the notions of roles, institutional facts, rules and norms.
- The study on how to specify distributed inter-organizations workflow was started.

Current and future work:

- The integration of the outcome of the negotiation process with the process of creating apropriate electronic contracts, suitable for monitoring purposes, is already in progress.
- The integration of contract monitoring and enforcement services with the overall Electronic Institution platform is also in progress.
- The negotiation protocol that leads to the formation of the Virtual Organization is being revised in order to improve the distributed dependencies resolution process.
- The integration of ontology-based services with the negotiation mediation service is still missing and it is also one of our future concerns.
- We intend to use inter-organizational workflow methodology in the Virtual Organization operation and monitoring stage. A software layer including Interfaces to, and Re-planning capabilities for, VE partners production control systems will be defined.
- We intend to start to define a suitable scenario for the exploitation of the Electronic Institutions services.

- We intend to study, for further implemention, learning models for institutional norms as well as for contracts' definition.

2.1.2.2 Agents' Adaptation, Learning and Emotions

Luís Nunes, Luís Sarmento, Daniel Moura, Eugénio Oliveira, Rui Camacho, Alexessander Alves
Coordinator:Eugénio Oliveira
Research direction: Agents' intelligent processes mostly rely on learning capabilities and sophisticated architectures. Through this research line we aim at studying both multi-agent learning and emotion-like features driven architectures
(i) Agents and Multi-agent learning. The main goal of this research issue is to find an answer to the following question: "(How) can several different, heterogeneous, Learning Agents improve their performance by exchanging information during their own learning process?". We have started research in the development of computational learning methods in bioinformatics.

(ii) Emotion-based agents' architecture. Through this research issue we would like to answer another important question: "Will it be possible to escape from usual utility-based decision functions, by using emotion-like features, in what decision-making for autonomous agents is concerned?"

Multi-Agent Learning *Research goal:* (How) can several different Learning Agents improve their performance by exchanging information during their own learning process?". That is the main question.

Recent work (2005):

- We have recently published several studies on the effects of communication during learning in teams of agents that use different learning algorithms. These studies were based in experiments in different scenarios: the Predator-Prey domain, a Traffic Control simulation based on real data and a Load-Balance simulation.
- During the above mentioned studies we have identified several weaknesses of the process, proposed and tested new solutions. The weaknesses are mainly related to the synchronization of information exchange in a team and to the integration of advice from peers using different learning algorithms. A PhD thesis on this subject was submitted in the course of 2005.
- Through collaboration with experts in Finland and Russia we have been involved on research for dimensionality reduction methods on datasets with very low cardinality applied to the problem of protein folding recognition. Also, we are doing predictive analysis of gene expression data for cancer diagnosis using a new feature selection method.

Current and future work:

- Having in mind the conclusions drawn from previous research we intend to pursue research on learning from multiple sources in an attempt to contribute to the creation of an autonomous learning agent situated in a multi-agent environment. This learning agent should be able to identify sources of information and integrate different types of data concerning a problem in the process of generating a solution. Ideally it should also be able to tune its learning parameters to improve its learning performance.
- We also intend to develop our collaboration with other teams abroad, on studying and developing methods for the Automatic Generation of Ensembles of Nearest Neighbour Classifiers for High-Accuracy Real-World Applications. We intend to apply this new methodology in the diagnosis and prognosis of cancer from gene expression data and intelligent image compression algorithms.
- A new research item is now beginning, involving cooperation with the laboratory of cytology and molecular biology of Porto in developing a computational learning methodology for the problem of multi-sequence comparison applied to the study of mutually exclusive exons.

Emotion-like based Agents *Research goals:The second main question to be answered is: Will it be possible to escape from usual utility-based decision functions, by using emotion-like features, in what decision-making for autonomous agents is concerned?*

Recent work:

- While our past work in this area mainly concerned the refinement of basic concepts of the emotion-based agent architecture, the work in 2005 was now focused on providing a more appropriate formalization of the architecture. We have thus proposed an extension to the BDI architecture capable of supporting Artificial Emotions, named Emotional-BDI Architecture. This architecture is original in the sense that is designed to extend the BDI architecture with explicit representation of two important concepts that are related to emotional processing: Capabilities and Resources. This is achieved while trying to keeping the same logic formalisms already in place for the BDI architecture. The Emotion-BDI Architecture was introduced in (Pereira et al., 2005).
- We were also concerned with the implementation of a tactical model to coordinate a small team of emotion-based agents (here, agents are fire fighters that try to control a forest fire). In the present model, there are two coordination levels: team coordination and local coordination. Team coordination is about positioning the team in the terrain and assigning high-level tasks to fire fighting agents. Local coordination is necessary to carry out these high-level tasks effectively. Local coordination is achieved by perception and predefined rules.

Current and future work:

- Future work will include the implementation of Emotion-BDI Agents in the Pyrosim Environment developed before (Sarmento et al). Pyrosim is a fire-forest simulator environment, which simulates a very dynamic and real-time environment. We also aim at the development of verification procedures to validate the proposed agent architecture.
- We are now conducting experiments to determine which tactics are better for a given fire. We possibly will apply machine-learning algorithms to the experimental results to try to discover rules for tactic selection. Another interesting approach is to use feedback from the agents emotional mechanism to make tactical decisions (e.g. change tactic, escape, call for reinforcements, etc).

2.1.2.3 Multi-Agent Coordination, Simulation and Cooperative Robotics

Luís Paulo Reis, António Manuel Pereira, Francisco Reinaldo, Carlos Alberto Leão, Luis Mota, Pedro Miguel Faria, Paulo Cardoso.
Coordinator:Luís Paulo Reis
Research direction: Coordinating teams of autonomous (or semi-autonomous) agents that perform in rich, dynamic, both cooperative and adversarial environments is a major aim of this work line. For this objective, we are exploring several research directions that can be seen as complementary: new coordination protocols; methodologies for analyzing team behavior; implementation of agent-based common framework suitable for controlling teams of cooperative robots for robosoccer; design of realistic multi-agent simulators (Coastal Ecosystems Simulator) ; generalization to other domains.

Multi-Agent Simulation *Research goal: We aim at developing a complete multi-agent system for performing ecological realistic simulation, including: an ecological simulator, a graphical visualizer, a Calibration Agent based on learning techniques capable of calibrating complex ecological models and autonomous agents representing the intelligent entities present in the simulation. The system will be applied to ecological models of coastal ecosystems and used for aquaculture optimization.*

Recent work (2005):

- We started the development of EcoDynamo, a Realistic ecological simulation software.
- We developed a calibrated model for agent-based simulation of Ria Formosa in Algarve.
- Work has been done to define ECOLANG, a language to describe ecological systems (Pereira et al., 2005).
- We developed a first version of our Calibration Agent for ecological simulations.

Current and future work:

- We intend to pursue the refinement of EcoDynamo simulation software.
- We will develop a graphical visualizer for ecological simulations;
- Introduction of machine learning techniques in the Calibration Agent;
- Development of Aquaculture Agents capable of cultivating bivalves in the coastal ecosystem with intelligent seeding, inspecting and harvesting capabilities.

Coordination of Heterogeneous Teams in Search and Rescue Scenarios *Research goals: We intend to develop methodologies enabling to build a competitive simulation Rescue RoboCup Team. For this, several different problems must be addressed, including: agent architecture, basic skills, decision mechanisms, path planning capabilities, communication protocols, cooperation protocols, global strategy, etc. We also aim at developing a RoboCup Rescue team with innovative coordination methodologies and that is able to integrate learning techniques in its reasoning procedures. The coordination methodologies will be adaptations and extensions of previously researched coordination framework coming from our experience in FC Portugal team of RoboCup Soccer Simulation League*

Recent work:

- Development of an agent architecture and low-level skills for rescue agents.
- Development of a team strategy model for search and rescue operation.
- Development of FC Portugal Rescue 2005 team.
- Development of FCPx tool for high-level evaluation of rescue teams strategies.
- Participation in RoboCup Rescue.

Current and future work:

- Integration of learning methodologies in rescue agents by using our FCPx tool to gather simulation data enabling performance evaluation of different team strategies.
- Adaptation of coordination methodologies from our FC Portugal soccer team to the search and rescue domain.
- Creation of a general communication language for search and rescue operations enabling agents built by different universities to participate in the same rescue operation.
- Participation in RoboCup 2006 (Bremen, Germany, June 2006).

2.1.2.4 Text Mining and Agent-based Systems applications

Luis Sarmento, J.L.Pinto, N. Sousa, S.Rocha, G.Pereira, A. Castro, H. Marques, E. Oliveira,

Coordinator:Eugénio Oliveira

Research direction:In 2005 we have started a new line of research related to Natural Language processing and Text Mining. This work includes a partnership with the Linguateca Project. Moreover we also aim at applying agent and multi-agent architectures, negotiation protocols and learning algorithms to specific application domains

Natural Language Processing and Text Mining *Research goal:We intend to build up algorithms to mine very large Data Bases of portuguese text. This implies the possibility to search for specific patterns in a 1000 million words of portuguese text*

Recent work (2005):

- we developed BACO (Base de Co-Ocorrências), a large database of text and co-occurrences. BACO was build by means of pre-processing and storing the text from the WPT03 collection of Web documents in Portuguese, making it extremely easy to search more than 1000 million words of text. The database is optimized for searching word co-occurrence data, which is extremely useful in word disambiguation and knowledge extraction tasks. BACO will also provide the basis for several statistic-driven language processing tasks and text-based analogy reasoning.

Current and future work:

- In 2006 we will put our efforts on the development of semantic analysis tools, namely for named-entity recognition and for terminology extraction. We will also focus on the development of similarity measures and algorithms for text-based analogy reasoning, which is the strategy that we will be following for developing large-scale and robust semantic analysis for Portuguese language.

A Multi-Agent System for Intelligent Monitoring of Airline Operations *Research goals: We intend to specify and implement a multi-agent system for monitoring of airline operations, including intelligent crew, aircraft and passenger problems recovery.*

Recent work (2005):

- A Multi-Agent System deals with different operational bases and all bases cooperate to find the solutions to the local problems. Robustness is a key feature and we achieve that through redundancy in finding the possible solutions to the problem, using agents that compete in finding for the best solution to be applied.
- To be an Intelligent System some kind of learning must be available. We are using learning to define the crew members profile, to learn the use of stand by crew members and include this learning in future crew scheduling and in suggesting new solutions based on previous decisions.
- To explore the possibility of having a kind of electronic market for available crew members/aircrafts among airline companies, to be used in crew and aircraft recovery. This would work as a market of solutions to specific local problems and these solutions would compete with the recommended local solutions.

Current and future work (2006):

- A master thesis is being produced.
- To specify and implement a prototype that will evaluate the hypothesis made over relevant scenarios.

4-legged robotic surveillance- "Smart Guardian" *Research goals:The main goal of the Smart Guardian project is to create an Agent that makes use of Learning techniques when patrolling and detecting intruders in a dynamic environment.*

Recent work (2005):

- The work, at this stage, has been to map the AIBO robot's surroundings using its sensors; to define the basic architecture that enables the robot to be suficiently curious to investigate parts of the world that are unknown to it and to move to locations pointed out by the user. We are using Tekkotsu framework (developed at CMU) a C++ layer on top of OPEN-R that

provides a greater abstraction over the low level details of the robot. TheRobot Interface has been abstracted to a common model, allowing adapting to other robots with minimal changes.

- A BDI Agent Architecture that is adapted for Real-Time to control the Robot, has been designed and implemented.

Current and future work (2006):

- World Model Updating Algorithm Implementation for the 4-legged robot.
- To develop a Path Planning algorithm which uses the dynamically built Model of the environment.
- To Build a realistic Simulator for the Robot locomotion in the environment.

Agent-based Electrical Energy e-Market *Research goals:To design a secure platform to enable trusted encounters between agents representing energy costumers and suppliers in an Electronic Market. Current European efforts for the establishment of both de-regulated Electrical Energy Markets and Electronic Commerce platforms can be brought together through appropriate multi-agent platforms enabling autonomous agents interaction for automatic trading.* Recent work (2005):

- In the specification of the multi-agent system encompassing the needed functionalities for the Electrical Energy e-market, we have until now emphasising security procedures, accountability of the communications, good performance and software portability. Also, integration with legacy systems has been privileged. In our Electricity E-Market, agents authenticate through digital certificates, while messages between the market operator and the market agents are digitally signed. We have selected the TLS/SSl protocol and, as for the message digital signatures is concerned, the open standards are being used. They rely on classical MAC and cryptography algorithms used in SSL. Market operator is seen as a trusted third partner, responsible for registration, auctions and matching bids and offers.

Current and future work (2006):

- To apply and integrate all those developed algorithms in a single platform for an Energy market auction-based simulation

Multi-Agent System for Web searching *Research & Development goals: We are designing a multi-agent system which tries to capitalize from different agents parallel Web searching tasks to enhance the overall system performance on finding relevant web pages for specific users.* Recent work (2005):

- Multi-Agent System Architecture for parallel Web search has been specified and implemented.
- Different Web pages text analysis algorithms (such as TFIDF) have been implemented and compared.
- algorithms for users' profiling will be implemented.

Current and future work (2006):

- The final Agent-based Information Retrieval System will be implemented and evaluated. We are hoping that final results will show significant improvments on searching for relevant information when compared to traditional web searchers.

2.1.3 Ongoing projects

A. AgentLink III

This project is funded by the European Union IST Programme and supports an international network of excellence for Agent Based Computing. It follows AgentLink I and II existing for the last 6 years.

Project title: AgentLink III
Effort at LIACC: 1 man year
Funding entity: EU (IST)

Funding for LIACC: covers travelling and short stays expenses
Total award period covered: from September 2003
Coordinator at LIACC: Eugénio Oliveira
Prime contractor: University of Southampton
Other partners include, IIIA/Barcelona, Technical University of Munich, University of York, OFAI (Vienna),Queen Mary Westfield College/University of London, University of Paris VI, University of Neuchatel, Imag/Grenoble and many others.

Partners were grouped in different Special Interest Groups and NIAD&R - LIACC belongs to two different SIGs: Agent-Mediated Electronic Commerce (AMEC) and Adaptive and Learning Agents (ALAD).

Recent work:

- Our activity in AgentLink is directly related with our research on: Agents Negotiation protocol models
  - We have presented and discussed, an agent-mediated platform for Virtual Enterprise formation (ForEV)(Ana Paula Rocha).
  - We also are contributing for designing specific policies for representing enterprise/products knowledge, through appropriate ontologies useful for both the VE formation and the monitoring process. This work is the subject of a PhD thesis (A.Malucelli).
  - We have participate in a meeting, promoted by partners from Barcelona, explaning our ideas on the Normative Environment for an Electronic Institution. (E. Oliveira).
  - As a result of the challenge presented by an industrial representative at one of the AMEC SIG's sessions, we have specified and developed our approach to the E-brokering services for the Insurance domain.

Current and future work

Our main objectives in this project are:

- To formalize the concept of Electronic Institutions, including several different kinds of services and incorporating laws and rules to be enforced on any agent-mediated electronic market. We are also interesed in specify the requirements for, formalise the concept of and explore the knowlege included in an Electronic Contract. An Electronic Contract has to be automatically built to substantiate the VE partners agreement reched during previous negotiaion stage.
- To generalize the concept of Electronic Institution for controlling and monitoring Distributed workflows,through all the available secure, robust and transparent procedures for interaction.
- Two PhD theses are being pursued in this context (A. Maluceli, H.Cardoso).
- We are also involved in another SIG (ALAD) by exchanging our research results on Multi-Agent learning.

B.Electronic Institution including Electronic Contracting for Virtual Organizations (Instituição Electrónica incluindo Contratação Automática para Organizações Virtuais)

Project Title: POSI/EIA/57672/2004
Duration: 24 months (May 2005 - April 2007)
Funding Entity: FCT/POSI
Funding: 40 000 EUR
Coordinator at LIACC: Eugénio Oliveira
LIACC Research Team: Ana Paula Rocha, Henrique Lopes Cardoso, Rui Neves, Paulo Leitão, Eugénio Oliveira
Partners:LIACC - University of Porto; Escola Superior de Tecnologia e de Gestão de Bragança; CentralCasa, Desenvolvimento de projectos de Domótica, Lda

This project aims at developing a software framework - an Electronic Institution - where agents representing different enterprises can interact in a regulated fashion. The concept of an Electronic Institution is related to real-world institutions that define the norms and rules of the society, regulating the activity of its individuals. We intend to specify and implement a normative framework that imposes such governance to computational agents, including general norms and rules, as well as those directly related to contractual activities. Within this normative layer, a representation formalism for contracts will be devised, allowing contracts to be validated and their execution to be verified. Together with these regulations, institutional services assisting contractual activities are of primary importance, specifically devoted to the creation and operation of Virtual Organizations. These services include negotiation mediation, contract templates, ontologies, and contract validation, monitoring and enforcement. The execution of contracts that formalize cooperative business operations imposes some concerns in which the integration of different workflows is concerned. Therefore, in this project we also intend, as a complementary task, to address the interdependencies between inter-organizational workflow enactment and contract specification and execution monitoring.

Recent work (2005):

- Development of a framework, based on the JADE platform for enterprise agents creation. item Inclusion in the framework of adaptive negotiation protocols for agents' interaction.
- First prototype of Ontology services agent.
- A Representation formalism for norms and contracts has been defined.

Current and future work

- Complete Formalization of a VO Contract representation language. item Definition of Services for Contract execution monitoring and enforcement. item Modeling of an Inter-organizational workflow management module. item First preliminary simplified scenario description.

C. ABSES - Agent Based Simulation of Ecological Systems

Project Title: FCT/POSC/EIA/57671/2004
Duration: 30 months (Apr 2005 - Oct 2007)
Funding Entity: FCT/POSC
Funding: 75000 EUR
Coordinator at LIACC: Luís Paulo Reis
LIACC Research Team: Luís Paulo Reis, António Pereira, Francisco Reinaldo, Tiago Fonseca
Partners: CEMAS - University Fernando Pessoa

ABSES project aims at developing a complete multi-agent system for performing ecological realistic simulation, including: an ecological simulator, a graphical visualizer, a Calibration Agent based on learning techniques capable of calibrating complex ecological models and autonomous agents representing the intelligent entities present in the simulation. The system will be applied to ecological models of coastal ecosystems and used for aquaculture optimization. Specific objectives include:

- Creation of calibrated models for different coastal ecosystems enabling it s realistic simulation;
- Implementation of a user-friendly agent-based coastal ecosystems simulation software;
- Construction of an automatic model calibration agent based on machine learning techniques;
- Implementation of an on- line visualizer for ecological simulations;
- Construction of agents with learning and negotiation capabilities for representing humans present in the ecological simulations;

Recent work (2005):

- EcoDynamo - Realistic ecological simulation software;
- Calibrated model of Ria Formosa - Algarve, Portugal;
- ECOLANG - A language to describe ecological systems (Pereira et al., 2005);
- First version of our Calibration Agent for ecological simulations.

Current and future work

- Refinement of EcoDynamo simulation software;
- Development of a graphical visualizer for ecological simulations;
- Introduction of machine learning techniques in the Calibration Agent;
- Development of Aquaculture Agents capable of cultivating bivalves in the coastal ecosystem with intelligent seeding, inspecting and harvesting capabilities

D. Control Startegies Characterization for Heterogeneous MAS

Project Title: GRICES/CAPES PROJECT
Duration: 2 years (March 2005- March 2007)
Funding Entity: Bi-lateral (Brasil/Portugal) GRICES (Portugal) / CAPES (Brasil)
Funding: Missions.
Coordinator at LIACC: Eugénio Oliveira
LIACC Research Team: Rosaldo Rossetti, Joaquim Canhoto, Luis Nunes, Eugénio Oliveira
Partners: UFRGS, Porto Alegre, Brasil (Prof. Ana Bazzan)
The aim of the project is to extract good control strategies emerging from heterogeneous multi-agent interaction. The application domain is Traffic Controlfor metropolitan regions and, therefore, it implies the joint study of multi-agent systems interoperability and Intelligent Transportation Control Systems. Software Agents controlling traffic in a simulator are evaluated through other higher level specialist agents. These specialists try to induce successful both local and global control strategies to be applied further on in traffic control.

The project specific objectives are:

- Definition of a model for a MASTTERLab software (Laboratory for MAS-based Traffic and Transportation Engineering Research).
- Modeling and implementation of a traffic simulator for agent-base traffic control
- specification of different types of agents for traffic control
- Definition of when, what and how agents should communicate at the simulation level
- Definition of Learning Agents capable of inferring control strategies from the lower level available data.
- Enforcing new strategies on the scenario and evaluating them.

Recent work (2005):

- First meetings between brasilien and portuguese partners for mutual understanding of the project objectives (Ana Bazzan came to Porto and Rosaldo Rossetti to Porto Alegre).
- Tentative implementation and use of different traffic control simulators (SUMO,own).

Current and future work

- Make available a suitable agent-base traffic control simulator.
- Building up different algorithms for traffic control agents and make them cooperate.
- Modelling different vehicles behavior in the simulating scenario
- Specifying learning agents to deal with control results at a lower level.

E. RESCUE: Coordination of Heterogeneous Teams in Search and Rescue Scenarios

Project Title: FCT/POSC/EIA/63240/2004
Duration: 24 months (May 2005 - Apr 2007)
Funding Entity: FCT/POSC
Funding: 32800 EUR
Coordinator at LIACC: Luís Paulo Reis
LIACC Research Team: Luís Paulo Reis, Francisco Reinaldo, João Certo, Nuno Cordeiro
Partners: IEETA - University of Aveiro

This project is exactly intended to develop methodologies enabling to build a Simulation RoboCup Rescue Team. For this, several different problems must be addressed, including: agent architecture, basic skills, decision mechanisms, path planning capabilities, communication protocols, cooperation protocols, global strategy, etc. The Project also aims at developing a RoboCup Rescue team with innovative coordination methodologies and that is able to integrate learning techniques in its reasoning procedures. The coordination methodologies will be adaptations and extensions of previously researched coordination framework coming from our experience in FC Portugal team of RoboCup Soccer Simulation League (world champion in RoboCup 2000). The project specific objectives are:

- Definition of a team strategy for search and rescue tasks including sub strategies for fire brigades, ambulance teams and police forces;
- Definition of a hierarchical agent architecture for rescue agents including learning, communication and advanced coordination capabilities;
- Implementation of communication, coordination and supervision methodologies in agent teams accomplishing complex tasks in dynamic environment s;
- Development of a tool for automatic team strategy evaluation enabling to gather high-level information from Rescue simulations;
- Integration of learning methodologies to improve agents performance;
- Participation in RoboCup Rescue Osaka2005 and Bremen2006 international competitions.

Recent work (2005):

- Development of an agent architecture and low-level skills for rescue agents;
- Development of a team strategy model for search and rescue operation;
- Development of FC Portugal Rescue 2005 team (¡http://www.fe.up.pt/ rescue¿);
- Development of FCPx tool for high-level evaluation of rescue teams strategies (¡http://www.fe.up.pt/ rescue/FCPx¿);
- Participation in RoboCup Rescue

Current and future work

- Integration of learning methodologies in rescue agents by using our FCPx tool to gather simulation data enabling performance evaluation of different team strategies;
- Adaptation of coordination methodologies from our FC Portugal soccer team to the search and rescue domain;
- Creation of a general communication language for search and rescue operations enabling agents built by different universities to participate in the same rescue operation.
- Participation in RoboCup 2006 (Bremen, Germany, June 2006).

2.1.4 Cooperation

Bi-lateral Actions

1. Universidade Federal do Rio Grande do Sul, Porto Alegre, Brasil. Research Project, Seminar, visit under the GRICES-CAPES Program (R. Rossetti). Pof. Ana Bazzan.
2. Sobolev Institute of Mathematics of the Russian Academy of Sciences, Novosibirsk. European project.

Scientific Research Networks and Organizations

- AgentLink III

Links with foreign institutions

- University of York, United Kingdom, Dr. Daniel Kudenko.
- Imperial College- University of London, Prof. Abe Mamdani.
- Université de Technologie de Compiègne, France, Prof. Jean Paul Barthès.
- DFKI – German Artificial Intelligence Research Center, Saarbrücken, Dr. Klaus Fischer.
- Humboldt Universitat Berlin, Institut fur Informatik,Prof. Hans Dieter-Burkhard.
- University of Utrecht, Dr. Virginia Dignum
- École National des Mines de Saint-Étienne, France, Dr. Olivier Boissier.
- University of Trier, Germany, Dr. Norbert Kuhn.
- Information Processing Laboratory of the Oulu University, Finland.
- Sobolev Institute of Mathematics of the Russian Academy of Sciences, Novosibirsk.
- Universidade Federal do Rio Grande do Sul, Prof. Ana Bazzan.
- Universidad Autónoma de Yucatán, Merida, México, Prof. Luis A. M. Ubando.
- The Centre for Biomedical Engineering, University College of London, Dr. Stephen Taylor.
- City College, University of London, Dr. Eduardo Alonso.
- Czech Tecnical University, Prague, Professor Vladimir Marik
- International Institute for Artificial Intelligence, Spain, Dr. Carles Sierra.
- Universidade Católica de Curitiba, Brasil, Dr. Marcus Shmeil.
- Centro Universitário do Leste de Minas Gerais - UnilesteMG, Coronel Fabriciano, Minas Gerias, Brasil, Prof. Antonio Machado Filho

There have been training and post-graduation relations with:

- Universidade Católica de Curitiba, Brasil, Professor Marcos Shmeil. (Andreia Malucelli)
- Humboldt Universitat Berlin, Institut fur Informatik,Prof. Hans Dieter-Burkhard. (Luis Mota).
- The Centre for Biomedical Engineering, University College of London, Dr. Stephen Taylor.
- University of Trier, Germany, Dr. Norbert Kuhn.
- Universidade Federal do Rio Grande do Sul, Prof. Ana Bazzan.

Links with national institutions

- FCT- Fundação para a Ciência e a Tecnologia.
- IEETA- Universidade de Aveiro. Prof. Nuno Lau.
- FCT- Universidade Nova de Lisboa. Prof. Steiger Garção.
- IST- Universidade Técnica de Lisboa. Prof. Ana Paiva.
- FCUL- Faculdade de Ciências da Universidade de Lisboa. Prof. Helder Coelho.
- ISCTE- Instituto Superior de Ciências do Trabalho e da Empresa, Lisboa. Dr. Luis Nunes.
- CEMAS - Universidade Fernando Pessoa, Prof. Pedro Duarte.
- IPB- Escola Superior de Tecnologia e Gestão, Instituto Politécnico de Bragança. (Prof. Paulo Leitão).
- INESC Porto - Prof. Augusto de Sousa.
- CEREM - Universidade Fernando Pessoa, Prof. Nuno Ribeiro.
- TAP- Transportes Aéreos Portuguêses, Lisboa. (

There has been collaboration in post-graduation actions with:

- ISCTE- Instituto Superior de Ciências do Trabalho e da Empresa, Lisboa. Dr. Luis Nunes.
- IEETA- Universidade de Aveiro. Prof. Nuno Lau.(Pedro Faria - PhD, Carlos Leão - PhD, Darya Barteneva - MSc).
- CEMAS - Universidade Fernando Pessoa, Prof. Pedro Duarte (António Pereira - PhD).
- INESC Porto - Prof. Augusto de Sousa, Prof. Manuel Matos (Pedro Moreira - PhD, JLPinto - MSc).).
- CEREM - Universidade Fernando Pessoa, Prof. Nuno Ribeiro (Paulo Cardoso -MSc).
- TAP- Transportes Aéreos Portuguêses, Lisboa. (António Castro- MSc)
- Instituto Politécnico de Viana do Castelo.(Daniel Moura- MSc).