A. Program

1. Subject, justification and Motivation

Research in robotics has traditionally emphasized low-level sensing and control tasks, path planning, and actuator design and control. In contrast, several Artificial Intelligence researchers are more concerned with providing real/simulated robots with higher-level cognitive functions that enable them to reason, act and perceive in an autonomous way in dynamic, inaccessible, continuous and non deterministic environments. Combining results from traditional robotics with those from AI and cognitive science will be thus essential for the future of intelligent robotics, showing the increased importance of informatics and computer science research on this area.

The purpose of Intelligent Robotics in MAP-I is to prepare researchers in the application of Artificial Intelligence (AI) techniques in real/simulated robotics. The discipline will also promote discussion on several other specific topics:

- **Intelligent Systems and Devices:** What are the differences on applying intelligent systems to computer systems and robotic systems;
- **The Internet of Things and the Future Internet of Robotic Things**;
- **Simulated vs. Real Robotics:** How to bridge the gap between simulation and real robots and machines?
- **Robotics and Computer Science Competitions** as a mean to promote scientific progress;
- **Social Robots:** Will machines be our partners in the future and how?
- **Machine Learning for Robotics:** Are current machine learning approaches adequate for the future physical systems (robots)?
- **Why is Google taking over robotics research in the last two years?**

These topics will be the subject of invited talks by known researchers with vast experience in organizing/participating in national/international real or simulated robotic competitions and on migrating approaches tested on simulators to real robotic platforms.

The discipline will also emphasize cooperative robotics and application in a domain where the proponents are known as lead world researchers: RoboCup – Robotic Soccer. In the last fifteen years RoboCup has increasingly become as a testbed for research in cooperative/intelligent robotics and multi-agent systems. Teams from the best companies and universities in the world compete in nine major leagues, including seven cooperative leagues. The research developed during the development of FC Portugal robosoccer teams, that regularly compete in four of these leagues (2D Simulation, 3D Simulation, Rescue and Legged League), conducted the Universities of Aveiro, Porto and Minho to win three RoboCup world championships and eight European championships in different leagues. The research focus was on the development of a formal model for the concept of strategy, for a team of heterogeneous agents, in a competition and generic coordination and communication mechanisms, general enough for other cooperative tasks. These are research topics that are still unexplored in intelligent/cooperative robotics and may easily lead to worldwide recognized PhD thesis as the number of PhD students supervised by this proposal proponents, including several international students, clearly indicates.

There are several similar teaching projects in other universities. However, the focus, teaching methods and learning outcomes are different. The proposed teaching project, compared with other competitors,
benefits from the availability of robotic platforms, internationally recognized base codes and simulators, previously developed by the proponents, very useful for fulfilling the goals of the teaching project.

Briefly mentioning similar projects, the course “CSCI 854 - Control and Learning in Mobile Robots and Multi-Robot Systems” from the University of Southern California, which gives credits the PhD program (IS track), follows a similar approach emphasizing the robotic agent architectures (reactive, hybrid, behavior-based), Navigation and Cooperation between Robots, it also includes Human-Robot Interaction issues, which are not included in this proposal. The course “82778 CIS 6930 - Introduction to AI Robotics” taught by Prof. Robin Murphy at the University of South Florida, includes a graduation section, and is focused on the relation between AI and Robotics, the Biological Inspirations of robotics, Sensing, Navigation, Planning and Multi-Agent Systems, the approach is similar to the current proposal, only the focus as been changed in some aspects from the biological inspirations issue to the development of robotic teams, while this proposal follows different high-level approaches to the development of this type of teams. There is also a course at the University of Lund, Department of Computer Science, Postgraduate Studies named “DAT125/EDA135 - Artificial Intelligence for Robots” with a very similar approach as the one proposed in this document but, again limited by the unavailability of the above-mentioned platforms, base codes and simulators.

2. Objectives

Intelligent robotics course main objectives are:

- To understand the basic concepts of Robotics and the context of Artificial Intelligence in Robotics.
- To study methods of perception and sensorial interpretation (emphasizing computer vision), which allow to create precise world models and mobile robots’ control methods.
- To study the methods which allow mobile robots to navigate in familiar or unfamiliar environments using Planning and Navigation algorithms.
- To study the fundamentals of cooperative robotics and of the robots teams construction.
- To analyze the main national and international robotic competitions, the more realistic robot simulators and the more advanced robotic platforms available in the market (emphasizing the robots NAO and KUKA LWR)

3. Learning Outcomes

A successful learner from this discipline will be able to:

- Acquire knowledge of current state and trends in intelligent robotics and practical knowledge from programming real/simulated robots;
- Demonstrate an understanding of main challenges of the discipline and be enabled to select appropriate techniques to solve them;
- Have a broad critical understanding of how Artificial Intelligence may be applied generally to intelligent and cooperative robotics;
- Appreciate the problems associated with programming and controlling simulated/real robotic platforms with different perception and action capabilities;
- Understand the challenges behind cooperative robotics and the construction of robotic teams that operate in dynamic, inaccessible, non-deterministic environments;
- Reference the sources used in their work in the context of intelligent robotics, being aware of the best projects/research works in this area around the world. Students must use accurately the standard referencing styles within the text of all written work for all sources used.
4. Detailed Program

1. Introduction
   1.1) Artificial Intelligence
   1.2) Basic concepts of Robotics
   1.3) Artificial Intelligence in Robotics
   1.4) History, Evolution, and Current Trends in Intelligent Robotics

2. Architectures for Robotic Agents
   2.1) Reactive, Deliberative, Hybrid
   2.2) Belief, Desire and Intentions (BDI)
   2.3) Cooperative Architectures

3. Perception and Sensorial Interpretation
   3.1) Proximity sensors: Sonar or ultrasonic, infrared (IR), touch, light and feel sensors
   3.2) Computer Vision: Cameras, Digital Image, Colour Models, Image Processing, Image Analysis
   3.3) Odometry, Rotation and Compass Sensors
   3.4) Sensor Fusion Techniques

4. Localization and Mapping
   4.1) Creation, Representation and Updating of World States.
   4.2) Markov and Gaussian Localization
   4.3) Grid and Monte-Carlo Localization
   4.4) Mapping: Occupancy Grid and SLAM
   4.5) World Exploration

   5.1) Gears, Speed, Torque
   5.2) Robot locomotion simulation

6. Plan Automatic Generation:
   6.1) Means-Ends Analysis, Linear, non-linear, hierarchic and partially oriented planning
   6.2) Planning and Learning: Plan generality

7. Navigation
   7.1) Algorithms of navigation in known/unknown environments
   7.2) Voronoi Diagrams
   7.3) A* and D* Algorithms
   7.4) Cellular Decomposition

8. Cooperative Robotics
   8.1) Introduction to the cooperation between robots for teamwork
   8.2) Joint Intentions, TAEMS, Role-Based, Social Rules
   8.3) Communication and Mutual Modeling
   8.4) Locker-Room, Strategical Coordination, Partial Hierarchical
   8.5) Swarm Robotics

9. Applications
   9.1) National and International Robotic Competitions: RoboCup, RoboOlympics, Fira Cup, DARPA Grand-Challenge, Portuguese Robotics Open, Autonomous driving, Micro-Mouse (Micro-Rato) and fire fighting Robots; European Robotics Challenges; Amazon Picking Challenge
   9.2) Robotic simulators: Soccerserver 2D and 3D, RoboCup Rescue, Virtual Rescue, Ciber-Mouse, Gazebo, USARSim
9.3) Robotic Platforms: ROS; MindStorms, NAO, Bioloid, ERS210A e ERS-7 (Sony Aibos), JACO arm, KUKA LWR, KUKA OmniRob: Hardware, Software Architectures and Robotic Programming Languages.

5. Teaching Methods

Main teaching techniques will be focused on:

- Challenging students to higher level learning as is appropriate in a PhD program of this type. Of course low level learning, i.e., comprehending and remembering basic information and concepts is important. However emphasis of intelligent robotics will be on problem solving, decision making, critical thinking/design, and creative thinking/design.

- Use active learning such as the use of simulators and real robotic platforms. Exposition will be made mostly with interaction in theoretical classes. Some learning will of course be passive, i.e., listening and reading. However, high level learning requires active learning and thus the use of appropriate material/platforms/simulators. Thus the discipline will use simulators for mobile robots navigation (“ciber-mouse”, “soccerserver”) and cooperative robotics (“robosoccer” and “robocup rescue”). It will also use humanoid platforms (DARwIn-OP, Nao, Bioloid, Robonova) and mobile robotic platforms (KUKA miiwa, ERS210A e ERS7 –Sony AIBOs) available at our labs and appropriate software for high-level programming of robots: ROS, OPEN-R SDK (ERS210A e ERS7), FC Portugal base code for Soccer-Server (2D e 3D) and RoboCup Rescue.

- Structured sequence of different learning activities (lectures, demonstrations, reading, analysis, writing, oral presentations, design, experimentation, among others). Learning activities structured in a sequence such that they enable opening classes and assignments about basic principles to lay the foundation for complex and high level learning tasks in later, complex classes and assignments.

- Detailed feedback given to students about the quality of their research work and learning process. High level, active learning require, more than any type of learning, frequent and immediate feedback for students to know whether they are "doing it correctly!".

This high-level teaching method will enable student not only to increase their skills in researching about intelligent robotics but also in all other areas related to informatics and computer science.

Some of the exercises with simulators and real robots will be supported by documentation that will be produced specifically for this course.

6. Evaluation System

This is a research discipline, intended first to teach the students the state of the art in intelligent robotics, and then to help them to do a simple project and a paper of publishable quality in an international conference about this subject. There will be a significant amount of reading/analysis of quality research papers that will be handed out. The evaluation of students will be based on:

- Analysis of a selected scientific paper about intelligent robotics;
- Oral presentation of a selected new trend on intelligent robotics;
- Practical Project with demonstration, oral defence and production of a publishable scientific paper.

7. Bibliography

B. Teaching Staff

1. Summary

Teaching staff is responsible by a leading world Project – FC Portugal – that won 3 World and 8 European RoboCup – Robotic soccer championships. The team also supervised more than 20 PhD students concluded, including several international PhD students attracted by the international visibility of the team research in robotics and of the RoboCup project. The team has been and is involved in several national and international robotic research and technology transfer projects. More than one hundred and fifty papers about intelligent robotics and intelligent simulation have been published, by teaching staff members, in the previous fifteen years.

2. Resumed CVs

Luís Paulo Reis

Name: Luís Paulo Gonçalves dos Reis

Place and Date of Birth: Cedofeita, Porto, October, 15th of 1970

Address: University of Minho, School of Engineering, Universidade do Minho, Campos de Azurém 4800-058

Phone: +351919455251

E-Mail: lpreis@dsi.uminho.pt

Academic Degrees:

- Phd, Sep 2003, Eng. Electrotécnica e de Computadores, FEUP, Artificial Intelligence (MAS)
- MSc, Dec 1995, Eng. Electrotécnica e de Computadores, FEUP, Industrial Informatics (Very Good), 18.3 Val (out of 20)
• Licenciatura (5 Year BSc), Jul 1993, Eng. Electrotécnica e de Computadores, FEUP, Informatics and Systems, 18 Val (out of 20)

**Present Position:**

• Associate Professor (Professor Associado) at University of Minho, since Sep 2011
• Researcher at LIACC - Artificial Intelligence and Computer Science Lab., since Dec 1995
• Member of the Directive Board of LIACC, since Oct 2007
• Collaborator of Centro ALGORITMI, INESC-TEC and IEETA since 2011/2012
• Director of LIACC, since May 2016

**Past Positions:**

• Professor Auxiliar at FEUP-DEI, Apr 2006 – Set 2011
• Professor Auxiliar Convidado at FEUP, Oct 2003 – Apr 2006
• Assistente Convidado at FEUP, Dec 2001 – Feb 2004
• Mestre Assistente Convidado at Univ. Fernando Pessoa – Porto, Oct 2001 – Sep 2002

**Pedagogical and Divulgation Activities:**

• Disciplines: Logic Programming, Artificial Intelligence, Robotics, Intelligent Robotics, Intelligent Agents, Planning and Scheduling Methodologies, Database Laboratory, Basic Informatics, Computational and Communication Systems, Alg. And Data Structures, Programming 2, Simulation, among 15 others. Pedagogical classifications over: 4.0 Val (out of 5.0) in almost all disciplines (T, TP e P).
• PhD Programs Disciplines: Intelligent Robotics (MAP-I), Planning and Scheduling Methodologies (PRODEI-FEUP), Robotics (PRODEI-FEUP), Advanced Methodologies for Simulation and Modeling (PRODEI-FEUP adapted also to MAP-I by other member of the team)
• Participation in more than 40 divulgation actions at FEUP and UMinho (including Feira de Ciência e Tecnologia, Mostras de Ciência, Ensino e Inovação da UP, Exposição Ciência e Robótica – Arrábida Shopping, Semanas Abertas da FEUP and Talks in Superior/Secondary Schools).

**PhD/Postdoctoral Supervising:**

• 6 Postdoctoral researchers supervised.

**MSc Supervising Supervising**

• 96 MSc Thesis supervised concluded.

**Research Interests:**

• Artificial Intelligence (Multi-Agent Systems, Intelligent Agents, Coordination in Multi-Agent Systems, Simulation, Intelligent Robotics, Robotic Soccer, Constraint Logic Programming).

**Main Research Projects:**


• **Intellwheels - INTELLWHEELS - Intelligent Wheelchair with Flexible Multimodal Interface** (FCT/PTDC/EIA-CRO/98664/2008, 94500 EUR, Principal Researcher),

• **ERAS - Expeditious Reconstruction of Virtual Cultural Heritage Sites** (FCT - PTDC/EIA-EIA/114868/2009, begin in Jan 2011, Coordinator in FEUP/LIACC

• **FP7 EuRoC: European Robotics Challenges, 2014**, funding of aprox:500k Eur.

• **QVida+: Estimação Continua de Qualidade de Vida para Auxilio Eficaz à Decisão Clinica / QLife+: Continuous Quality of Life Estimation for effective Clinical Decision Support**, Portugal 2020, Inv. Principal UMinho, Funding 680k Eur

**Main Organization of International Scientific Meetings:**


**Publications and Communications:**

- More than 250 Papers indexed at SCOPUS.


**Program/Scientific Committee in Conferences:**


- Main Program Committees: RoboCup TC (2001-2003), Bal.Rea.Soc.Del.MAS01 (LNAI vol.2103), WAF01 (Madrid, Sp), MASTA01 (Porto, PT), CeNPLf (04-07), Robotica (04-09, Porto, Coimbra, Guim., Algarve, Aveiro, C.Branco), RoboCup04 Int. Symp. (Lisbon, PT), Têkhne – Rev.Est.Polit. (2004-...), AAMAS05 (Utrecht, Ne), MASTA05 (Covilhã, PT), IROBOT05 (Covilhã, PT), RoboCup06 Int. Symp. (Bremen, Ge), CISTI06-09 (PT, ES), IBERAMIA/SBIA06 (Rib.Preto, Brazil), AAMAS06 (Hakodate, Jp), VIImage07

Principal Awards and Prizes:

- 2016, 3rd Place RoboCup 2016 - 3D Simulation League, Leipzig, Germany, RoboCup Federation
- 2015, Best Paper ICAART2015 - 7th International Conference on Agents and Artificial Intelligence, INSTIIC
- 2015, 3rd Place RoboCup 2015 - 3D Simulation League, China, RoboCup Federation
- 2015, Winner at EuroRoboCup 2015 - Simulation League 3D – Humanoids, Magdeburg, Germany – RoboCup Federation
- 2015, Best Paper IEEE/ICARSC2015 - 15th International Conf. on Mobile Robots and Competitions, SPR
- 2015, 2nd Place on the Computer Diplomacy Challenge 2015, Int. Computer Games Association (DipBlue),
- 2014, Winner of EuroRoboCup 2014 - Simulation League 3D – Humanoids, Magdeburg, Germany – RoboCup Federation
- 2014, Winner of Scientific/Free Challenge, RoboCup 2014 - Simulation League 3D – Humanoids, João Pessoa, Brazil – RoboCup Federation
- 2014, 2nd Place at the World Computer Poker Competition (AAAI, Kuhn Track), AAAI, August 2014
- 2013, 3rd Place RoboCup 2013 - 3D Simulation League, Eindhoven, Holland, RoboCup Federation
- 2013, 1st Place RoboCup 2013 – Scientific Challenge Simulation2D, Eindhoven, Holland, RoboCup Fed.
- 2013, Best Paper IEEE/ICARSC2013 - 13th International Conf. on Mobile Robots and Competitions, SPR
- 2013, 1st Place EuroRoboCup 2013 - 3D Simulation League, Magdeburg, Germany, RoboCup Federation
- 2012, Honor Mention Prémio Jaime Filipe - Intellwheels Project, INRr
- 2012, 1st Place EuroRoboCup 2012 - 3D Simulation League, Eindhoven, Holland, RoboCup Federation
- 2012, 2nd Place EuroRoboCup 2012 - Rescue Simulation League, Eindhoven, Holland, RoboCup Federation
- 2012, 3rd Place EuroRoboCup 2012 - 2D Simulation League, Eindhoven, Holland, RoboCup Federation
- 2011, 2nd Place Award “Ser Capaz” - Associação Salvador - Intellwheels Project, Associação Salvador
- 2011, Galardão da Inclusão / Inclusion Award - Applied Research - Intellwheels Project, CRID/IPL
- 2011, 2nd Place EuroRoboCup 2011 - 2D Simulation League, Magdeburg, Germany, RoboCup Federation
- 2011, 2nd Place EuroRoboCup 2011 - 3D Simulation League (Humanoids), Magdeburg, Germany
- 2011, 2nd Place at FreeBots 2011 Competition, Robótica 2011- Intellwheels Project, SPR
- 2011, Best Paper Robótica 2011 - 11th International Conference on Mobile Robots and Competitions, SPR
- 2010, 3rd Place EuroRoboCup 2010 - 3D Simulation League (Humanoids), Magdeburg, Germany,
- 2010, 3rd Place EuroRoboCup 2010 - 2D Simulation League, Magdeburg, Germany
- 2010, Best Paper ICEIS 2010 - 12th ICEIS (Area: Human-Computer Interaction), INSTIIC
- 2009, 3rd Place EuroRoboCup 2009 - 2D Simulation League, Hannover, Alemanha , RoboCup Federation
- 2009, 3rd Place EuroRoboCup 2009 - 3D Simulation League, Hannover, Alemanha , RoboCup Federation
- 2008, Prémio de Incentivo Pedagógico/Pedagogical Award, FEUP - Faculdade de Engenharia da Universidade do Porto (course: Robotics - MIEIC)
- 2007, 2nd Place in PV-League - Physical Visualization (RoboCup), RoboCup Federation
- 2007, European Championship (German Open) 2nd Place RoboCup 2D Simulation Competition
- 2007, European Championship (German Open) Winner RoboCup 3D Simulation Competition
2006 Winner of RoboCup 2006, Bremen (FC Portugal - Simulation 3D League), RoboCup Federation
2006 European Championship (Roboludens) 2nd Place RoboCup 2D Simulation Competitio,
2006 European Championship (Roboludens) Winner RoboCup 3D Simulation Competitio,
2006 European Championship (Roboludens) Winner RoboCup Rescue - Simulation, RoboCup Federation
2005 Winner of the Portuguese Robotics Open (FC Portugal - Simulation League)
2004 Winner of the Portuguese Robotics Open (FC Portus - Legged League)
2004 Winner of the Portuguese Robotics Open (FC Portugal - Simulation League)
2004 2nd Place in the Coach Competition of RoboCup 2004 (FC Portugal), Lisbon, RoboCup Federation
2002, 2nd Place in Ciber-Rato 2002 Contest, Universidade de Aveiro
2003, 2nd Place in the Coach Competition of RoboCup 2003 (FC Portugal), Padova, RoboCup Federation
2002, Winner of the Coach Competition of RoboCup 2002 (FC Portugal), Fukuoka, RoboCup Federation
2001, 3rd Place in RoboCup 2001, Seattle (FC Portugal - Simulation League), RoboCup Federation
2001, Winner of German Open 2001 - Robotic Soccer (5dpo - Small-Size League), Paderborn
2001, Winner of German Open 2001 - Robotic Soccer (FC Portugal - Simulation League), Paderborn
2001, Winner of Ciber-Rato 2001 Contest, Universidade de Aveiro
2000, Winner of RoboCup 2000, Melbourne (FC Portugal - Simulation League)
2000, Winner of Euro RoboCup 2000, Amsterdam (FC Portugal - Simulation League)
1999, 2nd Place in Micro-Rato 1999 Contest, Universidade de Aveiro
1999, Innovation Award/Prémio Inovação of Micro-Rato 1999, Universidade de Aveiro
1996, Century Award/Prémio Centenário of the Faculty of Engeneering, FEUP
1994, National Engineering Prize/Prémio Nacional de Engenharia, Ordem dos Engenheiros
1994, Engenheiro António Almeida Award, Fundaçao Eng. António Almeida
1994, APRP Award – Associação Portuguesa de Reconhecimento de Padrões, APRP

Selected Publications:

- Luis Mota, Luis Paulo Reis and Nuno Lau, *Multi-Robot Coordination using Setplays in the Middle-size and Simulation Leagues*, Mechatronics, Elsevier, Vol. 21, Issue 2, pp. 434-444, March 2011, ISSN: 0957-4158, DOI: 10.1016/j.mechatronics.2010.05.005 (ISI-JCR, IF: 0.94; SCIImago Q2)
Veterans Affairs, USA, Vol. 48, Issue 9, pp. 1061-1076, December 2011, ISSN: 0748-7711, DOI:10.1682/JRRD.2010.08.0139 (ISI-JCR, IF: 1.71; SCImago Q1)


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**Nuno Lau**

**Name:** José Nuno Panelas Nunes Lau  
**Place and Date of Birth:** Porto, November 28, 1970  
**Address:** Universidade de Aveiro – DETI, Campo de Santiago, 3810-193 Aveiro, Portugal  
**Phone:** +351 234 370524  
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**Homepage:** http://www.ieeta.pt/~lau

**Academic Degrees:**  
- PhD, Dec 2003, Electrical Engineering, Universidade de Aveiro  
- DEA, Set 1994, Biomedical Engineering, Université Claude Bernard – Lyon I  

**Present Position:**  
- Assistant Professor, Aveiro University, since Dec 2003  
- Researcher at IEETA, Intelligent Robotics and Systems (IRIS), since 2015
• Principal Investigator of the Intelligent Robotics and Systems (IRIS) research group at IEETA, since 2015

Past Positions:
• Researcher of IEETA, Transversal Activity on Intelligent Robotics (ATRI), 1999-2014
• Assistant Researcher, Aveiro University, 1995-2003
• Stagiary Assistant, Aveiro University, 1994-1995
• Monitor, FEUP, 1991-1993
• INESC-Aveiro researcher, 1994-1999

Teaching courses:
• Porto University: Programming I, Programming II
• MAP-I: Intelligent Robotics

Supervising experience:
• 11 PhD, Aveiro University (7), Porto University (2), UTAD (1) (6 concluded, 5 ongoing)
• 29 MSc, Aveiro University (22 finished, 2 ongoing), Porto University (5 finished)
• 16 Final Year Projects, 8 in the area of Robotics, Electrical Engineering and Computer Science graduations, Aveiro University, co-supervisor
• 2 Final Year Projects in the area of Robotics, Porto University, co-supervisor
• 9 Research Scholarships, 7 FCT, 2 IEETA

Area of Scientific Activity:
• Intelligent Robotics, Coordination of Multi-Agent Systems, Reconfigurable Systems

Research Projects:
• POSI/ROBO/43908/2002 - CAMBADA - Cooperative and Autonomous Robots with Advanced Distributed Architecture (research team member)
• POSI/CHS/43140/2001 - Confibest - Methods and Models for Problem Oriented Reconfigurable Systems
• PTDC/EIA/70695/2006 - ACORD - Adaptative Coordination of Robotic Teams (member or research team)
• FCT RIPD/ADA/109636/2009 - INTELLWHEELS - Intelligent Wheelchair with Flexible Multimodal Interface, 2010-2012 (coordinator at Aveiro University)
• QREN/ADI - LUL - Living Usability Lab, 2010-2012 (member of research team)
• QREN PRODUTECH PSI, 2010-2014 (member of the research team)
• QREN PRODUTECH PTI, 2010-2014 (coordinator at Aveiro)
• QREN Cloud Thinking, 2013-2015 (coordinator of WP5)
• FP7 EuRoC: European Robotics Challenges, 2014- (challenger team leader), funding Univ. Aveiro of aprox:500k Eur.

Organization of Scientific Meetings:
- Micro-Mouse Robot Contest, Aveiro University, member of Organizing Committee, 2001-2006
- 5th Inter-University Programming Marathon, member of Technical Organizing Committee, Out 2005
- 1st Inter-University Programming Contest, member of Scientific Committee, Mar 2005.
- IROBOT’2005 – 1st International Workshop on Intelligent Robotics, EPIA – Portuguese Conference on Artificial Intelligence, Covilhã, member of Organizing Committee, 5 Dez 2005
- CiberMouse@RTSS2006 Robotic, Cyber Robotic Competition at Real-Time Systems Symposium, Rio de Janeiro, Brazil, 2006
- CiberMouse@RTSS2007, Cyber Robotic Competition at Real-Time Systems Symposium, Tucson, USA, 2007
- CiberMouse@RTSS2008, Cyber Robotic Competition at Real-Time Systems Symposium, Barcelona, Spain, 2008
- CyberRescue@RTSS2009, Cyber Robotic Competition at Real-Time Systems Symposium, Washington DC, USA, 2009
- IROBOT’2017 – 8th International Thematic Track on Intelligent Robotics, held at EPIA’2017 – Portuguese Conference on Artificial Intelligence, Porto, Portugal, September, 2017

Publications and Communications:
- 1 Thesis, 15 international journal papers, 20 book chapters/series, 20 national journal papers, more than 130 papers in conference proceedings

Program/Scientific Committee in Conferences:

Reviewer in Journals / other conferences:

Principal Awards and Prizes:
• 3rd Place RoboCup 2016 - 3D Simulation League, Leipzig, Germany, RoboCup Federation
• 3rd Place RoboCup 2016 - MSL League, Leipzig, Germany, RoboCup Fed., 2014
• 3rd Place RoboCup 2015 - 3D Simulation League, China, RoboCup Federation
• Winner at EuroRoboCup 2015 - Simulation League 3D – Humanoids, Magdeburg, Germany – RoboCup Federation
• Best Paper IEEE/ICARSC2015 - 15th International Conf. on Mobile Robots and Competitions, SPR
• Winner of EuroRoboCup 2014 - Simulation League 3D – Humanoids, Magdeburg, Germany – RoboCup Federation
• Winner of Portuguese Robotics Open 2014 - Simulation League 3D – Humanoids, Robótica 2014 – Festival Nacional Robótica, SPR
• 2014, Winner of Scientific/Free Challenge, RoboCup 2014 - Simulation League 3D – Humanoids, João Pessoa, Brazil – RoboCup Federation
• 3rd Place RoboCup 2014 - MSL League, João Pessoa, Brazil, RoboCup Fed., 2014
• 3rd Place RoboCup 2013 - 3D Simulation League, Eindhoven, Holland, RoboCup Fed., 2013
• 1st Place RoboCup 2013 – Scientific Challenge Simulation2D, Eindhoven, Holland, RoboCup Fed., 2013
• 1st Place RoboCup 2013 – Scientific Challenge Simulation3D, Eindhoven, Holland, RoboCup Fed., 2013
• Best Paper Robótica 2013 - 13th International Conference on Mobile Robots and Competitions, SPR, 2013
• 1st Place EuroRoboCup 2013 - 3D Simulation League, Magdeburg, Germany, RoboCup Federation, 2013
• Winner of RoboCup Dutch Open 2012 Simulation 3D League, RoboCup Federation, Eindhoven, 2012
• Winner of Portuguese Robotics Open 2012 MSL League, Festival Nacional de Robótica, Guimarães, 2012
• Best Paper Award, 11th International Conference on Mobile Robots and Competitions, Robotica 2011, Lisboa, 2011
• 2nd Place in RoboCup German Open 2011, 3D Simulation League, RoboCup Federation, Magdeburg, Germany, 2011
• 2nd Place in RoboCup German Open 2011, 2D Simulation League, RoboCup Federation, Magdeburg, Germany, 2011
• 3rd Place in RoboCup World Championship 2010, MSL League, RoboCup Federation, Singapore, 2010
• 2nd Place in RoboCup German Open 2010, MSL League, RoboCup Federation, Magdeburg, Germany, 2010
• 2nd Place in RoboCup German Open 2010, 2D Simulation League, RoboCup Federation, Magdeburg, Germany, 2010
• 2nd Place in RoboCup German Open 2010, 2D Simulation League, RoboCup Federation, Magdeburg, Germany, 2010
• Winner of Portuguese Robotics Open 2010 MSL League, Festival Nacional de Robótica, Leiria, 2010
• 3rd Place in RoboCup World Championship 2009, MSL League, RoboCup Federation, Graz, Austria, 2009
• Winner of Portuguese Robotics Open 2009 MSL League, Festival Nacional de Robótica, Castelo Branco, 2009
• Winner of RoboCup 2008 MSL League, Robot World Cup Soccer Games and Conferences, RoboCup Federation, China, 2008
• Winner of Portuguese Robotics Open 2008 MSL League, Festival Nacional de Robótica, Aveiro, 2008
• 2nd Place in RoboCup World Championship 2007, PV-League (Mixed Reality League), RoboCup Federation, Atlanta, USA, 2007
• Winner of RoboCup German Open 2007, 3D Simulation League, RoboCup Federation, Hannover, Germany, 2007
• Winner of RoboCup World Championship 2006, 3D Simulation League, RoboCup Federation, Bremen, Germany, 2006
• Winner of RoboCup Dutch Open 3D Simulation League RoboCup Federation, Eindhoven, Holland, 2006
• Winner of RoboCup Dutch Open Rescue Simulation League RoboCup Federation, Eindhoven, Holland, 2006
• 2nd in Coach Competition Simulation League at 8th RoboCup International Competitions and Conferences, RoboCup Federation, Lisbon, 2004
• 2nd in Coach Competition Simulation League at The 7th RoboCup Int. Competitions and Conferences, RoboCup Federation, Pisa, 2003
• Winner of Coach Competition Simulation League at The 6th RoboCup Int. Competitions. and Conferences, RoboCup Federation, 2002
• Winner of RoboCup German Open 2001, Simulation League, RoboCup Federation, 2001
• 3rd Place in Simulation League at The Fifth Robot World Cup Soccer Games and Conferences, RoboCup Federation, 2001
• Winner of Simulation League, The Fourth Robot World Cup Soccer Games and Conferences, RoboCup Federation, Seattle, 2000
• Winner of EuRobocup 2000 Simulation League RoboCup Federation, Amsterdam, 2000
• Innovation Prize at Micro-Mouse Contest, Aveiro, 1999
• Best paper at RECPAD 94, Associação Portuguesa de Reconhecimento de Padrões, 1994

Selected publications:


• Nima Shafii, Luis Paulo Reis and Nuno Lau, “Biped Walking using Coronal and Sagittal Movements based on Truncated Fourier Series”, RoboCup 2010: Robot Soccer World Cup XIV, LNCS, Springer, June 25, 2010


• João Figueiredo, Nuno Lau, Artur Pereira, “Multi-agent Debugging and Monitoring Framework”, 1st IFAC Workshop on Multivehicle Systems (MVS’06), Bahia Convention Center, Salvador, Brazil, October 2 – 3, 2006

• Luís Paulo Reis, Nuno Lau, Francisco Reinaldo, Nuno Cordeiro and João Certo. “FC Portugal: Development and Evaluation of a New RoboCup Rescue Team”. 1st IFAC Workshop on Multivehicle Systems (MVS’06), Bahia Convention Center, Salvador, Brazil, October 2 – 3, 2006


• Francisco Reinaldo, João Certo, Nuno Cordeiro, Luís P. Reis, Rui Camacho, Nuno Lau, “Applying Biological Paradigms to Emerge Behaviour in RoboCup Rescue Team”, Actas do 1st Workshop on Intelligent Robotics – IROBOT’05, Springer, 2005


Luis Paulo Reis and Nuno Lau, “FC Portugal Team Description: RoboCup 2000 Simulation League Champion”, RoboCup-2000: Robot Soccer World Cup IV, Peter Stone, Tucker Balch and Gerhard Kraetzschmar editors, LNAI 2019, págs. 29-40, Springer Verlag, Berlim, 2001


Edited by Peter Stone, with Minoru Asada (humanoid), Tucker Balch (workshop), Raffaelo D'Andrea (Cornell team), Masahiro Fujita (legged), Bernhard Hengst (UNSW team), Gerhard Kraetzschmar (mid-size), Pedro Lima (engineering challenge), Nuno Lau (FC Portugal team), Henrik Lund (RoboCup Jr.), Daniel Polani (scientific challenge), Paul Scerri (simulation), Satoshi Tadokoro (rescue), Thilo Weigel (CS Freiburg team), and Gordon Wyeth (small-size), “RoboCup-2000: The Fourth Robotic Soccer World Championships”, AI Magazine, Vol. 22, nº1, págs. 11-38, Spring, 2001

Detailed CV:  More detailed CV at: http://www.ieeta.pt/~lau

Armando Sousa

Name:  Armando Jorge Miranda de Sousa

Place and Date of Birth:  Porto, February 1971

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Academic Degrees:

- PhD, July 2004, Eng. Electrotécnica e de Computadores, FEUP – Unanimity
- MSc, Dec 1997, Eng. Electrotécnica e de Computadores, FEUP, Industrial Informatics - Very Good)
- Licenciatura (5 Year BSc), Jul 1994, Eng. Electrotécnica e de Computadores, FEUP, Automation, Control and Instrumentation

Present Position:

- Professor Auxiliar at FEUP, since July 2004, up to present
- Researcher at INESCTEC – “CROB” Center for Robotics and Intelligent Systems – since 2007

Past Positions:

- Researcher at ISR – Automation Group – since 1993
- Invited Professor at UTAD – year 2000
- Lecturer at FEUP since 1997
- Lecturer at ISEP year 1996/7

Pedagogical and Divulgation Activities:

- 2009/10 up to present - Professor of Robotics and Intelligent Robotics for MIEIC (MsC. program) and ProDEI (doctoral program)
• Professor of several other Automation, Control, Systems and Computational Intelligent Courses
• 2009/10 up to present - General Coordinator for Reception of new students at FEUP (about 1000 students/year)
• 2009/10 up to present - General Coordinator for “Projeto FEUP” cross-program course
• Group member for the integration of new students at UP
• Participation in many more than 20 divulgation actions on behalf of FEUP, INESCPorto and ISR-P (including demonstrations, faculty and university open days, science fairs, other activities and invited presentations)
• Invited Jury for over 25 MScs and PhDs in and out of University of Porto
• Regular Member of Scientific Panel/Program committee of over 15 conferences and 2 journals

Experience in Supervision:
• 1 Phd student supervised to completion and currently Supervising 3 PhDs – please refer to detailed CV for details
• 37 MSc Thesis (plus 6 ongoing) – please refer to detailed CV for details

Research Interests:
• Robotics and Automation
• Information Fusion, Vision Systems,
• Intelligent Systems and Intelligent Robotics,
• Robotic Soccer
• Education

Research Projects:
• PEC 137 – Robôs em movimento –Ciência Viva, 2013
• MEDIS - A Methodology for the Formation of Highly Qualified Engineers at Masters Level in the Design and Development of Advanced Industrial Informatics Systems 544490-TEMPUS-1-2013-1-ES-TEMPUS-JPCR 2013
• Vincere - Ciências e engenharia em português: video e interação 122015 Engenharia - video e interação 2013
• BESTCase – RL4 - Cooperation and perception for augmented autonomy NORTE-07-0124-FEDER-000060 BESTCASE-RL4 – 2013 -
• RobVigil - “Robot Vigilância”, Projeto QREN, InescTec, 2011/12 - SI IDT - 7905/2010
• Portus - "Common Framework for Cooperation in Mobile Robotics"
• ACORD - "Adaptative Coordination of Robotic Teams”
• CleanRob – "Autonomous Cleaning Robot" (DEEC/FEUP, ISR-P) – 2004 (ongoing), Principal Researcher: Armando Sousa, projecto DEEC/FEUP/ISR-P
• SoftCore Robot – “FPGA based versatile Robot” – IPG 44 UP – July 2007 to July 2008, Principal Investigator: Armando Sousa

Publications and Communications:
- 2 Thesis, 8 Book Chapters, 5 Papers in Peer Reviewed Journals, 62 Papers in International Conferences

**Principal Awards and Prizes:**

- 2015 Prémio de excelência pedagógica da Universidade do Porto
- 2009 Pedagogic award of FEUP
- 2006 Mundial RoboCup, Bremen, Alemanha - F180: 2º Classificado;
- 2006 "Dutch Open", Eindhoven, Holanda: F180: Vencedor; F2000: 5º Lugar (2º lugar no “desafio” desta liga)
- 2005 "German Open", Paderborn, Alemanha: F2000: Quartos de Final;
- 2004 Mundial, Lisboa, Portugal: F180: 5º Classificado e F2000
- 2004 "German Open", Paderborn, Alemanha: F180: 2º Classificado;
- 2003 Mundial, Pádua, Itália: F180: 5º Classificado e F2000: 14º Classificado
- 2003 "German Open" Paderborn, Alemanha: F180: 2º Classificado e F2000: 3º Classificado
- 2002 "German Open", Paderborn, Alemanha: F180: 2º Classificado e F2000: 5º Classificado
- 2001 Mundial, Seattle, EUA: F180: 6º Classificado
- 2000 "Open Europeu", Amsterdão, Holanda – F180 e F2000

**Some Relevant Publications:**

- Luís Cruz, Luis Paulo Reis, Nuno Lau, Armando Sousa "Optimization Approach for the Development of Humanoid Robots' Behaviors" – Advances in Artificial Intelligence – IBERAMIA 2012 - (Book Chapter) Lecture Notes in Computer Science Volume 7637, 2012, pp 491-500; DOI:/978-3-642-34654-5_50
- André Carvalhosa, Pedro Machado, Armando Sousa, José Carlos Alves, "Soft Core Robot with Joint Wheel Motion Controller" – IECON 2009 - The 35th Annual Conference of the IEEE Industrial Electronics Society, 3-5 November 2009, Porto, Portugal, pp. 3168-3173

Detailed CV: More details at: fe.up.pt/asousa and http://orcid.org/0000-0002-0317-4714