Four Decades of AI in Portugal

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The emergence of AI in Portugal results from the contact between Lus Moniz Pereira and Helder Coelho in the *Centro de Estudos de Ciberntica* (center for studies in cybernetics) created in the Instituto Superior Tcnico (IST), now a school of Universidade de Lisboa. They then moved to *Laboratrio Nacional de Engenharia Civil* (national lab of civil engineering) in the early 70's where early work in AI was initiated, together with Fernando Pereira (currently research director at Google). Some of this work included problem solving and reasoning using logic programming (Coe82). They pursued their PhD degrees abroad (Lus Moniz Pereira at Brunel University, London, and Helder Coelho and Fernando Pereira at University of Edinburgh), as most of the Portuguese researchers of their generation. This early connection with Universities abroad contributed to a continued high degree of internationalization of the AI research in Portugal.

The association representing the Portuguese AI community is APPIA (Associao Portuguesa Para a Inteligłncia Artificial), founded in July 31st, 1984, with currently 620 active members. Four of its members have been awarded the ECCAI fellowship (Lus Moniz Pereira in 2001, Helder Coelho in 2002, Pavel Brazdil in 2008, and Jos Jlio Alferes in 2012). The APPIA's main scientific event is a biennial international conference, the EPIA (Portuguese Conference on Artificial Intelligence, Encontro Portugułs de Inteligłncia Artificial). The first edition of EPIA was in 1985 in Oporto. Since then, the conference has grown from around 50 submissions at its launch to 150--200 submissions in recent years, with an acceptance rate of about 30% (e.g., (PMaAC15)).

Most of the funding comes from public sources, as technology transfer is not widespread across Portuguese industry. However, there is a large amount of technology-based companies, e.g., university spin-offs, most of them founded by people coming from the academia. Public funding sources include both European projects and National projects, managed by the *Fundao para a Ciłncia e a Tecnologia* (FCT), the national funding agency for science and technology. About a decade ago FCT initiated a set of international partnerships connecting Portuguese and North American universities, namely the MIT - Portugal, the Carnegie Mellon - Portugal, the UT-Austin Portugal, and the Harvard Medical School - Portugal. These partnerships have contributed to further deepen the internationalization level of the Portuguese research community.

Current topics

The Portuguese AI research community covers a broad range of topics, with strong connections with the industry, as well as other disciplines, such as the social sciences, biology, neurosciences, robotics, linguistics, and mathematics. This article aims at providing a (unavoidably incomplete) brief survey of some of these topics.

CENTRIA was the first AI research center in Portugal. Founded by one of the pioneers of AI in Portugal, Luis Moniz Pereira, have been centering their research on using logic methods for knowledge representation and reasoning. They have performed foundational research on logic programming. Recently, besides advancing the state of the art in logic-based reasoning, they have studied related topics such as ethics, morality, and tolerance in the context of AI (PS16).

Helder Coelho, one of the other pioneers of the AI in Portugal, has done not only relevant contributions to several AI areas, including foundational issues, distributed AI, and its applications to biology, education, and economy. He as also has contributed significantly to the dissemination of AI in Portugal, not only to the scientific community but also to the general public (Coe99). He has also authored 35 books of different kinds, including for dissemination, education, and of scientific character.

Emerging from the GIS group at IST, the SISCOG company, founded in 1986, is a company providing AI solutions to costumers. In the 90's they developed a solution for train crew scheduling that as implemented in the Dutch Railways (MM98), having received a IAAI award in 1997. Ever since, they have been focusing on

providing innovative solutions to the transportation industry. Their success have been acknowledged, e.g., by the AAAI Innovative Application Award in 1997.

In 1988 the LIACC research center was founded in Porto, focusing on multi-agent systems, machine learning, data mining, and meta learning, among other areas. One of the founders was Pavel Brazdil, one of the ECCAI fellowship holders. This research center, which is now integrated in INESC-TEC, has done relevant contributions in the above mentioned areas (RLO00; BSDC03).

The GAIPS group of INESC-ID in Lisbon has been very active in the area of intelligent agents, namely in the area of synthetic characters, serious games, and affective computing (PP09; DP05). One of their applications has been featured in the EXPO'98 international exhibition in Lisbon. They have been involved in many European projects, holding strong ties with many international partners. They have extended their area of research out from purely virtual agents towards real physical robots. For instance, a empathic social robot, based on the iCat platform, for playing chess with kids, which they have evaluated in a series of long-term experiments. Recently, they have extended their areas of interest to reinforcement learning in the context of social agents.

Also from INESC-ID, the SAT group lead by Joo Marques-Silva and Inłs Lynce has produced extensive research in the area if boolean satisfiability (including MaxSAT problems). The well-known GRASP solver have been pioneered by Joo Marques-Silva (MSS99). In the mean time they have contributed to the state of the art on efficient SAT solvers (LMS05), as well as their applications, namely in the area of computational biology (LMS06).

With strong connections to robotics, the IEETA research center, based in Aveiro, has targeted a broad range of areas, namely biomedical informatics, intelligent robots, and information systems. It should be noted that they have been quite successful in the international RoboCup scientific events, as CAMBADA team, having achieved top ranks in several leagues (LLC+11).

Estela Bicho, from the University of Minho, has been involved in many European projects focusing on the problem of cognitive robotics. She has done relevant contributions in this area, in particular exploring the usage of dynamical systems and dynamical neural field theories (BMS00).

Research in AI at ISR/IST, one of the research centers of IST, University of Lisbon, holds strong connections with the fields of robotics and systems/control theory. They was a partner in the European project RobotCub from which the well-known iCub humanoid robot was developed, and has participated in many subsequent projects with a strong component on cognitive robotics (MLBSV08). They have participated in RoboCup events since the second edition of the RoboCup in 1998. This involvement included not only the participation in robot soccer, robot rescue, and @home leagues, but also in the organization of RoboCup 2004 in Lisbon. Their research includes decision-theoretic methods under uncertainty, multi-robot systems, cognitive robotics, and emotion-based agents (SL09; CVPF99). They hold strong connections with other disciplines, namely neurosciences, philosophy, and linguistics.

Conclusions

This article has provided a brief summary of some of the current research activity in AI in Portugal. There is a strong, internationally connected, research community that have been growing since the early 70's. The community have been developing research crossing the borders towards other disciplines, including robotics, cognitive science, linguistics, philosophy, among others. Some of this research has found its way to the industry, leading to successful companies. Still, the vast majority of the AI research community is supported by public funding, at both national and European level.

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