



Call for a Post-Doctoral Research Fellowship in Deep Learning and AI for Perception, Identification and Control on Biomimetic Oculomotor Systems

Institute for Systems and Robotics / Instituto Superior Técnico - Lisboa, Portugal

The Computer and Robot Vision Lab of the ISR @ IST in Lisbon will open applications for a **2 year post-doc research fellowship** on Deep Learning and AI for Perception, Identification and Control of Biomimetic Oculomotor Systems. Starting date: a.s.a.p.

This fellowship is proposed in the context of a collaboration within the ERC project ORIENT, of Prof. John van Opstal from the Radboud University at Nijmegen, The Netherlands. One of the goals of the project is to study the principles underlying the gaze reorienting performance of the human visual system in dynamic scenarios. A biomimetic oculomotor robot system and simulators have been developed following the main biomechanical properties of the human analogue. We want to explore how novel Deep-Learning Techniques can help in modelling the human brain control of such a complex and high dimensional system. Deep-Learning methods will be used for object detection in foveal images, dynamical system identification, and optimal (reinforcement learning based) control. More details about the project can be found in the following link: http://www.mbfys.ru.nl/~johnvo/OrientWeb/orient_1.html

The ideal candidate should **hold a PhD degree** on Electrical, Computer, Mechanics, Aerospace, Biomedical or Physics Engineering. **We seek someone with** a background in **systems modelling and control, artificial intelligence, computer vision, and machine learning.**

The position comes with a net salary depending on candidate experience, starting at 1600€ (**12 months per year.** Note: the cost of living in Lisbon is 70% of that in Brussels). Depending on the work achievements, **the fellowship can be renewed for the duration of the project.** The work will be supervised by Prof. Alexandre Bernardino at IST in close collaboration with Prof. John van Opstal.

Interested candidates should express their interest by sending the following documents as soon as possible to alex@isr.tecnico.ulisboa.pt
[Subject line: Orient2020]:

- (1) Cover letter (max 1 page)
- (2) CV
- (3) Certificate of academic degree with grades.
- (4) Name and contact of two referees.

About the research goals of the fellowship:

An important goal of the ORIENT project (“Goal-Directed Eye-Head Coordination in Dynamic Multisensory Environments”) is the use of a biomimetic robotic oculomotor system (head/eye/vestibular/auditory) to study oculomotor control on humans and robots. Humans are extremely fast and efficient in relocating their gaze direction to different points in the visual field through saccadic eye movements. However, current robots are still unable to achieve similar performances. This project aims to bring robots closer to the human performance by exploiting modern control theory, computer vision, and machine-learning algorithms, all applied to a novel tendon-driven biomechanical system, which was designed according to the kinematics of the human eye. Simultaneously, we will uncover the neural mechanisms that biological systems may use to control complex motor systems with redundant degrees of freedom.

The work consists of the development of **oculomotor kinematics and dynamics control systems, following biomimetic principles on a realistic mechanical model of the human visual-motor system**, as well as the co-supervision of PhD and MSc students working on the project. The work will be supervised by Prof. Alexandre Bernardino at ISR/IST in close collaboration with Prof. John van Opstal.

About the host institution ISR/IST:

IST is the largest and most reputed school of engineering, science and technology in Portugal, with long tradition in teaching, and excellence in research, innovation and training activities. Since its creation in 1911, IST's mission is to contribute to the development of science, economy and society by promoting a higher degree of education in the areas of Science, Engineering and Technology at the undergraduate and graduate levels, and by delivering highly qualified professionals in the public and private sector, strengthening the National and European R&D effort.

The ISR-Lisboa (Institute for Systems and Robotics) is the research institute of IST involved in multidisciplinary research activities in the areas of Mobile Autonomous Robotics (Land, Underwater and Space autonomous vehicles), Computer and Robot Vision, Automation and Control, Dynamic Systems, Signal and Image Processing, Communications, Biomedical Engineering, Evolutionary Systems, Artificial Intelligence, Manufacturing Systems and Aeronautics. ISR-Lisboa is home to nearly 150 researchers (including approximately 50 faculty members and postdoctoral researchers). The ISR-Lisboa team involved in this project has a solid expertise in the areas of vision-based control, active vision, computer vision and vision-based navigation, and hosts several humanoid robotic platforms (including an iCub). It has been involved in major EU projects like CAVIAR, MIRROR, CONTACT, ROBOTCUB, FIRST-MM, HANDLE, ROBOSOM, POETICON++ and URUS.

About Lisbon:

Lisbon, with a population of about one million inhabitants (2 million in the metropolitan area), is the capital, the chief port and the largest city of Portugal. It stands on the westernmost point of land of the European continent, where the Tagus river flows into the Atlantic Ocean. Its climate is probably the mildest of all European capitals. Lisbon is one of the most ancient cities in the western Europe. Probably inhabited since the Neolithic period, it was settled by Phoenicians in 1200 BC, who named it Alis Ubbo (calm port). They prospered for more than 600 years until it was occupied by Greeks and Carthaginians, then by the Romans in 205 BC, by the Barbarians in the 5th century AC, by the Arabs in 715 AC, till it was finally conquered by D. Afonso Henriques during the Crusades in 1147, and declared capital of the Portuguese kingdom in 1252. The city name evolved with each new occupant until its present form Lisboa. In the 15th and 16th centuries, the Age of the Discoveries, Lisbon became the center of the world and the entrance of Europe to the Oceans. Being already an important city when conquered in 1147, it continued growing its importance. In 1260 the King Afonso III transferred his court there from Coimbra. The University of Lisbon was founded in 1292. It is perhaps this long history of finding new lands and cultures that explain why Lisboans are, by nature and tradition, open to the new and very welcoming to visitors.