Four PhD positions in Health-oriented Movement Sciences & Data Sciences in the south of France (2019-2022)

In the context of a new joint venture — **EuroMov: Digital Health in Motion** — between Montpellier University and the French Mines Telecom Institute (IMT Mines Ales), four PhD positions are available in Montpellier and Ales (south of France), at the interface between cognitive sciences, movement sciences, engineering, mathematics, and/or data sciences.

Univ. Montpellier is one of the Europe's leading universities specialising in health, science and technology. It is renowned for its excellent education and its cutting-edge fundamental research. **IMT Mines Ales** is part of the prestigious Institute Mines-Télécom, and is a graduate Institute for Engineering and Applied Science in Alès, southern France.

Outstanding applicants should have a background in one (or several) of the field/s mentioned above or in related disciplines. The PhD positions are offered in an interdisciplinary context: **Digital Sciences (Data Sciences, Signal Processing, Machine Learning, Artificial intelligence, Computer vision) and Movement Sciences (Neurosciences, Embodied Cognition Motor Control, Exercise Physiology).** We are seeking candidates with familiarity in one of the two domains and a strong appetite for the other domain. Essential requirements for all positions are strong quantitative and/or analytical skills, knowledge of at least one programming language (such as Python, Matlab, C/C++), excellent grades and the ability to learn and employ new methods and concepts from different disciplines. A strong motivation is expected as well as the willingness to work in a multi-disciplinary environment. Although all positions are based in France, successful candidates will be immersed in an international English-speaking context, hence fluency in French is not mandatory. Specific requirements for each position are detailed below.

The starting date is fall 2019. Applications are accepted until June 15, 2019. Short-listed candidates will be asked to prepare an interview for the hiring committee, composed of members from the doctoral school in Human Movement Sciences and from the doctoral school in Information, Structure, Systems. Interviews will take place on June 26, 2019. All positions are for 3 years. Net salary is around 1500€ (not including possible teaching assistance), and includes the French social security/health package. All professional expenses (e.g., experiments / hardware / software / travel / publications) are covered by EuroMov and IMT.

For all positions, applicants should (1) contact the supervisors to prepare their application and (2) send, in one merged PDF, a cover letter with a statement of research interests and targeted position/s (multiple candidacies are accepted), CV, publications, relevant certificates (degrees and grades), and the name and contact of at least two references to benoit.bardy@umontpellier.fr (director, EuroMov) and Jacky.Montmain@mines-ales.fr (director, LGI2P).

More information:
EuroMov: www.euromov.eu
University of Montpellier: https://www.umontpellier.fr/
Institut Mines Telecom : https://www.imt.fr/en/
IMT Mines Alès: https://www.mines-ales.fr
Doctoral School in Human Movement Sciences: https://ecole-doctorale-463.univ-amu.fr/fr
Doctoral School in Information, Structure, Systems: http://www.edi2s.univ-montp2.fr/

Position 1: Walk@Home - Walking Dynamics at Home:

Despite significant progress in our understanding of bipedal locomotion dynamics, our ability to assess the way we walk in our daily life, including in our own home, remains very limited. The goal of Walk@Home is to understand the human walk in our home environment, to characterize the natural embodiment of architectural space, and to extract relevant home-based signatures of health and wellness. The project benefits from a recently inaugurated and fully connected apartment with occupants downtown Montpellier, equipped with 60+ sensors, including the SenseFloor®, a textile based underfloor with integrated electronics. The PhD program will include a data base of around 2.5 million steps, as well as the acquisition of complementary data in VR-based walking experiments. In addition to the general requirements described above, candidates are expected to have experience in, or a strong interest for, human locomotion, data sciences, and virtual reality. The successful candidate will be enrolled as a PhD student at the EuroMov centre (Univ. Montpellier, France), under the supervision of Prof. Benoît Bardy (benoit.bardy@umontpellier.fr) and Prof. Gérard Dray (gerard.dray@mines-ales.fr).

Keywords: Walking dynamics, perception, data sciences, VR, health and wellness.

Position 2: TimeToSync - Multi-scale human group synchronisation

Perceptuomotor group synchronisation is an essential feature of human activities. Examples include hands clapping in an audience, walking in a crowd, music playing, sport and dance. Achieving synchronisation in the group involves shared intention and perceptual interaction, but also depend on how individual motor signatures (IMS) — specific blueprints of human individuals — are assembled together to form a specific group motor signature (GMS). In Time-to-Sync, the existence of multiple channels of perceptuomotor communication will be explored during natural and laboratory-based group synchronisation situations. Individual and group signatures will be evaluated and modelled, and their dynamics at multiple time scales will be investigated to capture affective, emotional, and intentional qualities. In addition to the general requirements described above, candidates are expected to have experience in, or a strong interest for, human group synchronisation experiments, motion capture, and artificial intelligence. The successful candidate will be enrolled as a PhD student at the EuroMov centre (Univ. Montpellier, France), under the supervision of Prof. Benoît Bardy (benoit.bardy@umontpellier.fr) and Associate Prof. Stefan Janaqi (stefan.janaqi@mines-ales.fr). S/he will be part of a newly funded H2020 European project, EnTiMeMent (https://cordis.europa.eu/ project/rcn/218717/factsheet/en), offering complementary research training in a multi-country and multidisciplinary environment.

Keywords: Group synchronisation, multiple temporal scales, human experiments, data sciences

Position 3: KeenMT – 3D visualization of human postures and trajectories of moving bodies

Keen-MT concerns three-dimensional visualization of trajectory from human bodies in motion. The goal of Keen-MT is to develop a device able to extract significant points on the human body in order to analyze body language. This device is designed to work in indoor environments where occultation typically occur: meeting room, connected home, etc. Dealing with occultation makes the multiplication of viewpoints and cameras necessary. For that reason, the system will be built from low-cost cameras to attain a reasonable budget. KeenMT involves an important focus on calibration/synchronization of the cameras, matching the different views, as well as on data fusion, to obtain three-dimensional and temporal information. The final purpose is a direct application allowing to determine the actors' positions (morphological skeleton points) in order to provide a spatiotemporal mapping of movements and behaviors. The project involves mixed techniques of Computer-vision and Artificial-Intelligence. The data obtained will be used to build a library categorizing classes or semantic of movements. The successful candidate will be enrolled as a PhD student at IMT Mines Ales under the supervision of Philippe Montesinos (philippe.montesinos@mines-ales.fr) and Prof. Pierre Slangen (pierre.slangen@mines-ales.fr) with frequent stays in EuroMov (Univ. Montpellier, France) with Prof. Denis Mottet (denis.mottet@umontpellier.fr).

Keywords: 3D visualization, human postures, movement semantics

Position 4: PIMS - Multi-objective optimization and machine learning for sport training: From performance to health

In an effort to maintain a winning edge, monitoring health and training load has become a key focus for athletes, coaches, and sports scientists. Indeed, a growing body of literature shows that management of training load is effective in reducing the risk of injury, as well as for improving athletic performance. Today, an enormous amount of data is monitored on a daily basis in team-sport athletes, involving sensing measurements and questionnaires. The reliability and precision of sensors as well as the frequency and subjectivity of answers to questionnaires are not easily handled in standard approaches. The existing literature provides just a preliminary understanding of which factors mostly affect injury risk, and an evaluation of potential statistical models in forecasting injuries and fatigue detection is still missing. The goal of PIMS is to implement a machine learning-based framework for the identification and a better understanding of the complex physiological and mental load-adaptation pathways at the individual level. This missing knowledge will be extremely valuable for strength and conditioning practitioners in designing specific training programs to enhance physical qualities in field athletes, and will provide rich information to coaches in their decision- making. The project will benefit from training data available over seasons for various sport activities. The data imperfection and heterogeneity will be considered in soft computing models (fuzzy, belief functions, etc) that enable multi-criteria analysis and predictive modelling limiting information loss. In addition to the general requirements described above, candidates are expected to have experience in, or a strong motivation for, machine learning methods. Experience with training methods is a plus.

The successful candidate will be enrolled as a PhD student at IMT Mines Ales under the supervision of Prof. Jacky Montmain (jacky.montmain@mines-ales.fr), with frequent stays in EuroMov (Univ. Montpellier, France) with Prof. Stéphane Perrey (stephane.perrey@umontpellier.fr).

Keywords: Machine Learning, Monitoring, Training, Fatigue, Performance