

# PhD Position: IA applied to clinical biomechanics



## Summary

This PhD position is presented in a context where embedded biomechanical devices produce large amounts of data in ecological conditions (i.e. real-life conditions, as opposed to laboratory conditions) and where big data processing tools are increasingly efficient. These databases could be used in the medical field to know the evolution of a person's motor skills before starting or modifying medical treatment. There are many technical obstacles, first of all the ability to aggregate and analyze data at variable times (e.g. heart rate at 100Hz versus a discrete medical diagnosis). The nature of the measured data itself is obviously essential and requires an ergonomics analysis in order to understand the needs of the various health professionals and avoid the creation of a redundant and less efficient database.

Regarding information processing, an objective is to set up a multimodal learning model (for example based on multimodal transformers) which makes it possible to classify the state of the person wearing the different sensors. There are several technical and scientific difficulties in the fact of 1) taking into account heterogeneous multimodal data, 2) proposing an interface which makes it possible to explain the modalities (and at which moment) to make the decision and 3) taking data security into account with part of the calculations as close as possible to the on-board device in order to send the least possible sensitive data over the network.

## Laboratories presentation

This PhD is funded by an international cotutelle agreement between Université Polytechnique Hauts-de-France (UPHF) in Valenciennes (France) and Université de Mons (UMons) in Mons,

Belgium. The applicant will have two supervisors from each university and the final diploma from both universities.

The LAMIH UMR CNRS 8201 (Laboratory of Automation, Mechanics and Industrial and Human Computing) is a joint research unit between the UPHF and the National Center for Scientific Research (CNRS), specialized in transport and human mobility. The LAMIH has previous experience with several hospitals in the Hauts-de-France region with opportunities to provide clinical needs and patient data.

The ISIA laboratory develops biomedical with medical imaging and signal processing in various fields (polysomnography, EEGs, medical records, etc.). Carrying out research on the analysis, synthesis, recognition, and mapping of signals, such as speech, music, audio, image, video, gaze, face, body, and language, using artificial intelligence. They also use this expertise to build smart human-machine interfaces for creative and biomedical applications.

### **Qualification and skills**

- Applicants are expected to have a Master level degree.
- Experience in one or more of the following areas is desired: machine learning, deep learning, clinical biomechanics, biomechanical engineering.
- Applicants must have a good level in spoken French (B2) and in written English.
- Good team-working, observational and communication skills are required.

### **Organization and salary**

Over the 36 months of the position, the applicant will receive an average net salary of 1 750€ per month.

The applicant will spend a total of 18 months in UPHF and 18 months in UMons. A 40 km distance separates both universities, hence it is possible to keep the same residence during the whole position.

### **How to apply**

Applicants must send an email directly to the supervisors with the following documents:

- Resume
- Letter of motivation
- Recommendations

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