

## 18-month post-doctoral position M2S Lab – Inria Mimetic, Rennes, France

### Context

This 18-month post-doctoral position is framed under the European JPICH Digital Heritage SCHEDAR project. The latter intends to design novel algorithms and computational tools for archiving, curating, preserving and most importantly reusing dance data. SCHEDAR aims at (a) making dance 3D digitization accessible to everyone without expensive equipment or expertise, (b) enabling semantic information retrieval from these otherwise opaque datasets without the need of manual labelling and annotation of dance data, and (c) devising a highly immersive Virtual/Augmented Reality (VR/AR) platform for interactive dance teaching based on motion data. In this project, the post-doctoral position aims at proposing a next-generation dance teaching VR/AR application that uses all the technologies and tools developed in SCHEDAR to search, retrieve and utilize existing dance performances to provide 3D virtual dancers and relevant feedbacks to coach trainees.

This project is multidisciplinary and the candidate will therefore work with researchers from computer and sport sciences on different topics such as development and assessment of feedback in virtual environments, biomechanical analysis of motions and learning methods.

The post-doctoral candidate will work in the Mimetic team (<https://team.inria.fr/mimetic>) which is part of the Inria research institute, leader in computer sciences and of the M2S Lab of University Rennes 2 (<http://m2slab.com>) which is internationally recognized in sports sciences (Shanghai ranking). Mimetic team proposes innovative multidisciplinary approaches to analyse, model and synthesize motion, in particular with virtual environments. The post-doctoral candidate will also have access to 2 unique experimental platforms [Immersia](#) and [Immermove](#) that offer a high-tech setup to perform user experiments in real and virtual environments and measure motion (motion capture, EMG, force plate...).

This research topic will be carried out in Rennes, the capital of Brittany and the tenth largest city in France, with a metropolitan area of about 720,000 inhabitants. Moreover, with more than 66,000 students, Rennes is also the eighth-largest university campus of France and it has the 2nd highest concentration of digital and ICT firms in France after Paris. Rennes is also known to be one of the most festive and lively cities of France, home of several music and culture festivals. In 2018, the newspaper "L'Express" named Rennes as "the most liveable city in France".

### Objective

Preserving cultural activities such as traditional dance, and passing this knowledge to the next generation is a key aim. However, as coaches are rare in these very specific dances, technology can help to spread their expertise over the world. Thanks to its properties of standardisation, control and reproducibility, virtual reality have shown its effectiveness in assessing and training perceptual-motor skills in sport. However, it strongly depends on the provided feedbacks, both in terms of the representation of virtual partners and the additional information that guides the training. It also depends on the organization of the training sessions.

The host laboratory of this post-doctoral fellowship has a long experience in virtual reality for sports and its use for the evaluation and training of athletes. This post-doctoral candidate will thus benefit from this expertise to propose a new generation of VR/AR-based training tool in which virtual dancers will be in interaction with the real learner. The candidate will work with engineers, researchers and PhD students on that topic.

The scientific challenges the candidate will have to overcome mainly concern the transfer of visual-motor skills learnt in virtual environment to real situations. Previous work showed that learners

improved in virtual environments but this skills improvement has no relevance if it is not transferable to the field. Even if some work has begun to evaluate this transfer, the problem is complex, especially in the case of complex open motor skills and thus requires advanced research. Moreover, the more relevant the feedback is for progress, the more dependent the learner is on it. Its absence back in the real world may therefore interfere with the subject's performance. It is thus necessary to design relevant feedbacks to allow the learning of complex motions in virtual environments and to propose an innovative learning process including a pre- and post- evaluation of performance to assess the transfer to real practice.

The impact of this research is wide since it concerns the computer graphics community (VR/AR) on the design of such applications based on virtual feedbacks, but also the sports sciences community (both neurosciences and biomechanics) on the assessment and training of complex visual-motor skills. This research will thus be published in high-level international journals and conferences in both computer science and sports science.

## Main activities

The main activities of the post-doctoral fellow will focus on:

- 1) state of the art of transfer of visual-motor skills in physical activities and programming of training sessions.
- 2) the design of relevant feedbacks allowing a progressive learning in the very constrained and challenging context of high speed motions, in particular with complete rotations of the learner's body and limited field of view and therefore a temporary loss of visual information picked up on the partner;
- 3) the implementation of learning methods in conjunction with teachers to ensure an efficient progression of learners.
- 4) a quantitative assessment of the performance and progress of learners. It will be done on a sports sciences student group

## Skills

The candidate must have a PhD degree in computer sciences or sport sciences and should be comfortable with as much following items as possible:

- Experience in development of VR/AR solutions.
- Experience in carrying out users studies.
- Experience in motion capture and movement analysis.
- Good spoken and written English skills.
- Good communication skills. This post-doctoral position is framed under a larger project, thus the candidate will have to interact with other members of the project and assist to its meetings.

## General information

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**Where:** M2S Laboratory – ENS Rennes – Campus de Ker Lann – Av.Robert Schumann – 35170 Bruz – France

**Duration:** 18 months

**Salary:** 2350€ net monthly

**Desired start date:** January 2020

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