Post-doctoral position : XR and optimization models for improving workstation ergonomics

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Abstract

Keywords : virtual reality, 3D interaction, motion capture, industrial workstation, musculoskeletal disorders, task procedure, optimization algorithms, gesture training, procedure training, embodiment, multi-sensory cues.

1 Context

Musculoskeletal disorders (MSDs) currently account for 87% of work-related illnesses and are particularly prevalent in 7 sectors: logistics, retail, food, construction, cleaning, metalworking and personal care. Reducing MSDs at the workplace requires a complete assessment of a workstation, through procedure and human activity analysis. This position is open within the CARINGS project, funded by the French National Research Agency. The project aims at creating a workstation design tool meant to reduce risks of musculoskeletal disorders, by leveraging mathematical optimization tools and XR.

2 Research

The project brings together a consortium of three research laboratories (Mines d'Alès / EuroMov DHM - Motion capture, Ergonomics assessment, Mines Saint Etienne - CMP Gardanne - Manufacturing Sciences and Logistics Department - Optimization and operational research, Center for Robotics Mines Paris - Virtual and Augmented Reality). The consortium conducts research on three iterative steps that are the backbone of the design tool : 1) On a given workstation and task, use motion capture to acquire existing task operation procedures and gestures. 2) Feed the data to optimization algorithms that in turn suggest alternative procedures and gestures. Those can maximize various cost functions related to human comfort (see [5]). 3) **Use Virtual and/or Augmented Reality for assessment and training of the new procedures**.

This postdoctoral position concerns the third step of the project. The post-doctoral researcher will conduct research in the field of 3D interaction and XR. She/he will seek novel ways to teach procedures, tasks, and gestures by using embodied XR. The literature has studied the role of avatars and point of view (First person vs. 3rd person) on training and presence [2, 4, 6], the use of a virtual training environment registered on the actual task [3], the use of 3D visual trajectories to display gestures [1]. The research conducted in this postdoctoral work will extend on those ideas or propose novel approaches using multi sensory feedback (tactile/haptic) or sensori-motor illusions [7].

She/he will perform researches to :

- Explore ways to visualize the results of optimization algorithms within a AR/VR environment.
- Explore ways for training people to perform complex tasks and gestures by using embodied interaction.
- Explore novel feedback methods for correcting postures and giving recommendations to operators.

She/he will work closely with the consortium partners and participate in the publication of the project's scientific contributions.

3 Requirements

- PhD in Computer Science, Virtual Augmented Reality or similar relevant fields
- Strong knowledge of programming languages, e.g. Python, C/C++, C#
- Motivation for working in a multidisciplinary research project at the interface between optimization, computer science and 3D user interfaces
- a good level in English language (written and spoken)
- Additional knowledge in the following areas would be appreciated: game engine programming (Unity, Unreal), machine learning, conducting user studies, UX design

4 Hiring conditions

- 12-month full-time post-doctoral contract
- The successful candidate will be offered a salary commensurate to CV and Mines Paris PSL University salary scale
- The position is open to all, with accommodations available for candidates with disabilities
- Start date: Between April 2024 and January 1st 2025, for a 12 months duration
- Assignments will be carried out in the Robotics Lab in Mines Paris PSL University, 60 Boulevard Saint Michel, Paris, France

Other advantages:

- Telecommuting up to 2 days a week
- 49 days annual leave
- Public transport costs reimbursed up to 50%
- Sustainable mobility package (for carpooling or cycling)
- School and departmental staff associations
- Stimulating innovation ecosystem (startups, students, research, companies)

5 How to apply

The position is currently open, we welcome applications as of now, until filled, and not later than May 15th 2024. Interested candidates are required to send their applications including a CV with a publication list, a brief motivation letter explaining interests and qualifications regarding the position, prior research/work experience - all within a single pdf file - and contact information of two professional references to alexis.paljic@minesparis.psl.eu. Feel free to contact us for any question regarding the position.

References

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