

Modeling 6 DoF human motion data in extended reality

Keywords

machine learning, modeling, head and body motion analysis, extended reality (XR)

Location

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Duration

3 to 6 months. This internship has the possibility of continuation for a 3-year PhD.

Description

This internship lies in the framework of ANR CREATTIVE3D, which is a national-funded project that will study the impact of low-vision conditions when navigating complex environments by deploying virtual reality headsets (VR) and user behavior modeling, and the use of this understanding for the design of tools and protocols for rehabilitation of patients.

The core of this project thus lies in investigating the link between the objects and events in the 3D scene, and the behaviour of the user immersed in the scene. Promising developments on 3 DoF head motion prediction for 360° videos

establish how content influences the user's attention [1], and recent work for mixed reality environments have explored recurrent neural network architectures for 6 DoF pose detection [2], and stochastic models for prediction on synthetic data [3]. These methods provide avenues to investigating models for 6 DoF human motion prediction.

The objective of this internship is to conduct a comprehensive review and evaluation of recent models of in-context 6 DoF motion prediction, and establish a baseline model on existing 6 DoF datasets. This involves:

1/ conduct a comprehensive review of the current state of the art on 6 DoF human motion prediction, focusing notably on a - recent datasets of 6 DoF motion such as social XR [4] and HUMAN4D [5]. b - predictive models of human motion in-context notably for virtual or extended reality environments

2/ analyze open code repositories of models and datasets for pose prediction, and select a subset to evaluate,

3/ hands-on testing of selected models on the selected datasets, and as a second step, evaluate the performance on our own preliminary motion capture data

4/ identification of their drawbacks, and proposal of potential solutions to in-context predictive models of human motion in VR/XR

Pre-requisites

Mandatory:

- a background in machine learning is mandatory
- Python programming proficiency

Appreciated:

- knowledge and understanding of 3D environments and motion prediction

References

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[2] Woźniak, M., Wiczorek, M., Siłka, J., & Połap, D. (2020). Body pose prediction based on motion sensor data and recurrent neural network. *IEEE Transactions on Industrial Informatics*, 17(3), 2101-2111.

[3] Cao, Z., Gao, H., Mangalam, K., Cai, Q. Z., Vo, M., & Malik, J. (2020, August). Long-term human motion prediction with scene context. In *European Conference on Computer Vision* (pp. 387-404). Springer, Cham.

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- [5] Chatzitofis, A., Saroglou, L., Boutis, P., Drakoulis, P., Zioulis, N., Subramanyam, S., ... & Daras, P. (2020). HUMAN4D: A human-centric multimodal dataset for motions and immersive media. *IEEE Access*, 8, 176241-176262.