PhD subject:

4D Human Modeling for Real-World Human Cognition by Care-Robots for Aged People

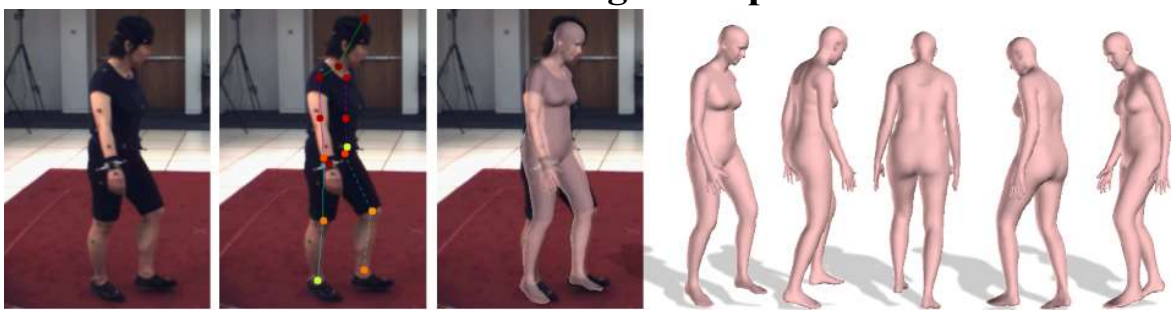

Figure 1: We will use the geometric reconstruction of the human body from videos[1] to train a generative model of dressed 4D human body.

Hosting institute

ICube Laboratory (The Engineering science, computer science and imaging laboratory) at the University of Strasbourg is a leading research center in Computer Science, with more than 300 permanent researchers, with the recently opened AI graduate school supported by the French government.

Work place and salary

The thesis work will take place in the MLMS (Machine Learning, Modeling & Simulation) research team of the ICube laboratory (The Engineering science, computer science and imaging laboratory) of the University of Strasbourg, a leading research center with more than 300 permanent researchers. The workplace is located on the hospital site of the laboratory, a 10-minute walk from the heart of downtown Strasbourg, listed as a UNESCO World Heritage Site.

2 135,00 € gross monthly

Supervisors

– director: Hyewon Seo (ICube, Univ. Strasbourg)

– co-supervisors: Frederic Cordier (Univ. Haut-Alsace), Stephane Cotin (INRIA Strasbourg)

Staring date

March – October 2023.

Context

Robot vision for human cognition often fails to work well in the real-world situation, despite the disruptive results achieved in Computer Vision and Artificial Intelligence. While most training data have been

[1] F. Bogo, A. Kanazawa, C. Lassner, P. Gehler, J. Romero, and M. J. Black. Keep it SMPL: Automatic estimation of 3D human pose and shape from a single image. In European Conf. on Computer Vision. Springer International Publishing, 2016.

collected in well-conditioned, easy-to-isolate backgrounds, wild videos from the real-world may contain various environmental conditions such as lighting, background patterns, and, most notoriously, occlusions. The latter becomes the source of recurrent problems of human cognition by care-robots in the in-house situation. Large variations in body shapes, motions, clothes, and frequent interactions with objects also contribute to the difficulty. Learning-based methods relying on dataset inevitably show limited performance, as it is almost impossible to collect a large, annotated dataset that spans over all possible configurations of the real-world scene. In the framework of a binational and tri-institutional project (CNRS, INRIA, and ETRI: Electronics and Telecommunications Research Institute from South Korea), we are going to develop a set of techniques to push back these limits.

Work description

Model-based learning approaches have shown promising results, as shown by a considerable amount of previous work on human face and body prediction/recognition from images based on pre-built 3D models. However, many existing models only consider the geometry of the human face or body in isolation, making a real-life situation involving obstacles or environmental objects difficult. In this project we will also take a model-based approach but with increased realism, an extra dimension (i.e. time) and beyond. The specific objective is to make the performances of this recognition of the human body robust to large variations (in the shape of the body, movements,..) to occlusion (clothing, furniture, wall,..), by developing a generative model of a realistic 4D human. The work consists in developing a method for the geometric reconstruction of the human body from videos, whose results will serve as training data for a generative model of the dressed and textured human body.

Constraints et risks

The thesis is within the framework of a collaborative project with a predefined time schedule, so the delivery of the work should conform to this global schedule. The list of targeted actions as well as video dataset are provided by the ETRI partner. One or two mid-term guest researchers at ETRI (Daejeon, South Korea) are considered for collaboration.

Supplementary information

It would be ideal to start with the master 2 internship linked to this thesis: http://igg.unistra.fr/People/seo/StudentsJoboffer_files/SujetM2_Reconstruction_from_Video.pdf

Candidate profile

− Master student in Computer Science, Electronic & Electrical Engineering, or in Applied Mathematics

− Solid programming skills: Python/C++

− Background in Geometric Modeling and Statistics

− Experience in Deep Learning

− Good communication skills

Application

https://emploi.cnrs.fr/