PhD Position in Generative Models of 3D and 4D (3D+t) Human Shape, Lille, France

Starting date: as soon as possible

Supervisors: Mohamed Daoudi (IMT Nord Europe), Sylvain Arguillère (CNRS/Univ. Lille) in collaboration with Martin Bauer (Florida State University, USA) and Nicolas Charon (University of Houston, USA).

To apply fill out the form:

https://docs.google.com/forms/d/e/1FAIpQLScb93QqvaTVDsYSkFuiHWkLPR13P4imCBWgCOI27U4SZqCanA/viewform?usp=pp_url

Context

The PhD will take place in project 4DShape project funded by ANR and NSF. The 4D Shape project will start in November 2024 and last 3 years. It involves 4 partners from France and the USA.

Objectives

3D/4D human shape, generative models, geometry of surfaces. In recent years there has been an increased interest in analyzing and generating the shape and motion of 3D humans (body and face). Advances in 3D human shape estimation algorithms, 3D scanning technology, hardware-accelerated 3D graphics, and related tools, are enabling access to large-scale 3D human shape data. This data usually comes in the form of 3D surface meshes that, in general, do not correspond to coherent discretizations, i.e., the same surface can be represented by many different triangular meshes with varying connectivity and a varying number of vertices. Thus, methods designed for 3D/4D shape analysis of parameterized surfaces and deep learning face severe limitations when applied to such real data.

The goal of the project is to identify, develop, and perfect a natural framework where one can both embed and generate surfaces of the human body and faces independently of the way they are parameterized/discretized, including raw scans, in a way that captures and reproduces both the identity of the subject and the natural motions they can make.

The central hypothesis of the proposed research is that the combination of geometric methods and deep learning techniques will lead to both theoretical and quantitative performance breakthroughs in these challenging problems. It will provide new tools, both theoretical and practical, not only for comparing 3D/4D surfaces but also for defining novel deformation processes for putting them in motion and/or changing their identity, irrespective of the way the input data may be parameterized. Including 4D data in our frameworks, we expect the results to open new horizons for several applications including virtual reality, AR/VR content creation, gaming, and affective computing.

International collaboration

This project is an international project funded by ANR and NSF. The groups involved in the project 4DSHAPE have been published in top journals and

conferences [1] [2] [3]. The candidate will have to collaborate with the groups of Professor M. Bauer (Florida State University) and the group of Professor Nicolas Charon (University of Houston). Yearly visits of the PhD student to the USA partners are expected.

Required background and skills

The applicant should have conducted Master or engineering studies in the relevant fields (artificial intelligence, data science, computer vision, applied mathematics);

- Excellent programming skills in Python (familiar with one of the deep learning packages is a must, preferably PyTorch);
- Very strong knowledge in computer vision and deep learning techniques (CNN, GAN, Diffusion models, etc.);
- Knowledge of 3D data processing is appreciated;
- Fluency in written and spoken English;
- Relational working qualities.

References

[1] Emmanuel Hartman, Emery Pierson, Martin Bauer, Nicolas Charon, Mohamed Daoudi, BaRe-ESA: A Riemannian Framework for Unregistered Human Body Shapes. ICCV 2023: 14135-14145.

[2] Emmanuel Hartman, Emery Pierson, Martin Bauer, Mohamed Daoudi, Nicolas Charon, Basis restricted elastic shape analysis on the space of unregistered surfaces. International Journal of Computer Vision (IJCV) (2024), To appear.

[3] Federico Nocentini, Thomas Besnier, Claudio Ferrari, Sylvain Arguillère, Stefano Berretti, Mohamed Daoudi, ScanTalk: 3D Talking Heads from Unregistered Scans. European Conference on Computer Vision (2024).

Contact:

For more information about our work, please contact Professor Mohamed DAOUDI mohamed.daoudi@imt-nord-europe.fr

Location:

The position is located in Lille, France. With over 110,000 students, the metropolitan area of Lille is one of France's top education student cities. The European Doctoral College Lille Nord-Pas de Calais is headquartered in Lille Metropole and includes 3,000 PhD Doctorate students supported by university research laboratories. Lille has a convenient location in the European high-speed rail network. It lies on the Eurostar line to London (1:20 hour journey). The French TGV network also puts it only 1 hour from Paris, 35 mn from Brussels, and short trips to other major centers in France such as Paris, Marseille, and Lyon.