Internship Offer: 3D reconstruction

Reconstructing deformable 3D shapes from images or video remains a central challenge in computer vision, with applications in medical imaging, animation, robotics, AR/VR, and human–computer interaction. Unlike rigid reconstruction, deformable 3D reconstruction must account for non-linear, time-varying shape changes, often under limited observations and noise.

Existing approaches broadly fall into two paradigms:

1. Statistics-based (global) methods, which learn low-dimensional shape priors [1] from data. Many advances based on such a paradigm are proposed and evolved into learning based pipelines [2]. These approaches provide oversmooth local details and struggle with out-of-distribution deformations.

2. Geometry-based (local) methods, which rely on physical or geometric constraints [3] (e.g., isometry, local rigidity, surface smoothness). These capture fine-scale deformations but are sensitive to noise and ambiguity, especially under sparse observations. This research proposes a unified framework that integrates global statistical priors with local geometric constraints to achieve accurate, robust, and detailed deformable 3D reconstruction. The primary goal is to design and validate a hybrid reconstruction pipeline that combines the strengths of both paradigms.

Specific objectives include:

- Develop a unified representation that encodes both global shape priors and local geometric constraints.
- Design an optimization framework that jointly enforces statistical consistency and geometric fidelity.
- Incorporate learning-based components (e.g., neural networks) to adaptively balance global and local information.
- Design a hybrid approach that relies on statistical priors for overall shape and geometric priors for details.

Candidate profile

- Currently pursuing a Master's or engineering degree in computer science, computer vision, AI, or a related field.
- Solid programming skills (Python) and experience with a deep learning framework (PyTorch or TensorFlow).
- Autonomy, rigor and good communication skills.

Practical information

- **Duration:** 6 months
- **Start date:** February 2027

- **Location:** Lyon (LIRIS laboratory at Ecole Centrale de Lyon)
- **Supervision:** Shaifali Parashar
- **Compensation:** around 500 euros per month
- **Application:** send a CV, master transcripts and a letter of recommendation to shaifali.parashar@gmail.com.

References

[1] Bregler et al., Recovering Non-Rigid 3D Shape from Image Streams. In CVPR 2020.

[2] Deng et al., Deep Non-rigid Structure-from-Motion Revisited: Canonicalization and Sequence Modeling. In AAAI, 2025.

[3] Parashar et al., A Closed-Form, Pairwise Solution to Local Non-Rigid Structure-from-Motion. In TPAMI, 2024.