



Job vacancy #2023-06375

PhD Position F/M Hair Capture and Modeling

Contract type : Fixed-term contract

Level of qualifications required : Graduate degree or equivalent

Fonction : PhD Position

About the research centre or Inria department

The Inria Grenoble research center groups together almost 600 people in 23 research teams and 7 research support departments.

Staff is present on three campuses in Grenoble, in close collaboration with other research and higher education institutions (University Grenoble Alpes, CNRS, CEA, INRAE, ...), but also with key economic players in the area.

Inria Grenoble is active in the fields of high-performance computing, verification and embedded systems, modeling of the environment at multiple levels, and data science and artificial intelligence. The center is a top-level scientific institute with an extensive network of international collaborations in Europe and the rest of the world.

Context

About

The Ph.D. position is part of a joint laboratory between Interdigital, a leading technology and research company, and Inria, the French national institute of computer science and automation. The PhD will be one of several PhD topics around the avatar representation of people, within a collaboration framework between Inria and InterDigital called Nemo.ai.

The PhD will start as soon as possible and will last 3 years.

It will be supervised by The Morpheo team at INRIA Grenoble Rhône-Alpes and the MetaVideo group at InterDigital Research and Innovation labs in Rennes. The focus of Morpheo's research is on perceiving and interpreting moving shapes, with applications to character animation, and immersive and interactive environments. The MetaVideo group that will co-supervise the PhD develops representations for the transmission of digital human and avatar character models in interactive environments.

<https://team.inria.fr/morpheo/>

[InterDigital - Create. Connect. Live. Inspire.](#)

Location

The PhD student will be hosted by the Morpheo team at INRIA Grenoble Rhône-Alpes, with some stays in the InterDigital R&I labs in Rennes.

Some connections with the other members of the research team (INRIA Grenoble, INRIA Rennes, InterDigital Rennes) will also be planned, such as visits, seminars and talks.

More information

For more information on this position, contact jean-sebastien.franco@inria.fr or Francois.LeClerc@interDigital.com.

Assignment

Topic

Capturing and modeling the dynamics of human hair is a difficult problem, still little explored by the research community. The complex structure of thin intertwined strands makes recovering hair models from images or videos a particularly challenging task.

Pioneering works consider multi-view stereo reconstructions of point clouds which are further fitted to learned examples of hair strands, as in [1]. Still building on multi-view stereo, [2] proposes to modify the approach and to reconstruct line curves instead of points. Recent works in the field investigate deep learning strategies. For instance [3] directly infers a parametric strand representation from a single view using an auto encoder architecture. In [4] a Variational Auto-Encoder (VAE) is trained to learn latent volumetric representations of hairs which combine occupancy and orientation information. The VAE is further conditioned on image input and can generate a hair representation from a single image. [5] proposes a Generative Adversarial Network (GAN) to generate 3D volumetric and orientation fields given 2D hair orientations and bust depths as extracted from a 2D image. The 3D orientation volumes can then guide hair synthesis.

All the above approaches recover only static hair representations from image information. In [6] the dynamic aspect is tackled with a strategy that builds on [5] to produce 3D orientation volumes in addition to motion encoded as 3D warping volumes.

The PhD objective is to recover dynamic hair models given image sequences. A first task is related to the representation to be considered for that purpose. Recent works in the field build on 3D orientation volumes as mentioned before. A potentially interesting direction in that respect is provided by [7] which considers dynamic garments and represent them with a coarse 2D template over which dynamic information is encoded as a texture. A similar strategy could be explored in 3D to represent hair.

The second task will consist in recovering hair models from input images and proposing a data driven approach for that purpose. A dataset of 3D hair models and corresponding image renderings will be provided. Augmenting this dataset and finding suitable representations of hair for processing will be another task of the PhD.

References:

1. Liwen Hu, Chongyang Ma, Linjie Luo, and Hao Li. Robust hair capture using simulated examples. ACM TOG 2014.
2. Strand-accurate Multi-view Hair Capture Giljoo Nam, Chenglei Wu, Min H. Kim, Yaser Sheikh, CVPR 2019.
3. Yi Zhou, Liwen Hu, Jun Xing, Weikai Chen, Han-Wei Kung, Xin Tong, and Hao Li. HairNet: Single-View Hair Reconstruction using Convolutional Neural Networks. ECCV 2018.
4. Shunsuke Saito, Liwen Hu, Chongyang Ma, Linjie Luo, and Hao Li. 2018. 3D Hair Synthesis Using Volumetric Variational Autoencoders. ACM TOG 2018.
5. Hair-GANs: Recovering 3D Hair Structure from a Single Image, Meng Zhang Youyi Zheng IEEE TVCG.
6. Dynamic Hair Modeling from Monocular Videos using Deep Neural Networks, L. Yang, Z. Shi, Y. Zheng, K. Zhou, ACM TOG 2019.
7. Dynamic Neural Garments M. Zhang, D. Ceylan, T. Wang, N. Mitra, ArXiv 2021.

Main activities

See assignments.

Skills

Candidate profile

- Master in Computer Science or Applied Mathematics.
- Solid programming skills, e.g. python and/or C++.
- Solid mathematical knowledge in geometry, linear algebra and statistics.
- Experience with computer vision, deep learning and shape modeling is a plus.
- Experience with physics-based simulation is a plus.
- Good English level. French is not required.

Benefits package

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking (90 days / year) and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage under conditions

Remuneration

1st and 2nd year: 2 051 euros gross salary /month

3rd year: 2 158 euros gross salary / month

General Information

- **Theme/Domain** : Vision, perception and multimedia interpretation

- Statistics (Big data) (BAP E)
- **Town/city** : Montbonnot
- **Inria Center** : [Centre Inria de l'Université Grenoble Alpes](#)
- **Starting date** : 2023-10-01
- **Duration of contract** : 3 years
- **Deadline to apply** : 2023-10-31

Contacts

- **Inria Team** : [MORPHEO](#)
- **PhD Supervisor** :
Franco Jean / jean-sebastien.franco@inria.fr

About Inria

Inria is the French national research institute dedicated to digital science and technology. It employs 2,600 people. Its 200 agile project teams, generally run jointly with academic partners, include more than 3,500 scientists and engineers working to meet the challenges of digital technology, often at the interface with other disciplines. The Institute also employs numerous talents in over forty different professions. 900 research support staff contribute to the preparation and development of scientific and entrepreneurial projects that have a worldwide impact.

The keys to success

Only complete applications will be considered. Please send:

- CV
- motivation letter
- your grades (Bachelor and Master studies)
- the name and contact information of 2 people willing to provide a reference for you (Master's supervisor or Prof. for instance)

Warning : you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.

Instruction to apply

Applications must be submitted online on the Inria website.

Processing of applications sent by other channels is not guaranteed.

Defence Security :

This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST). Authorisation to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

Recruitment Policy :

As part of its diversity policy, all Inria positions are accessible to people with disabilities.