



## HR EXCELLENCE IN RESEARCH

### 2020-02420 - PhD Position F/M Neural novel view synthesis of dynamic people in monocular videos

**Contract type :** Fixed-term contract

**Level of qualifications required :** Graduate degree or equivalent

**Other valued qualifications :** MSc or equivalent degree in computer science, applied mathematics, computer vision, computer graphics or machine learning.

**Fonction :** PhD Position

#### About the research centre or Inria department

The Inria Rennes - Bretagne Atlantique Centre is one of Inria's eight centres and has more than thirty research teams. The Inria Center is a major and recognized player in the field of digital sciences. It is at the heart of a rich R&D and innovation ecosystem: highly innovative PME's, large industrial groups, competitiveness clusters, research and higher education players, laboratories of excellence, technological research institute, etc.

#### Context

The PhD student will be co-supervised by Dr. Adnane Boukhayma (<https://boukhayma.github.io/>) and Prof. Franck Multon (<http://m2slab.com/index.php/members/franck-multon/>). The PhD will be conducted at Inria Rennes (<https://www.inria.fr/en/centre-inria-rennes-bretagne-atlantique>), in the MimeTIC research team (<https://team.inria.fr/mimetic/>).

#### Assignment

Capturing a scene or a 3D object with only a few images and synthesizing novel photo-realistic views of it is a long standing problem, traditionally referred to as image based rendering in the computer vision and graphics communities. It has recently regained attention due to its wide applications in free viewpoint and virtual reality displays, as well as image editing and manipulation. The problem remains challenging as it requires some form of understanding of the images' viewpoints as well as the 3D scene, fusing the visible regions and inpainting the missing ones. Image based rendering methods typically approach this by computing either (1) an explicit 3D representation of the scene, (2) image correspondences and warping fields, or (3) a light field representation. Most of these approaches are slow, costly or prone to failures. Recently, deep learning methods (e.g. [1,2,3,4,5,6,7,8]) managed to remedy some of the artifacts of the previous approaches, but they still lack in generalization and quality. We are further interested in the case where the input is a *video*, with a specific focus on humans (e.g. a person in changing poses or facial expressions). Using motion information for this problem has not been explored sufficiently, and while it could enhance the performance of view synthesis methods, it also presents additional challenges such as the need for non-linear alignments to combine the appearance information.

The goal of this PhD is to study novel view synthesis methods from monocular videos of dynamic objects using deep learning, with a focus on the human shape. Generating novel views of a moving person captured in a video increases the complexity of the standard formulation of the image based rendering problem, as it requires building a model that can understand, factor out and leverage the resulting appearance variations from the human motion. Another major challenge is to design a model that can both: (1) learn from training data of random people and scenes, and (2) combine that knowledge efficiently with the information in the few frames of the person and scene of interest given at test time. This could be initially approached by studying few-shot learning of generative models, as was done recently e.g. for head image animation [9] and text-to-speech generation [10,11].

**Keywords:** Deep learning, Neural Rendering, Novel view synthesis, Human 3D representation, Few-shot learning

- [1] Neural Volumes: Learning Dynamic Renderable Volumes from Images, ACM TOG 2019
- [2] Local Light Field Fusion: Practical View Synthesis with Prescriptive Sampling Guidelines, SIGGRAPH 2019
- [3] Liquid Warping GAN: A Unified Framework for Human Motion Imitation, Appearance Transfer and Novel View Synthesis, ICCV 2019
- [4] HoloGAN: Unsupervised learning of 3D representations from natural images, ICCV 2019
- [5] Transformable Bottleneck Networks, ICCV 2019
- [6] Deep Blending for Free-Viewpoint Image-Based-Rendering, SIGGRAPH Asia 2018
- [7] View Independent Generative Adversarial Network for Novel View Synthesis, ICCV 2019
- [8] DeepView: View Synthesis with Learned Gradient Descent, CVPR 2019
- [9] Few-Shot Adversarial Learning of Realistic Neural Talking Head Models, ICCV 2019
- [10] Neural Voice Cloning with a Few Samples, NeurIPS 2018
- [11] Transfer Learning from Speaker Verification to Multispeaker Text-To-Speech Synthesis, NeurIPS 2018

#### Main activities

The PhD student will be tasked with:

- Developing novel deep generative approaches for the problem of novel view synthesis of a dynamic person in a monocular video.
- Exploring possible solutions based on few-shot learning, transfer learning, and meta learning.
- Comparing strategies based on direct image translation to those that render from explicit or implicit 3D representations.
- Achieving generalization to videos in the wild for deep networks trained primarily with real data captured in controlled environments and synthetic data.

## Skills

Candidates should preferably have a MSc or equivalent degree in computer science, applied mathematics, computer vision, computer graphics or machine learning. Proficiency in coding in Python and C++ is a plus.

## Benefits package

- Subsidized meals
- Partial reimbursement of public transport costs

## Remuneration

Monthly gross salary amounting to 1982 euros for the first and second years and 2085 euros for the third year

## General Information

- **Theme/Domain** : Interaction and visualization  
Scientific computing (BAP E)
- **Town/city** : Rennes
- **Inria Center** : [CRI Rennes - Bretagne Atlantique](#)
- **Starting date** : 2020-09-01
- **Duration of contract** : 3 years
- **Deadline to apply** : 2020-06-30

## Contacts

- **Inria Team** : [MIMETIC](#)
- **PhD Supervisor** :  
Boukhayma Adnane / [adnane.boukhayma@inria.fr](mailto:adnane.boukhayma@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

We are looking for excellent candidates, preferably with a good background in mathematics or computer science, passionate for research and innovation, who can work independently and who are also keen to collaborate with other students and researchers.

## Instruction to apply

Please submit online : your resume, cover letter and letters of recommendation eventually

### 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.

**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.