### Introduction and context

Content production for film and advertising increasingly relies on computer-generated imagery to lower costs and enhance creative possibilities. In particular, many of today’s movies and advertisements feature synthetic human characters. The animation of the characters’ bodies is driven by the dynamics of an animation skeleton built from the main joints of the human body. This skeleton is later fleshed into a 3D mesh by a process known as skinning, wherein the displacement of each vertex of the mesh is computed from the displacement of the neighbouring skeleton joints it is bound to. Accurately capturing the naturalness of human motion in the dynamics of the skeleton is key to the perceptual plausibility of the rendered animation.

Creating animations for photorealistic computer-generated movies is a highly demanding complex part of the film production workflow that requires an immense amount of manual work. Keyframing and motion capture are the two dominant techniques used in the industry today. Keyframing refers to a purely manual editing process where artists draw the skeletons at selected temporal frames (“keyframes”), and further define non-linear interpolation paths for joints locations in-between the keyframes. Motion capture is performed in a green room with specialized hardware, with marker-based setups that requires some involvement on the part of the actors, as well as manual post-processing to incorporate artistic edits into the animations. In both cases, the amount of human intervention and hence the production costs are very high. Thus, there is a strong business justification in the automation of the non-creative parts of the animation process.

Advances in machine learning and particularly deep learning in recent years have boosted the research effort towards obtaining skeletal animations from the analysis of videos. The idea is to learn a mapping between the image of a human character and the 2D or even 3D locations of the joints of the character body. However, due in part to the difficulty of the problem and in part to the lack of 3D annotated training data, the accuracy on joint location estimates is often poor, especially in the depth direction that is not observable in the image. Besides, the estimated skeletons consist of only a few joints and often fail to cover the hands and the feet.

The generation of animations from videos offers promising prospects for optimizing the animation workflow in the content production industry. Still, a lot of work is needed to improve the resolution and accuracy of the produced animations, and to adapt the technology to make it usable in an interactive way by animation artists. Advancing towards these goals is the main purpose of the proposed PhD.

### Existing techniques and limitations

The estimation of animation skeletons, a.k.a. human poses, in images and videos is an active research area, dominated by supervised machine learning approaches that leverage databases of images annotated with human joint locations. The initial target of 2D pose estimation [1] has now been extended to 3D, see for instance [2, 3]. Inferring the depth components of the skeleton joints turns out to be a challenging ill-posed problem. Even though various regularization strategies have been proposed, the estimated joint locations are still quite noisy, especially in the depth direction orthogonal to the plane of the observed image. This is also, to some extent, a consequence of the limitations

### Contexte et atouts du poste

This PhD will be in the context of a CIFRE collaboration between Technicolor and the MimeTIC team (Inria Rennes). Technicolor is a leading company in the VFX world, combining their RED expertise in Computer Vision and Computer Graphics with the artistic expertise from their studios, such as The Mill, Moving Picture Company, Mikros Image, etc. Inria is a French leading research centre in Computer Sciences, where research activities in MimeTIC focus on simulating virtual humans that behave in a natural manner and act with natural motions.

### Mission confiée

This PhD will be conducted in the context of a collaboration between Technicolor and Inria. The starting date of the PhD is flexible, and could be as soon as 1st of February 2019.

### Informations générales

- **Titre de la fonction**: Docteurant
- **Niveau de diplôme exigé**: Bac + 5 ou équivalent
- **Type de contrat**: CIFRE

### Thèmes de recherche

- **Domaine**: Interaction et visualisation
- **Centre**: Inria Rennes - Bretagne Atlantique

### Date de prise en compte

- **Date de prise en compte souhaitée**: 2019-02
- **Durée de contrat**: 3 ans
- **Date limite pour postuler**: 09-30

### Contacts

- **Equipe Inria**: MimeTIC
- **Directeur de thèse**: Hoyet Ludovic / ludovic.hoyet@inria.fr

### A propos d'Inria

Inria, l'institut national de recherche dédié aux sciences du numérique, promeut l'excellence scientifique et le transfert pour avoir le plus grand impact. Il emploie 2400 personnes. Ses 200 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3000 scientifiques pour relever les défis des sciences informatiques et mathématiques, souvent à l'interface d'autres disciplines. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 160 start-up. L'institut s'efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

### L'essentiel pour réussir

There you can provide a "broad outline" of the collaboration you are looking for what you consider to be necessary and sufficient, and which may combine:

- tastes and appetencies,
- area of excellence,
- personality or character traits,
- cross-disciplinary knowledge and expertise...

This section enables the more formal list of skills to be completed and tightened.

### Consignes pour postuler

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

### Sécurité défense

Ce poste est susceptible d'être affecté dans une zone à régime restrictif (ZRR), telle que définie dans le décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L'autorisation d'accès à une zone est délivrée par le chef d'établissement, après avis ministériel favorable, tel que défini dans l'arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel défavorable pour un poste affecté dans une ZRR aurait pour conséquence l'annulation du recrutement.

### Politique de recrutement

Dans le cadre de sa politique diversité, tous les...
Directions for research

Directions of research are flexible within the proposed context, but will explore areas related to improving animation quality for production usages.

References


Compétences

Requirements for candidacy

- Strong programming skills (C/C++ recommended)
- Strong knowledge of machine learning
- Basic knowledge of computer animation and graphics

Avantages

- Subsidised catering service
- Partially-reimbursed public transport

Rémunération

Monthly gross salary amounting to 1 982 euros for the first and second years and 2 085 euros for the third year.