Virtual Reality using High-Density Electrotactile Feedback

A propos du centre ou de la direction fonctionnelle

Inria, the French national research institute for the digital sciences, promotes scientific excellence and technology transfer to maximise its impact.

It employs 2,400 people. Its 200 agile project teams, generally with academic partners, involve more than 3,000 scientists in meeting the challenges of computer science and mathematics, often at the interface of other disciplines.

Inria works with many companies and has assisted in the creation of over 160 startups. It strives to meet the challenges of the digital transformation of science, society and the economy.

Contexte et atouts du poste

This PhD position is framed under the EU H2020 ICT 25 TACTILITY project. Tactility aims at creating a new generation of smart electrotactile systems able to adapt to the user, application scenarios, and use conditions. Such electrotactile interfaces will provide high-density stimulation for delivering natural-like sensations. The ability to generate localized tactile feedback will change the way we interact with virtual reality content. Users will be able to feel the physical properties of virtual objects (e.g., roughness, stiffness) supporting a wide variety of natural interactions and information retrieval. Such technology will allow the development of algorithms for real-time rendering of high-fidelity electrotactile stimulis to the user.

One of the main hypothesis of Tactility is that it is possible to improve the feeling of immersion and embodiment by leveraging a multimodal approach, i.e., by integrating electrotactile stimuli with visual and auditory information. TACTILITY is based on a highly interdisciplinary approach. Experts from fields such as computer science, electrical/electronic engineering, psychology and neuroscience are involved.

The PhD candidate will join the Inria’s HYBRID team (https://team.inria.fr/hybrid), internationally recognized in the virtual reality and haptic research fields. Currently, the team is composed by more than 30 members working in topics related to virtual reality, augmented reality, physical simulation, haptics and human computer interaction.

Mission confiée

Research in haptics has been notably increasing in the last years, with the objective to bring wearable haptic systems to the public, provide high-fidelity feedback and natural like sensations has the potential to revolutionise VR industry. For example, Microsoft and Facebook have underpinned a notable research effort in the last years in that direction, with numerous research in wearable systems [1] and perceptual studies [2].

From existing haptic devices, tactile displays are the best placed candidates to achieve this goal. Tactile displays provide feedback to the user by stimulating the skin mechanically (e.g., vibration motors) or electrically to simulate physical properties or to convey information. For example, they are commonly used as feedback interfaces in virtual reality applications [3, 4], teleoperation [5], as well as in prosthetics, to provide sensory information from the missing limb [6]. Although a wide range of tactile displays systems exist, such as ultrasound [7], air streams [8], and piezo-matrix [9], they are either too complex to scale to large workplaces, or can render just basic information (e.g. notifications) [10].

In contrast, electrotactile displays can provide tactile feedback with high resolution and/or communicate multiple variables simultaneously [11]. Electrotactile displays deliver low-intensity electrical current to the skin in order to activate cutaneous nerve fibers and elicits tactile sensations. Electrotactile interfaces offer simple structure, low-power consumption and low cost, since there are no moving mechanical elements. Furthermore, they can integrate a large number of tactile electrodes and allow independent modulation of stimulation parameters (e.g., location, intensity and frequency).

Principales activités

The main research objective would be the creation of a new generation of “Tactile” User Interfaces (TUI) leveraging high-density electrotactile feedback. While the main usages of tactile feedback are targeted to the enhancement of dexterous interaction (e.g. grasping virtual objects), other promising usages are envisioned for the enhancement of other virtual reality tasks, such as object selection, indirect manipulation, virtual navigation or application control tasks. Current interaction techniques mainly rely on visual information in order to drive the perception-action loop. By introducing tactile feedback, we aim to enrich the information exchange between the virtual environment and the user in order to increase user’s awareness on the interaction state. Furthermore, the ability to render tactile feedback, will enable “blind” interactions as the user would be able to interact without directly looking the interface.

References


Informations générales

- **Thème/Domaine :** Interaction et visualisation
- **Ville :** Rennes
- **Centre Inria :** CRI Rennes - Bretagne Atlantique
- **Date de prise de fonction souhaitée :** 2020-10-01
- **Durée de contrat :** 3 ans
- **Date limite pour postuler :** 2020-04-26

Contacts

- **Equipe Inria :** HYBRID
- **Directeur de thèse :** Argelaguet Sanz Fernando / ferran.argelaguet@inria.fr

A propos d’Inria

Inria is the Institute national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 200 équipes-projets agiles, en général communiquées avec des partenaires académiques, impliquent plus de 3500 scientifiques pour relever les défis du numérique, souvent à l’interface d’autres disciplines. L’institut fait appel à de nombreux talents dans plus d’une quarantaine de métiers différents. 900 personnels d’appui à la recherche et à l’innovation contribuent à faire émerger et grandir des projets scientifiques ou entrepreneuriaux qui impactent le monde. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 180 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.

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 postes Inria sont accessibles aux personnes en situation de handicap.

Attention : Les candidatures doivent être déposées en ligne sur le site Inria.

Le traitement des candidatures adressées par d’autres canaux n’est pas garanti.


Compétences
The candidate must have a master degree (or equivalent), with a preference in virtual reality or computer graphics. In addition, the candidate should be comfortable with as much following items as possible:

- Master on human computer interaction or equivalent.
- Experience in 3D/VR applications (e.g. Unity3D).
- Experience in evaluation methods and controlled users studies.
- Good knowledge in programming languages.
- Good spoken and written English.
- Good communication skills. This PhD is framed under a larger project, thus the candidate would have to interact with other members of the project and assist to the project meetings.

Avantages

- Subsidized meals
- Partial reimbursement of public transport costs

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