Offer #2025-08861

PhD Position F/M Digital Tools for accompaniment of people with disabilities for sport activities

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 Centre at the University of Rennes is one of Inria's nine centres and is home to more than thirty research teams. It is a major and well-recognized player in the field of digital science. The centre is at the heart of a rich ecosystem of R&D and innovation, involving highly innovative SMEs, large industrial groups, competitiveness clusters, research and higher education institutions, excellence laboratories, and a technological research institute.

Context

Sport plays an important role in the well-being of individuals: it is known to improve the self-esteem and the autonomy of people with disabilities, as well as the social inclusion [1]. Practicing sport has also a positive impact on rehabilitation and motivation. The Paris 2024 Paralympic Games have called for a revolution for parasport. Beyond the event, we must now focus on strengthening and promoting the practice of sport by people with disabilities at all levels.

The proposed PhD aims then to offer technological tools to improve performances of users of power wheelchairs: analysis of sessions, training aid, rehabilitation tools through sport. To this aim, we propose to design solutions compatible with the virtual reality power wheelchair simulator developed at INSA Rennes as part of the

European Interreg ADAPT project. Simulators have already been proven to be efficient in the context of rehabilitation [2] [3] and we want to extend the study of the possibilities offered by these platforms to sport situations. The targeted use case is the powerchair football. The team in Rennes expressed the need to help the players to better take benefit of this sport.

The PhD work will rely on specification work led by our biomedical engineer. For the validation step, the PhD student will cooperate with clinicians of Pole Saint Hélier.

Concretly, the work will focus on two use cases. The first one is to provide an augmented reality feedback tool that considers the disabilities of each player to be able to replay game sequences for the analysis and improvement of individual performances. The PhD student will have to tackle the issue of tracking several of them, detecting players, ball and equipment. The first one is about beginners. As a specific powered wheelchair is used, it is tiring, discouraging in the worst case, to play efficiently when beginning. This will be addressed by a virtual reality scenario using a simulator. The PhD student will extend previous work [4] on everyday motorized wheelchairs to the Strike force model whose behavior is different.

Assignment

Mission

Based on the specification work, the PhD student should provide an augmented reality tool to provide feedback of sessions and matches. To permit a reliable and acceptable augmentation, the PhD student will propose a coarse-to-fine approach to estimate the 3D pose of a wheelchair. The key idea is to detect and track in the image the wheelchair, to estimate its 3D bounding box and then refine its pose estimation, similarly to [Chabot17]. It will be challenging since it is a very dynamic vehicle, with no texture. Robustness to personalized medical equipment must be tackled. This task will be reinforced with the dynamic modelling of the wheelchair behavior.

Collaboration

The thesis will be conducted within a multidisciplinary team combining skills in robotics, image analysis, virtual reality, haptics, mechanics and electronics, and will be based on the recommendations and clinical expertise of the Pôle Saint Hélier. The recruited person will be in close connection with a local team of soccer players with powered wheelchairs (Handisport Rennes Club).

Bibliography

[1] "De la physique à la pratique physique : la promotion du sport chez les personnes en situation de handicap", Lemahieu Laura, Thèse de doctorat dirigée par

Géminard Jean-Christophe, Lyon 2020

[2] "A meta-analysis and systematic literature review of virtual reality rehabilitation programs", Matt C. Howard, Computers in Human Behavior, vol70, pp 317 – 327, 2017

[3] « ViEW, a wheelchair simulator for driving analysis », Y. Morere, G. Bourhis, K. Cosnuau, G. Guilmois, E. Rumilly, and E. Blangy. . In Assistive Technology , pages 1–11. Taylor & Francis, 2018

[4] "A generic power wheelchair lumped model in the sagittal plane: towards realistic self-motion perception in a virtual reality simulator" Fabien Grzeskowiak, Ronan Le Breton, Louise Devigne, François Pasteau, Marie Babel, Sylvain Guegan. In ICRA 2023 - IEEE International Conference on Robotics and Automation, May 2023, Londres, UK

[5] F. Chabot, M. Chaouch, J. Rabarisoa, C. Teulière and T. Chateau, "Deep edge-color invariant features for 2D/3D car fine-grained classification," *2017 IEEE Intelligent Vehicles Symposium (IV)*, Los Angeles, CA, USA, 2017, pp. 733-738

[6] Fabien Grzeskowiak, Ronan Le Breton, Louise Devigne, François Pasteau, Marie Babel, Sylvain Guegan "A generic power wheelchair lumped model in the sagittal plane: towards realistic self-motion perception in a virtual reality simulator" In ICRA 2023 - IEEE International Conference on Robotics and Automation, May 2023, Londres, UK

[7] F. Grzeskowiak, M. Babel, J. Bruneau, J. Pettré. Toward Virtual Reality-based Evaluation of Robot Navigation among People. In IEEE Conf. on Virtual Reality and 3D User Interfaces, IEEE VR 2020, Atlanta, United States, Mars 2020.

[8] G. Vailland, Y. Gaffary, L. Devigne, V. Gouranton, B. Arnaldi, M. Babel. Vestibular Feedback on a Virtual Reality Wheelchair Driving Simulator: A Pilot Study . In ACM/IEEE International Conference on Human-Robot Interaction, HRI 2020, Cambridge, United Kingdom, Mars 2020.

Main activities

The PhD student will evaluate the modelling of the dynamics in the simulator to test the impact of training in virtual reality to gain confidence and reduce stress for real sessions. The PhD student will collaborate with players with disabilities, team coaches and clinicians to elaborate training scenarios.

If possible, in addition to the modelling of the dynamics during a game sequence, to provide relevant and realistic scenarios, it is necessary to model impacts between players and impacts between a player and a ball. This requires us to be able to

capture such events and then to model them. Camera embedded onto the wheelchair and motion capture systems will be used to this aim.

The evaluation of the contributions is another challenge. It requires subjective tests taking into account the feedback of the players. To perform experiments with real players, either to collect data, or to evaluate the contributions, it requires the agreement of a committee dedicated to personal protection in research projects (comité de protection des personnes (CPP)). The staff involved in this project is used to work with Pole St Helier, a rehabilitation center located in Rennes, France, to get such agreements.

Skills

- Master 120 ECTS in intelligent systems, cognitive science, robotics or similar
- C/C++ programming, Matlab, Python
- Interdisciplinary skills

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 (after 6 months of employment) 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

Remuneration

2200 per month

General Information

- **Theme/Domain :** Robotics and Smart environments
  Scientific computing (BAP E)
- **Town/city :** Rennes
- **Inria Center :** Centre Inria de l'Université de Rennes

- **Starting date :** 2025-10-01
- **Duration of contract :** 3 years
- **Deadline to apply :** 2025-06-29

Contacts

- **Inria Team :** RAINBOW
- **PhD Supervisor :**
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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

- Capacity to efficiently work in a scientific environment, passion for experimental research, capacity to connect psychology and physical phenomena
- Analytical mind, excellent oral and written communication
- Capacity to conduct independent work within a team
- Excellent level in French and/or English (C1 or equivalent)

> **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

Please submit your CV, cover letter, and any recommandations online

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.