2019-01832 - PhD Position F/M Learning Scoliosis Patterns using Anatomical Models and Motion Capture

Type de contrat : CDD de la fonction publique
Niveau de diplôme exigé : Bac + 5 ou équivalent
Autre diplôme apprécié : Master in Computer Science or Applied Mathematics
Fonction : Docteurant

A propos du centre ou de la direction fonctionnelle
Grenoble Rhône-Alpes Research Center groups together a few less than 800 people in 39 research teams and 8 research support departments.

Staff is localized on 5 campuses in Grenoble and Lyon, in close collaboration with labs, research and higher education institutions in Grenoble and Lyon, but also with the economic players in these areas.

Present in the fields of software, high-performance computing, Internet of things, image and data, but also simulation in oceanography and biology, it participates at the best level of international scientific achievements and collaborations in both Europe and the rest of the world.

Contexte et atouts du poste
Position : A full-time doctoral research position is open at INRIA - Grenoble, MORPHEO team (https://team.inria.fr/morpheo/).
Date : The position will start in fall 2019. Funding is for 36 months.
Consortium : The position is part of a collaboration between INRIA, the company Anatoscope (http://anatoscope.com/) specialized in digital anatomy simulation and the Orthopedic Pediatric’s in Grenoble (OPG) at Grenoble hospitals (http://centre-alpin-scoliose.chu-grenoble.fr/).
Advisors : The PhD will be advised by Sergi Pujades, Edmond Boyer (Morpheo INRIA), François Faure (Anatoscope) and Aurélien Courvoisier (Grenoble Hospitals).

Clinical Context
Idiopathic scoliosis is a progressive disease, with multiple forms, mostly affecting young women and evolving throughout the period of growth. Accurately classifying the scoliosis pattern of each patient at early stage would allow a major breakthrough in the prediction of disease evolution and the design of efficient treatments. Unfortunately, this is not possible using the static 3D skeleton models provided by the most advanced currently available methods.

In the recent years, motion capture data of scoliosis patients has been collected in Grenoble University Hospital. It exhibits dynamic patterns in space and over time which are of primary interests. For instance, 3D spine deformations seem better revealed through patient motions than static poses. Therefore, the scoliosis medical community is showing a great interest for computational tools that would help analyze and diagnose using novel 3D dynamic imaging techniques.

Mission confiée
Objectives
The objectives of the PhD are to investigate and create novel computational models in order to, from short to longer term:
- Build a personalized anatomic avatar that encodes both external and internal body parameters, using for that purpose individual multi-modal data (such as X-ray and surface scans).
- Investigate novel shape and motion bio-markers allowing to infer the current medical bio-markers for the scoliosis, i.e. Cobb angles and spine 3D angle rotations.
- Investigate novel shape and motion bio-markers allowing to go beyond current clinical practice and predict the scoliosis evolution during growth.

Scientific Approach
To reach the objectives a Data-Driven strategy will be used. The first objective will be to create individual anatomic models of the patients, that faithfully reproduce the acquired shape of the body as well as the motion of the spine. This includes the development of methods to automatically register the static multi-modal data of the patient (x-ray, scans) and the estimation of the physical properties of a simplified anatomical human model capable to reproduce the observed motions. Both real and synthetic data will be used towards this end. In a second part, the PhD will study how these shapes and motions correlate with the current clinical bio-markers as well as the scoliosis evolution over time.

The mid-term goal is to come up with a breakthrough clinical software for the analysis and treatment of scoliosis patients, by leveraging machine learning techniques on the

Informations générales
- Thème/Domaine : Vision, perception et interprétation multimedia
- Ville : Montbonnot
- Centre Inria : CRI Grenoble - Rhône-Alpes
- Date de prise de fonction souhaitée : 2019-10-01
- Durée de contrat : 3 ans
- Date limite pour postuler : 2019-08-25

Contacts
- Équipe Inria : MORPHEO
- Directeur de thèse : Pujades Sergi / sergi.pujades-rocamora@inria.fr

A propos d’Inria
Inria, the national institute of research dedicated to the sciences of the digital, promotes scientific excellence and the transfer for have the major impact. It employs 2400 persons. Ses 200 equipes-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
How to apply:
Please send your application including:
- Mandatory: Complete CV
- Mandatory: Letter of motivation (at most one page) - briefly describing the personal experience in the relevant areas (see Candidate Profile).
- Mandatory: Degrees and lists of grades (translated to English or French).
- Mandatory: Name and e-mail address of two references (this typically includes your Master thesis supervisor).
- Topic of Master thesis and report if available through this Jobin website.

NOTE: only complete applications submitted through Jobin will be considered.

Consignes pour postuler
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
large data set collected at Grenoble University Hospital.

**Data corpus**
The PhD will work with longitudinal studies of actual patients from Grenoble University Hospital. The multiple modalities of data include a bi-planar full-body x-ray imaging, static surface scans, as well as sparse dynamic motion capture scans. The PhD will be able to participate in the data acquisition process and suggest improvements.

**Compétences**
**Candidate Profile:**
- A master in Computer Science or Applied Mathematics (mandatory).
- Strong mathematical background – geometry – linear algebra – optimization techniques
- Language requirements: fluent spoken English or French, and fluent written English
- The candidate should have preliminary experience in at least two of the following areas: image processing – geometry processing – machine learning – temporal series – physics simulation. A specific section in the application letter must briefly describe the personal experience in these areas.
- Strong coding skills (c++ / python)

**Avantages**
- 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

**Rémunération**
Gross monthly salary for the 1st and 2nd year : 1982€
Gross monthly salary for the 3rd year : 2085€