**2020-02557 - PhD Position F/M PhD position: Robust visual localization using high level features**

**Type de contrat : CDD**
**Niveau de diplôme exigé : Bac + 5 ou équivalent**
** Fonction : Doctorant**

**Contexte et buts du poste**

Le PhD student will be based in the INRIA Nancy research center - France and will be a member of the MAGRIT group. Applications are invited for a fully-funded PhD Studentship starting in October 2020 to undertake research in the area of **Computer Vision and Machine Learning.** The team's main research focus is on visual positioning and applications with augmented reality. (see [http://magrit.loria.fr](http://magrit.loria.fr))

**Supervision and contact:** Marie-Odile Berger ([marie-odile.berger@inria.fr](mailto:marie-odile.berger@inria.fr)), Gilles Simon ([gilles.simon@loria.fr](mailto:gilles.simon@loria.fr))

This PhD is funded by a collaboration between INRIA and the German Research Center for Artificial Intelligence (DFKI, Kaiserslautern). The recruited student will attend project meetings.

**Mission confiée**

This PhD thesis will address the problem of visual positioning with the aim of going beyond classical localization and mapping, which focuses currently only on point cloud representations. In contrast, our aim is to allow for 6DOF positioning and global scene understanding in wild and dynamic environments (e.g. crowded streets). We are interested in methods that scale up nicely with the size of the environment and that can be used persistently over time by reusing consistent maps. Targeted applications are about augmented reality, particularly in urban and industrial environments.

Point-based positioning techniques are prone to error in scenes with repeated patterns and does not scale well [1]. Reasoning with objects takes advantage of a robust but approximate detection of features through the use of convolutional neural networks (CNN). However, computing the pose without prior information of detected objects and 3D models require particular 3D shape models. Both box [2] and ellipsoid models [3] have been considered in the past. We chose the latter representation and proved that it makes it possible to compute the pose in closed form (which is fast) based on very few objects (one, if the camera orientation is known, two otherwise) [4-5].

**Principales activités**

**Project description**

The goal of this PhD is to push forward the state of the art in visual and spatio-temporal positioning in complex environments, merging novel machine learning approaches with geometric reasoning. In the continuity of our recent works on the joint use of geometric cues, vanishing points [6], and semantic cues/objects [4-5], our aim is to generate new high level features suitable for localization as well as means to match them, to define their uncertainty and to integrate them into localization procedures for improved robustness.

The PhD student will be tasked with:

- detecting vanishing points in complex (i.e. non-Manhattan) environments based on high-level (object) detections,
- estimating the uncertainty associated to low and high level features contributing to pose and SLAM and integrating them into the localization process,
- developing new data association methods suited to objects and based on geometry, appearance and semantic criteria,
- defining improved approximations of 3D objects that can give rise to direct pose computation.

**Bibliographie**


**Informations générales**

- **Thème/Domaine:** Vision, perception et interprétation multimedia
- **Ville:** Villers les Nancy
- **Centre INRIA:** CRI Nancy - Grand Est
- **Date de prise de fonction souhaitée:** 2020-10-01
- **Durée de contrat :** 3 ans
- **Date limite pour postuler :** 2020-05-27

**Contacts**

- **Equipe INRIA :** MAGRIT
- **Directeur de thèse :** Berger Marie-odile / marie-odile.berger@inria.fr

**A propos d'Inria**

Inria est l’institut national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 200 équipes-projets agiles, en général communes 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.

**L’essentiel pour réussir**

**Skills and profile**

Applicants must hold an MSc degree in computer science or electrical engineering with prior experience in computer vision and machine learning.

**How to apply**

Interested candidates should express their interest by sending the following documents as soon as possible to:

- [marie-odile.berger@inria.fr](mailto:marie-odile.berger@inria.fr)
- [gilles.simon@loria.fr](mailto:gilles.simon@loria.fr)

- Brief statement of interest (max 1 page).
- CV.
- Certificate of academic degree with grades.
- A short (max one page) description of your Master thesis (or equivalent) or of the work in progress if not yet completed.
- Name and contact of two referees.

**Additional information:** See [http://magrit.loria.fr](http://magrit.loria.fr) for additional information on the activities of the team.

**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°2011-1423 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...
Compétences
Skills and profile
Applicants must hold an MSc degree in computer science or electrical engineering with prior experience in computer vision and/or machine learning.
Languages: French or English

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
Monthly salary after taxes: around 1596,05€ for 1st and 2nd year. 1678,99€ for 3rd year. (medical insurance included).