Offre n°2023-06911

Internship: Small object detection in aerial images and ground photos: application to manhole cover detection

Le descriptif de l’offre ci-dessous est en Anglais

Niveau de diplôme exigé : Bac + 4 ou équivalent

Fonction : Stagiaire de la recherche

A propos du centre ou de la direction fonctionnelle

The Inria centre at Université Côte d’Azur includes 37 research teams and 8 support services. The centre's staff (about 500 people) is made up of scientists of different nationalities, engineers, technicians and administrative staff. The teams are mainly located on the university campuses of Sophia Antipolis and Nice as well as Montpellier, in close collaboration with research and higher education laboratories and establishments (Université Côte d’Azur, CNRS, INRAE, INSERM ...), but also with the region’s economic players.

With a presence in the fields of computational neuroscience and biology, data science and modeling, software engineering and certification, as well as collaborative robotics, the Inria Centre at Université Côte d’Azur is a major player in terms of scientific excellence through its results and collaborations at both European and international levels.

Contexte et atouts du poste

Knowledge of urban sewerage and drainage networks is essential for the rational management of natural resources (pollution transfer), flood control and transportation network management. Acting as rainwater collectors, drainage networks can overflow at certain points and exacerbate flooding. However, most hydraulic models do not take into account the drainage network, which is assumed to be rapidly saturated during a flood event. However, this is not due to a limitation of the models, but to a lack of knowledge of the characteristics of the networks. In fact, in many countries, whether developed or emerging, maps of networks or diagrams of structures are not widely available or are highly imperfect.

In France, local authorities are now responsible for wastewater treatment and must draw up a detailed description of wastewater and rainwater collection and transport facilities. But the maps available are still not very accurate, not very detailed and sometimes in analog format.

Image processing methods based on a geometric filter and a deep learning approach have demonstrated to be effective for detecting manhole covers on very high spatial resolution aerial images [2, 4, 5]. These works leveraged an early convolutional neural network model, AlexNet, to detect manholes from images at 5 cm spatial resolution acquired over two communes near Montpellier. The initial results showed that the manhole covers could be detected with an accuracy of 72% and a recall of 54% (which could be as high as 60%). Beyond the use of aerial imagery, several works have demonstrated that street-level imagery can be of great interest to detect and locate road objects [7]. The joint exploitation of aerial and street-level imagery has also been recently explored for enhancing aerial image segmentation [6], land use mapping for urban settlement [3] and traffic signs detection [1].

Several avenues of research could be explored to improve current manhole detection results, more precisely i) evaluate more recent deep learning frameworks for both semantic segmentation and object detection and ii) integrate street-level imagery in a multi-modal analysis in order to assess the added value of this complementary information source for the process of manhole detection and location.

Mission confiée

The aim of the internship will be to build upon our previous work on the detection of manhole covers through very high spatial resolution images using modern deep neural networks.

Principales activités

The aim of the internship will be to build upon our previous work on the detection of manhole covers through very high spatial resolution images using modern deep neural networks. More specifically, it will involve:

- Carrying out a bibliographical study of recent advances on the subject, in order to determine the current deep learning architecture(s) best suited to the problem.
- Train and validate a network on the images available (and if possible, on other images of lower resolution, available in open source).
- Reduce as much as possible possible false positives by verifying the actual presence of manhole covers detected on street-view images.

**Compétences**

- Master 2 in computer science or signal processing, with good knowledge on machine learning and/or image analysis.
- Tools and programming language : Python (preferably) and familiarity with some deep learning library (PyTorch, Tensorflow).

**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

**Informations générales**

- **Thème/Domaine** : Sciences de la planète, de l'environnement et de l'énergie
- **Calcul Scientifique** (BAP E)
- **Ville** : Montpellier
- **Centre Inria** : Centre Inria d'Université Côte d'Azur
- **Date de prise de fonction souhaitée** : 2024-02-01
- **Durée de contrat** : 6 mois
- **Date limite pour postuler** : 2024-02-14

**Contacts**

- Équipe Inria : LEMON
- Recruteur : Delenne Carole / carole.delenne@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 215 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3900 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 200 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**

More information can be found on this pdf file

**Supervision**

0. Evergreen : Diego Marcos Gonzalez
1. Lemon : Carole Delenne

**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.

**Consignes pour postuler**

Applications must be submitted online on the Inria website. Collecting applications by other channels is not guaranteed.

**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.