



Offre n°2024-07231

PhD Position F/M Estimating/Modelling the statistical degradation laws of the secondary road network from video-based pavement monitoring

Type de contrat : Fixed-term contract

Niveau de diplôme exigé : Graduate degree or equivalent

Fonction : PhD Position

A propos du centre ou de la direction fonctionnelle

The Inria Centre at Rennes University is one of Inria's eight centres and has more than thirty research teams. The Inria Centre is a major and recognized player in the field of digital sciences. It is at the heart of a rich R&D and innovation ecosystem: highly innovative PMEs, large industrial groups, competitiveness clusters, research and higher education players, laboratories of excellence, technological research institute, etc.

Contexte et atouts du poste

Scope

The ROAD-AI challenge is a collaborative project between INRIA and Cerema, started in 2021. The objective is to study some innovative solutions that may ease the management of transport infrastructures (roads, structures).

Within this context, the following PhD thesis is proposed to develop a specific solution for the maintenance of secondary road assets, i.e., low-traffic roads, from video-based surface monitoring data only, namely, pavement images.

[1] <https://www.inria.fr/fr/road-ai-defi-infrastructures-routieres-durables-sures-resilientes>

Keywords: Statistical modeling, image segmentation, machine learning, non-destructive testing.

Mission confiée

Thesis objectives and contents

To manage and maintain the performance of road assets, stakeholders have been using statistical models to predict road degradations with time and traffic, namely, roadway evolution and/or survival law models. These models are based on measurements of different specific physical quantities, which are related to pavement management and carried out in situ by specialized operators. This management approach prevails on the high-traffic national network and might be adapted to the secondary road network. Compared to the national network, the secondary road network experiences lower traffic and is less instrumented and documented.

The objective of the thesis will be, on the one hand, to assess the feasibility of updating the statistical degradation model laws of roadway from video-based imaging the pavement surface conditions; and on the other hand, to adapt the latter approach to the secondary road network.

The expectations of the thesis require a large enough data base of labelled pavement images along with the corresponding detailed knowledge of the underlying pavement structure. Images labelling (with annotation, record of disorders, etc.) will be provided for the study and may cover a 5 years period at least.

To meet the objectives of the thesis, the following issues are considered:

- Bibliographical survey:

- o the existing survival/evolution laws which are based on both the structural and the surface conditions of the roadway.

o the existing automatic image processing techniques, e.g., segmentation and feature engineering, to estimate surface condition indicators.

o the simplifying hypotheses that could be applied on the secondary road network

- The selection and the computation of the surface condition indicators within pavement images which then serve as input parameters to the statistical degradation laws.

- The determination of the relevant image analysis scale being adapted to the estimation of the roadway degradation laws; it will be determined in relation with the diagnostic needs, the gridding scale at which the pavement structure and data on road surface conditions can be provided, etc.

- The development of the model versatility for further adaptation to various roadways context and specific management issues, e.g., climate changes, mid-mountain vs. sea-shore climate.
- The performance assessment of the statistical model laws should take account of the accuracy on the estimated surface indicators. The performance of the algorithms will be compared to some benchmark method which is routinely used at the operational level.

Host teams: joint Inria/UGE project team (I4S) and Cerema research team (ENDSUM)

Working location: Strasbourg (Cerema)

Start: fall 2024

Duration: 3 years

Application deadline: 30th of June 2024

Management

- **Director:** laurent.mével@inria.fr
- **Supervisors:** philippe.foucher@cerema.fr; vincent.baltazart@univ-eiffel.fr
- **Associated experts:** alain.hebting@cerema.fr; fabien.menant@univ-eiffel.fr

Compétences

Good writing and communication skills in English.

Mastery of Latex, Word, Python, Overleaf, Matlab are a plus.

Avantages

- Subsidized meals
- Partial reimbursement of public transport costs
- Possibility of teleworking (90 days per year) and flexible organization of working hours
- Partial payment of insurance costs

Rémunération

Monthly gross salary amounting to 2100 euros for the first and second years and 2200 euros for the third year

Informations générales

- **Thème/Domaine :** Optimization, machine learning and statistical methods
Statistics (Big data) (BAP E)
- **Ville :** Strasbourg
- **Centre Inria :** [Centre Inria de l'Université de Rennes](#)
- **Date de prise de fonction souhaitée :** 2024-10-01
- **Durée de contrat :** 3 years
- **Date limite pour postuler :** 2024-05-07

Contacts

- **Équipe Inria :** [I4S](#)
- **Directeur de thèse :**
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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

Required Skills and scientific background

- Statistics, applied mathematics, pattern recognition and/or machine learning.
- Computing skills in Python and/or Matlab and/or R and/or Julia languages.
- Background on physics, mechanics and non destructive testing would be appreciated.
- Good writing skills and communication reporting.

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

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.