2018-01032 - Postdoc Position in Machine Learning applied to aviation (M/F)

Type de contrat : CDD de la fonction publique  
Niveau de diplôme exigé : Thèse ou équivalent  
Fonction : Post-Doctorant

A propos du centre ou de la direction fonctionnelle

The Inria Lille - Nord Europe Research Centre was founded in 2008 and employs a staff of 360, including 300 scientists working in sixteen research teams. Recognised for its outstanding contribution to the socio-economic development of the Nord - Pas-de-Calais Region, the Inria Lille - Nord Europe Research Centre undertakes research in the field of computer science in collaboration with a range of academic, institutional and industrial partners.

The strategy of the Centre is to develop an internationally renowned centre of excellence with a significant impact on the City of Lille and its surrounding area. It works to achieve this by pursuing a range of ambitious research projects in such fields of computer science as the intelligence of data and adaptive software systems. Building on the synergies between research and industry, Inria is a major contributor to skills and technology transfer in the field of computer science.

Contexte et atouts du poste

Commercial aviation is already responsible of 3% of the total CO2 emissions, and with a constant growth rate of 5% per year, traffic will double within the next decade. Major improvements have been made in aircraft design and materials, engines performance and efficiency; still aircrafftoperations remain unchanged for many years. With the digital transformation of many industries, airline operations have been just at the beginning of a major change. With the support of new technologies related to machine learning and artificial intelligence, in-flight connectivity, major improvements can be introduced to optimize flight trajectories.

The main objective of PERF-AI is to bring those new technologies to the field of aviation based on statistical analysis of flight data that are generated by aircraft throughout their lifecycle.

Currently, aircraft manufacturers, flight management systems and flight preparation software providers are using a single manufacturer’s performance model that is the same for every aircraft of the same type, and also on a weather forecast that is computed long before the flight.

The performance is based on manufacturer’s model that is derived from flight tests conducted on brand new aircraft during certification phase. The only corrections applied to those performance models are made through the fuel or performance factor, that is a single percentage applied to the whole flight, though it is only a measurement made during cruise phase and corresponds to a steady flight. PERF-AI will focus on the challenge of minimizing fuel consumption throughout the flight. The aim will be to provide a flight trajectory optimization prototype that implements new machine learning performance models. Minimizing the fuel consumption can be mathematically modelled as an optimal control problem, whose solution is expected to be as close as possible to the best trajectory in reality. This can only be achieved if the mathematical modelling of the problem is performed as accurately as possible, a requirement for this being the precise estimation of the aircraft’s behaviour. This motivates the search for narrow system identification techniques, which are the main topic of this call. Several machine learning methods will be identified and tested for this purpose. New techniques will be proposed in order to have the most accurate tool as possible. Moreover, high-level artificial intelligence techniques will use the machine learning models for the objective of the fuel use minimization.

Mission confiée

The post holder is expected to start in January 2019 or later. The position is funded for 18 months. The average gross monthly salary is about 2700€. The position comes with health insurance and social benefits, such as subsidised catering service and partially-reimbursed public transport.

The project PERF-AI is funded by the European Commission for the period 2018–2020. The post holder will be working within the Modal project-team of the Inria Lille - Nord Europe research center, under the direct supervision of (i) Dr. Benjamin Guedj, research scientist at Inria, (ii) Dr. Vincent Vandewalle, assistant Professor at Lille University.

Inria is the top french research institute in computer science and mathematics, with a particular focus on machine learning and artificial intelligence. Inria is organized in eight research centers.

Further info on Inria and its Lille - Nord Europe research center:

https://www.inria.fr/en/  
https://www.inria.fr/en/centre/lille

Lille, France is a beautiful, historic city conveniently located near Paris, Brussels, and London with excellent train and air connections (50 minutes by high-speed train to CDG international airport), and is renowned for its welcoming living environment.

Further info on Lille: https://en.wikipedia.org/wiki/Lille  
Occasional travels to Safety Line’s offices in downtown Paris are expected.

Safety Line is an innovative digital technology company, specialised in data management software solutions for aviation. With a team of highly experienced Safety experts (including former BEA investigators), data scientists and IT specialists, SL aims to bring their capabilities ranging from flight data recorder raw data decoding and processing, big data analytics to perform flight profile optimization (OptiClimb), end to end IT solutions for airlines operations.  

Principales activités
The postdoc will define the mathematical problem from the technical challenges and the flight data characteristics (time-dependent data, large correlations between flight parameters, large scale data) in a general setting.

A supervised statistical learning setting (regression model) will be defined since the scalar outcome can be extracted from the data (consumption, aerodynamic forces, etc.).

The postdoc will identify relevant state-of-the-art machine learning algorithms. It includes, but not limited to, tree-based ensemble algorithms and Gradient Boosting algorithms, model aggregation, Bayesian and kernel methods. Safety Line will bring an expertise to the flight data and flight mechanics that will support the statistical modelling.

A particular focus will be on the development of an optimization procedure which makes use of the aircraft performance model defined. A reinforcement learning setting with continuous states and actions will be investigated in order to take into account nonparametric performance models. The optimization tools will be adapted to all flight phases (climb, cruise, descent) and a first proof of concept will be implemented.

**Compétences**

- PhD degree in statistics, machine learning, or related area.
- Working fluency in English. French is also helpful but not required, as international research in the area is typically published and presented in English.
- Ability to take leadership roles on research projects, and also to engage in cooperative teamwork.
- Ability to write research papers and diffuse results in international conferences.
- Good Python programming skills for running experiments with developed algorithms.

**Avantages sociaux**

- Subsidised catering service
- Partially-reimbursed public transport
- Social security
- Paid leave

**Rémunération**

Gross salary 2653 € per month.

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**Informations générales**

- **Thème/Domaine** : Optimisation, apprentissage et méthodes statistiques
  Statistiques (Big data) (BAP E)
- **Ville** : Villeneuve d'Ascq
- **Centre Inria** : CRI Lille - Nord Europe
- **Date de prise de fonction souhaitée** : 2019-01-01
- **Durée de contrat** : 1 an, 6 mois
- **Date limite pour postuler** : 2018-12-31

**Contacts**

- **Equipe Inria** : MODAL
- **Recruteur** :
  Guedj Benjamin / benjamin.guedj@inria.fr

**A propos d'Inria**

Inria, the institute national de recherche dédié aux sciences du numérique, promote l'excellence scientifique et le transfert pour avoir le plus grand impact. Il emploie 2400 personnes. Ses 200 équipes-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.

**Conditions pour postuler**

Full applications will be processed in priority (CV + Cover letter + 2 letters of recommendation).

**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.

**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.