2018-01036 - Engineer Position in Machine Learning applied to aviation (M/F)

**Level of qualifications required:** Graduate degree or equivalent  
**Function:** Temporary scientific engineer  
**Level of experience:** Recently graduated

### About the research centre or Inria department

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. Recognized 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.

### Context

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 aircraft operations 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. By using a machine learning model, 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 modeling of the problem is performed as accurately as possible, a requirement for this being the precision 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 models 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 minimizing the fuel consumption.

### Assignment

The post holder is expected to start in June 2019 or later. The position is funded for 12 months. 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/)  
- [https://www.inria.fr/en/centre/lille](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](https://en.wikipedia.org/wiki/Lille)  

Occasional travels to Safety Line's offices in downtown Paris are expected. 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:

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### Main activities

The engineer will implement the machine learning models defined by the consortium, relying in particular on flight data characteristics (time-dependent data, large correlations between flight parameters, large scale data).

### General Information

- **Theme/Domain:** Optimization, machine learning and statistical methods  
- **Statistics (Big data) (BAP E)**
- **Town/city:** Villeineuve d'Ascq  
- **Inria Center:** CR Lille - Nord Europe  
- **Starting date:** 2019-06-01  
- **Duration of contract:** 1 year  
- **Deadline to apply:** 2019-06-30

### Contacts

- **Inria Team:** MODAL  
- **Recruiter:** Guedj Benjamin / benjamin.guedj@inria.fr

### About Inria

Inria, the French National Institute for computer science and applied mathematics, promotes "scientific excellence for technology transfer and society". Graduates from the world's top universities, Inria's 2,200 employees rise to the challenges of digital sciences. With its open, agile model, Inria is able to explore original approaches with its partners in industry and academia and provide an efficient response to the multidisciplinary and application challenges of the digital transformation. Inria is the source of many innovations that add value and create jobs.

### Conditions for application

The complete application will be processed in priority (CV + cover letter + 1 or more recommendation letter + grades transcripts (if applicable)).

### Defence Security

This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST). Authorization to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

### Recruitment Policy

As part of its diversity policy, all Inria positions are accessible to people with disabilities.

### Warning

You must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.
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 engineer will implement in Python a general pipeline to address data assimilation, processing, and machine learning models (including, but not limited to, tree-based ensemble algorithms, 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.

**Skills**
- Master degree in statistics, machine learning, computer science 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 read and understand research articles, and implement corresponding algorithms in a Python environment.
- Ability to engage in cooperative teamwork (such as frequent reporting).
- Excellent Python programming skills.

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

**Remuneration**
Compensation according to the profile.