



**Offer #2024-07584**

## **Doctorant F/H A learning theory for over-parametrized bilevel optimization**

**Contract type :** Fixed-term contract

**Level of qualifications required :** Graduate degree or equivalent

**Fonction :** PhD Position

### **About the research centre or Inria department**

The Inria Grenoble research center groups together almost 600 people in 23 research teams and 7 research support departments.

Staff is present on three campuses in Grenoble, in close collaboration with other research and higher education institutions (University Grenoble Alpes, CNRS, CEA, INRAE, ...), but also with key economic players in the area.

Inria Grenoble is active in the fields of high-performance computing, verification and embedded systems, modeling of the environment at multiple levels, and data science and artificial intelligence. The center is a top-level scientific institute with an extensive network of international collaborations in Europe and the rest of the world.

### **Context**

Bilevel optimization is a class of methods for solving optimization problems that have a hierarchical structure. These problems typically require optimizing two interdependent objectives: a lower-level objective  $g$  whose optimal solution is provided to an upper-level objective  $f$ . The hierarchical structure arises by taking into account the dependence of the lower-level solution on the upper-level variable (see figure below). These methods are increasingly recognized as a promising approach for solving a multitude of machine learning problems such as hyper-parameter optimization, meta-learning, meta-reinforcement learning [1] and metric learning [2]. Consequently, there has been an increased interest in developing scalable and reliable bilevel optimization methods for machine learning [3].

Despite recent progress in bilevel optimization, the hierarchical structure of bilevel problems raises many challenges when applied to machine learning problems involving large over-parametrized neural networks. While the use of such networks is ubiquitous and offers high modelling flexibility, it often results in non-convex bilevel problems with multiple solutions for which the generalization properties are poorly understood.

The PhD project aims at developing a learning theory for predictive models resulting from a bilevel optimization procedure.

### **Assignment**

#### **Assignments :**

The PhD project aims at developing a learning theory for predictive models resulting from a bilevel optimization procedure.

### **Main activities**

Research

### **Benefits package**

- 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 (90 days / year) 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
- Complementary health insurance under conditions

## Remuneration

1st and 2nd year: 2 082 euros gross salary /month

3rd year: 2 190 euros gross salary / month

## General Information

- **Theme/Domain** : Optimization, machine learning and statistical methods Statistics (Big data) (BAP E)
- **Town/city** : Montbonnot
- **Inria Center** : [Centre Inria de l'Université Grenoble Alpes](#)
- **Starting date** : 2024-10-01
- **Duration of contract** : 3 years
- **Deadline to apply** : 2024-05-18

## Contacts

- **Inria Team** : [THOTH](#)
- **PhD Supervisor** :  
Arbel Michael / [michael.arbel@inria.fr](mailto:michael.arbel@inria.fr)

## About Inria

Inria is the French national research institute dedicated to digital science and technology. It employs 2,600 people. Its 200 agile project teams, generally run jointly with academic partners, include more than 3,500 scientists and engineers working to meet the challenges of digital technology, often at the interface with other disciplines. The Institute also employs numerous talents in over forty different professions. 900 research support staff contribute to the preparation and development of scientific and entrepreneurial projects that have a worldwide impact.

**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.

## Instruction to apply

### 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). Authorisation 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.