**2018-00808 - Post-doctorant offer : PAC-Bayesian Analysis of artificial neural networks (M/F)**

**Contract type :** Public service fixed-term contract  
**Level of qualifications required: **PhD or equivalent  
**Fonction :** Post-Doctoral Research Visit

### 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. 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.

### Context

The MODAL team is active in both statistics and machine learning communities. One main research topic is to provide theoretical justifications on learning procedures. To this end, a part of the team (brought together by the researchers Pascal Germain and Benjamin Guedj) is fond of the PAC-Bayesian theory, which allows to express statistical guarantees on the quality of machine learning algorithms. These guarantees are typically stated as probability bounds on the generalization loss, known as generalization bounds. There are two appealing characteristics of these bounds: (i) the bounds are computable from the training loss, that is, without relying on a testing set; (ii) one can derive efficient algorithms to optimize them.

Note that the starting date of this 18-month postdoc may be postponed at the begin of year 2019 according to the candidate availability.

### Assignment

The person recruited will join a recent collaborative project initiated by two MODAL team researchers (Pascal Germain and Benjamin Guedj) with three colleagues of the Laboratoire Hubert Curien at University Jean Monnet of Saint-Etienne (Emilie Morvant, Amaury Habrard, and Rimi Emonet). The primary aim is to contribute to the theoretical understanding of representation learning successes - and in particular (deep) neural networks - with a heavy use of the PAC-Bayesian statistical learning theory. Among others, the conducted research will imply deriving generalization bounds for neural networks, empirically validating the bounds accuracy as model selection criteria (ideally they would allow us to get rid of the validation set), and potentially proposing new training methodologies based on the developed theory. Thus, the conducted research will cover both theoretical and practical aspects.

The person recruited will work with MODAL researchers, students and collaborators, and he/she will participate in the redaction of research articles. Travel expenses for participation to conferences and related scientific events are covered within the limits of the scale in force.

### For a better knowledge of the proposed research subject:

These research papers give an overview of the PAC-Bayesian theory as practised by Pascal Germain and its collaborators:

- **Pascal Germain, Alexandre Lacoste, Francois Laviolette, Maria Marchand, Jean-Francis Roy.** Risk bounds for the majority vote: from a PAC-Bayesian analysis to a learning algorithm. JMLR 2015
- **Pascal Germain, Amaury Habrard, François Laviolette, Emilie Morvant.** A New PAC-Bayesian Perspective on Domain Adaptation. ICML 2016.

Various PAC-Bayesian approaches are presented in the material of last NIPS Workshop on the subject:

- (Almost) 50 Shades of Bayesian Learning: PAC-Bayesian trends and insights

### Main activities

**Scientific research:**

2. Conduct empirical experiments to assess the accuracy of theory-based learning methodology and model selection criterion.
3. Collaborate with other researchers, PhD students and interns.
4. Write reports and submit research articles.

### Skills

**Technical skills:**

- Programming: Python, R.

**Non-technical skills:**

- Communication.
- Work in a team.
- Autonomy.

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**General Information**

- **Theme/Domain:** Optimization, machine learning and statistical methods
- **Town/city:** Villeneuve d’Ascq  
- **Inria Center:** CRI Lille - Nord Europe  
- **Starting date:** 2018-11-01  
- **Duration of contract:** 1 year, 6 months  
- **Deadline to apply:** 2018-08-31

**Contacts**

- **Inria Team:** MODAL  
- **Recruiter:**  
  Pascal Germain  
  pascal.germain@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 2,700 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 full application will be processed in priority (CV + motivation letter)

**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.

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**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.
Machine/Statistical learning
- Preparation of scientific documents (knowledge of LaTeX mandatory)
- Practical experience with neural network training (knowledge of PyTorch and/or TensorFlow is a strong plus)

Benefits package
- Subsidised catering service
- Partially-reimbursed public transport

Remuneration
2653€ gross per month