2018-00243 - [NEO] PhD Position / A SINGULAR PERTURBATION APPROACH FOR MACHINE LEARNING IN MULTIOBJECTIVE MARKOV DECISION PROCESSES WITH LEXICOGRAPHIC OPTIMISATION

**Contract type**: Public service fixed-term contract  
**Level of qualifications required**: Graduate degree or equivalent  
**Fonction**: PhD Position

### 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.

### About the research centre or Inria department

The Inria Sophia Antipolis - Méditerranée center counts 37 research teams and 9 support departments. The center’s staff (about 600 people including 400 Inria employees) is composed of scientists of different nationalities (250 foreigners of 50 nationalities), engineers, technicians and administrators. 1/3 of the staff are civil servants, the others are contractual. The majority of the research teams at the center are located in Sophia Antipolis and Nice in the Alpes-Maritimes. Six teams are based in Montpellier and a team is hosted by the computer science department of the University of Bologna in Italy. The Center is a member of the University and Institution Community (ComUE) “Université Côte d'Azur (UCA)”.

### Context

This PhD position is within framework of the joint laboratory Inria - Nokia Bell Labs.

### Assignment

Multi-objective optimization is often handled by either searching for a Pareto optimal solution or by formulation of the problem as a constrained optimization in which one optimizes one of the objectives and imposes constraints on all other objectives. We propose a new way to formulate multi-objective optimization as a lexicographic problem. This is motivated by lexicographic optimization encountered in engineering, such as max-min fairness definition in networking.

For a problem with \( N \) objectives, a lexicographic optimization is defined in an \( N \) step recursive way, in which at step 1 we compute the set \( S(1) \) of optimal solutions of the optimization of the 1st objective, and at step \( i > 1 \) we compute the set \( S(i) \) of solutions of the optimization of the \( i \)-th objective restricted to the set \( S(i-1) \).

Within this research shall propose dynamic programming based solutions for the problem of computing the sets \( S(i) \) and for obtaining lexicographic optimization of multi-objective Markov decision problems. We shall then propose adaptive control algorithms for combining learning and control in the case that the parameters of the Markov decision problem are not known in advance.
optimization objective at each steps we shall use the average cost criterion.
We shall extend this at the second and third years of the thesis to risk sensitive cost criterion.

References:

Main activities
Write scientific papers for conferences and for journals, participate in patents

Skills
Technical skills and level required :
Languages : English
Relational skills : Works well in team

Benefits package
- Subsidised catering service
- Partially-reimbursed public transport
- Social security
- Paid leave
- Flexible working hours
- Sports facilities

Remuneration
Duration: 36 months
Location: Sophia Antipolis, France
Gross Salary per month: 1982€ brut per month (year 1 & 2) and 2085€ brut/month (year 3)

General Information
- **Theme/Domain** : Networks and Telecommunications
- **Scientific computing** (BAP E)
- **Town/city** : Avignon
- **Inria Center** : CRI Sophia Antipolis - Méditerranée
- **Starting date** : 4/1/18
- **Duration of contract** : 3 years
- **Deadline to apply** : 3/31/18

Contacts
- **Inria Team** : NEO
- **Recruiter** :
  Altman Eitan / eitan.altman@inria.fr

Conditions for application
Application file: Applications must be submitted online on the Inria website. Collecting applications by other channels is not guaranteed.

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.

*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.