2018-00791 - PhD Position : Algorithms for shared on-demand transportation services in urban area

Level of qualifications required : Graduate degree or equivalent

Fonction : PhD Position

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

Hosting team. COATI (Combinatorics, Optimization, and Algorithms for Telecommunications, https://team.inria.fr/coati/) is a joint project-team between Inria Sophia Antipolis - Méditerranée and the I3S laboratory (UCA, CNRS). Its research fields cover Algorithms, Discrete Mathematics and Combinatorial Optimization with applications in various kinds of networks, including communication networks design and provisioning (optical WDM, MPLS, Backhaul, SDN, 5G, etc.), networks of proteins in bio-informatics, economics networks, as well as transportation networks. COATI has ongoing collaborations with SMEs Instant-System and Benomad.

The PhD thesis will be done in the framework of a partnership between COATI and Instant-System (http://instant-system.com/), a SME specialized in smart-mobility and based in Sophia-Antipolis.

Assignment

Summary of the project. We are interested in enhancing the mobility of citizens in urban areas by providing them, through a unique interface enabling to express their preferences, the most convenient transportation means to reach their destinations. The proposed itinerary may combine several of the many available means of transportation (buses, tram, metro, shared bicycles, carpooling, etc.). The complexity of computing such multimodal itinerary comes from the variety of the possible modes of transportation that have to be combined. Moreover, we want to enable the design of a mobility companion (a mobile application) able not only to guide the user along her journey, including when and how to change of transportation mean, but also to propose itinerary changes when the current one exceeds a threshold delay.

To this end, we collaborate with SME Instant-System that designs, commercializes and operates a multimodal platform including: the traveler's real-time information on public transport; a multimodal trip planner; the integration of carpooling in metropolitan area, so for short trips, associated smartphone app and web sites. The real time trip planner is a very innovative technological brick. Indeed, even in major French networks where real-time data is available on all channels, trip calculations are always based on theoretical timetables (this is for instance the case in Paris). In fact, in a mobile situation, the proposed trip does not take into account the actual state of the network. To overcome this issue, Instant-System integrates and continuously refreshes the position of all bus, subway, streetcar on the network and uses them in the trip calculations.

In this context, we aim at studying and developing algorithms for a new form of shared on-demand transportation service. With an Uber-like on-demand service, a user quickly gets a fast solution to reach her destination, but she has to pay a high price. With shared on-demand services, the system assigns several passengers to a vehicle to share expenses, and optimizes the routes of the vehicles so as to satisfy users constraints while optimizing operator's costs. The quality of service for passengers is lower (longer trips) but the price is reduced. This shared mode is different from carpooling since here the route of a vehicle is optimized for its passengers.

Main activities

The PhD student will investigate the algorithmic solutions enabling a city to operate such service as part of its PT offer. Questions of interest concern

- the fast computation of mix journey for the users combining on-demand service with regular transportation means (bus, metro, etc.),
- the design of flexible data structures and algorithms enabling fast query and update times,
- the filling of vehicles, the optimization of the overall operation cost, the pre-positioning of vehicles, etc.

Skills

Skills and profile :

- Master 2 in Computer Science or Operation Research
- Good knowledge of graph theory, graph algorithms and combinatorial optimization.
- Experience with Integer Linear Programming or Constraints Programming is appreciated.
- Programming skills (Java, C/C++, Python).
- Fluent English required, both oral and written. French is appreciated but not mandatory.

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**: Sophia Antipolis  
- **Inria Center**: CRI Sophia Antipolis - Méditerranée  
- **Starting date**: 2018-10-01  
- **Duration of contract**: 3 years  
- **Deadline to apply**: 2018-07-31

**Contacts**

- **Inria Team**: COATI  
- **Recruiter**: Coudert David / david.coudert@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**

**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.