Offre n°2020-02497

Post-Doctoral Research Visit F/M (BN 20) Generic Algorithms for Electric Vehicle Routing Problems

Le descriptif de l'offre ci-dessous est en Anglais

Type de contrat : CDD

Niveau de diplôme exigé : Thèse ou équivalent

Fonction : Post-Doctorant

A propos du centre ou de la direction fonctionnelle

Our aim is to develop tight formulations for combinatorial problems by combining the latest reformulation techniques, such as Lagrangian and polyhedral approach, non-linear programming tools and graph theoretics tools. Through industrial partnerships, the team targets large scale problems such as those arising in logistics (routing problems), in planning and scheduling, in network design and control, and in placement problems (cutting stock problems).

Contexte et atouts du poste

The work will be conducted in the Inria project-team ReAlOpt, in the building of Mathematics Institute of Bordeaux (IMB). The team is specialised in developing tight formulations and algorithms for combinatorial optimization problems exploiting the complementarity between the latest reformulation techniques, such as Lagrangian and polyhedral approaches (the generation of columns and cutting planes), and graph theoretic tools (for induced properties and implicit representations of solutions). Our focus is on deterministic optimization approaches based on mathematical programming, but our experience extends to stochastic programming, constraint programming, and graph
theory.

Mission confiée

Mixed Integer Linear Programming (MILP) is the most widespread approach for solving combinatorial optimization problems. There exist many important problems which should necessarily be modelled using MILP formulations with exponential number of variables in order to be solved in a reasonable time. Existing MILP solvers implementing the Branch-and-Cut method are not capable of solving such models. An alternative approach suitable for such formulations is Branch-Cut-and-Price
(BCP).

Recently an exact BCP solver has been proposed called VRPSolver, which
exploits the resource constrained path (RCP) structure, often encountered in combinatorial optimization problems. Although this solver is less generic than existing MILP solvers, it still can be used for solving a large variety of problems including vehicle routing and packing problems. VRPSolver is much more efficient than MILP or other BCP solvers for such problems, and thus it can solve instances of practically relevant size.

At the moment, VRPSolver can handle only trivial additive resources, which limits its modelling capabilities. Many vehicle routing problems cannot be tackled using VRPSolver because of this limitation, including the important class of electric vehicle routing problems.

The commercial adoption of electric vehicles requires routing optimization tools that address charging decisions. Electric vehicle routing problems (eVRPs) introduce an interdependency between resources (notably between the time spent charging and the battery's energy level) meaning that tackling eVRPs using BCP involves managing infinitely non-dominated states in the subproblem. Linear charging functions have been considered in, but there is still a lack of a
generic tool that takes more realistic charging functions (e.g., piecewise linear) into account.

Principales activités

The goal of the work is to extend capabilities of VRPSolver, by allowing the user to model and solve a much larger class of problems, including electric vehicle routing problems. To achieve this goal, three following topics should be addressed.

- One needs to design an interface for easily modelling various vehicle routing problems. This interface should include the possibility to specify resources with non-trivial

resource extension functions, including functions whose values depend on the current resource consumption.
- Most importantly, one needs to develop and implement a route generation (labeling) algorithm which is capable to take into account non-trivial resources mentioned above. Such algorithm should generalize algorithms known in the literature.
- The implemented algorithm should be embedded into VRPSolver. Then, the latter should be tested on various electric vehicle routing benchmarks from the literature such as the eVRP with time windows, the eVRP with non linear charging functions and other variants.

Compétences

Background: Operations Research
Knowledge: Integer Linear Programming (required), Dynamic Programming (required), Column Generation (optional), Vehicle Routing Problems (optional).
Skills: Significant experience with programming languages (required), C++ and/or Julia is a plus.

Avantages

- Subsidized meals
- Partial reimbursement of public transport costs
- Possibility of teleworking (after 6 months of employment) 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
- Social security coverage

Rémunération

2653€ / month (before taxs)

Informations générales

- **Thème/Domaine :** Optimisation, apprentissage et méthodes statistiques
  Calcul Scientifique (BAP E)
- **Ville :** Talence
- **Centre Inria :** Centre Inria de l'université de Bordeaux
- **Date de prise de fonction souhaitée :** 2020-11-01
- **Durée de contrat :** 1 an, 4 mois
- **Date limite pour postuler :** 2020-08-31

Contacts

- **Équipe Inria :** REALOPT
- **Recruteur :**
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A propos d'Inria

Inria est l'institut national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 215 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3900 scientifiques pour relever les défis du numérique, souvent à l'interface d'autres disciplines. L'institut fait appel à de nombreux talents dans plus d'une quarantaine de métiers différents. 900 personnels d'appui à la recherche et à l'innovation contribuent à faire émerger et grandir des projets scientifiques ou entrepreneuriaux qui impactent le monde. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 200 start-up. L'institut s'efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

Attention: Les candidatures doivent être déposées en ligne sur le site Inria. Le traitement des candidatures adressées par d'autres canaux n'est pas garanti.

Consignes pour postuler

Thank you to send :
- CV
- Cover letter
- Support letters (mandatory)
- List of publication

Sécurité défense :
Ce poste est susceptible d'être affecté dans une zone à régime restrictif (ZRR), telle que définie dans le décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L'autorisation d'accès à une zone est délivrée par le chef d'établissement, après avis ministériel favorable, tel que défini dans l'arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel défavorable pour un

poste affecté dans une ZRR aurait pour conséquence l'annulation du recrutement.

Politique de recrutement :
Dans le cadre de sa politique diversité, tous les postes Inria sont accessibles aux personnes en situation de handicap.