Offre n°2021-03427

Modeling Human Mobility considering novelty-seeking inclinations

Type de contrat : Stage

Niveau de diplôme exigé : Bac + 3 ou équivalent

Fonction : Stagiaire de la recherche

A propos du centre ou de la direction fonctionnelle

Located at the heart of the main national research and higher education cluster, member of the Université Paris Saclay, a major actor in the French Investments for the Future Programme (Idex, LabEx, IRT, Equipex) and partner of the main establishments present on the plateau, the centre is particularly active in three major areas: data and knowledge; safety, security and reliability; modelling, simulation and optimisation (with priority given to energy).

The 450 researchers and engineers from Inria and its partners who work in the research centre's 28 teams, the 60 research support staff members, the high-level equipment at their disposal (image walls, high-performance computing clusters, sensor networks), and the privileged relationships with prestigious industrial partners, all make Inria Saclay Île-de-France a key research centre in the local landscape and one that is oriented towards Europe and the world.

Contexte et atouts du poste

Understanding individual mobility patterns is of fundamental importance for many fields such as epidemic preventions, city planning, traffic engineering, or economic forecasting [1]. In recent years, the availability of mobile-phone records along with the increasing usage of Global Positioning System (GPS) equipped devices, provide us with groundbreaking tools to capture and analyze human movements [1], [2] and [3].

Mobility research focuses on modeling the mechanisms ruling the movements of individuals as well as forecasting their future visits. The seminal work by Song revealed the high potential predictability of human trajectories reaching scores up to 93% [3]. Yet, existing models systematically fail in reproducing individuals' movements and substantially deviate from empirical results [4]. Moreover, regardless of the applied methods (e.g., Markov chains, Naive Bayes, neural networks), the type of prediction (i.e., next-cell or next place) or the used data sets (e.g., GPS, CDR, surveys), current predictors show limited bounded predictive performance [2][5]. The reasons are manyfold: (i) the lack of ground truth data, (ii) the inherent complexity of human movements, and (iii) the poor understanding of individuals' tendency to visit new unknown locations.

While the first two elements are hard to tackle, understanding individuals' tendencies to discover new places is an accessible domain of study. More importantly, it is a critical aspect of human mobility behavior that should be carefully addressed to design generative models and develop accurate predictors [1][4].

Mission confiée

Research goal: This internship will focus on individuals' attractivity to explore new areas. The goal will be to integrate the exploration modeling methodology of an on-going PhD thesis as input to a practical predictor (to be defined), which will result in an exploration-enhanced predictor. For this, mobility trajectories to be predicted have to be assigned to a level of trust (LoT) parameter indicating per time unit, the level of accuracy we can expect from a predictor in terms of "the next location where an individual will probably be". This LoT will then be used to influence the prediction output, and consequently, its accuracy. The internship will involve data analytics, mobility data manipulation, programming, mobility modeling, and practical prediction. This internship will be the first to integrate the heterogeneity of individuals' propensity to explore in a predictor.

Principales activités

Scope of the internship: During the internship, the student will get acquainted with the statistical laws governing individuals' mobility and existing mobility models and predictors. Three significant steps involved in this internship are:

1. The biography studying the individuals' tendency to visit new areas and develop an advanced approach to detect moments of exploration;

2. The ``level of trust'' assignment to each spatiotemporal point of a trajectory;
3. The design of an exploration-enhanced predictor that considers individuals' susceptibilities to discover new places;
4. The open-source development of such predictor and its evaluation using real-world mobility traces.

References:

[1] C. Song, T. Koren, P.Wang and A. Barabási. 2010. Modelling the scaling properties of human mobility. Nature Physics 6 (Sep. 2010), 818–823.

[2] A. Cuttone, S. Lehmann and M. C. Gonzalez. 2018. Understanding predictabilityand exploration in human mobility. EPJ Data Science 7, 1 (Jan. 2018).

[3] C. Song, Z. Qu, N. Blumm and A.-L. Barabási. 2010. Limits of Predictability in

Human Mobility. Science 327 (Feb 2010), 1018–1021.

[4] L. Pappalardo, F. Simini, S. Rinzivillo, D. Pedreschi, F. Giannotti and A.-L. Barab´asi, "Returners and explorers dichotomy in human mobility," Nature Communications, vol. 6, no. 8166, Sep 2015.

[5] L. Amichi, A. C. Viana, M. Crovella, and A. A. Loureiro, "Understanding individuals' proclivity for novelty seeking," ser. SIGSPATIAL '20. New York, NY, USA: Association for Computing Machinery, 2020.

Compétences

- The applicants must be involved in a master's degree or in a PhD degree (preferable) in one of the following or closely related disciplines: computer science, electrical engineering, or applied mathematics.
- Eligible applicants must have demonstrable experience with computer programming, machine learning, and data analytics.
- Good communication and documentation skills in English

Avantages

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    - Subsidized meals
    - Partial reimbursement of public transport costs
    - Possibility of teleworking
    - Professional equipment available (videoconferencing, loan of computer equipment, etc.)
    - Social, cultural and sports events and activities

Informations générales

- **Thème/Domaine :** Réseaux et télécommunications
- **Ville :** Palaiseau
- **Centre Inria :** Centre Inria de Saclay
- **Date de prise de fonction souhaitée :** 2021-05-01
- **Durée de contrat :** 5 mois
- **Date limite pour postuler :** 2021-04-16

Contacts

- **Équipe Inria :** TRIBE
- **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

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.