2019-01551 - PhD Position F/M Mathematical modelling of -omics data and algorithmic development to monitor adaptive behaviour at the metabolic level [PHD Campaign 2019 - Campagne Doctorants Grenoble Rhône-Alpes]

Type de contrat : CDD de la fonction publique
Niveau de diplôme exigé : Bac + 5 ou équivalent
Fonction : Doctorant

A propos du centre ou de la direction fonctionnelle
Grenoble Rhône-Alpes Research Center groups together a few less than 800 people in 35 research teams and 9 research support departments.
Staff is localized on 5 campuses in Grenoble and Lyon, in close collaboration with labs, research and higher education institutions in Grenoble and Lyon, but also with the economic players in these areas.
Present in the fields of software, high-performance computing, Internet of things, image and data, but also simulation in oceanography and biology, it participates at the best level of international scientific achievements and collaborations in both Europe and the rest of the world.

Contexte et atouts du poste
The PhD will be co-supervised by Marie-France Sagot (DR Inria), Delphine Ropers (CR Inria), and by Arnaud Mary (Associate Professor University of Lyon). It will take place mainly in the Inria Erable team, which is institutionally associated to and physically located inside the Laboratoire de Biométrie et Biologie Évolutive (LBBE – UMR 5558) of the University of Lyon, with regular visits to the Inria Ibis team in Grenoble.

The collaboration between the Erable and the Ibis teams on this topic started with an IXXI project called Muse that is still ongoing.

Mission confiée
Adaptation of bacterial growth to environmental or genetic perturbations involves numerous regulations. Advanced -omics technologies allow monitoring the adaptive behaviour, by tracking down modifications of metabolite, mRNA and enzyme concentrations. One of the biggest challenges nowadays is to integrate the data and specially to make sense of them. By relating the modifications of metabolic fluxes with the concentration changes, these data should inform us on how cells coordinate their response to a given perturbation. More precisely, we would like to infer which part of the metabolism was directly affected by the perturbation. As the -omics information may be incomplete or noisy, it is however a far from trivial task to both model and address the question, given the complexity of the mathematical representations of metabolism.

Starting from two approaches previously developed in the Erable team at Inria that are able to handle metabolomics data in one case [1] and transcriptomics data (mainly RNA-seq) in the other [2], the aim of this PhD is to: (i) understand how the two types of -omics data may now be integrated within a same mathematical model; (ii) extend such model further to take into account other types of -omics data such as proteomic; (iii) develop efficient algorithms to extract from a metabolic network represented as a directed hypergraph all sub-graphs that include reactions playing a role in the adaptation to a change of conditions.

Two main biological contexts will be analysed using the models and algorithms that are elaborated. The first will be the post-transcriptional regulations, notably at the level of the central carbon metabolism, in the bacterium Escherichia coli considered independently of any other organisms which may be in its environment [3].

The second will then be to progress towards the analysis of such regulations in a context where different species interact durably within a same environment.

References

Principales activités
As usual for a PhD, we expect that work on the above will lead to publications in international journals or conferences with a selection committee. The algorithms developed should also lead to software that will then be made publicly available.

Compétences
Technical skills and level required : The recruited PhD student should have a background in computational biology, with an important experience already in or taste for mathematical modelling and/or algorithmic design. A previous experience also with biological problems and with discussing with biologists would be a strong plus.
Languages : A good knowledge of English is required.
Relational skills : Good relational skills, in particular to interact fruitfully with researchers from other disciplines, will be much appreciated.

Avantages
- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking (after 6 months of employment) and flexible organization of working time

Informations générales
- Thème/Domaine : Biologie numérique
- Biologie et santé, Sciences de la vie et de la terre (BAP A)
- Ville : Villeurbanne
- Centre Inria : CRI Grenoble – Rhône-Alpes
- Date de prise de fonction souhaitée : 2019-10-01
- Durée de contrat : 3 ans
- Date limite pour postuler : 2019-04-28

Contacts
- Equipe Inria : ERABLE
- Directeur de thèse : Sagot Marie-france / marie-france.sagot@inria.fr

A propos d’Inria
Inria, l’institut national de recherche dédié aux sciences du numérique, promeut l’excellence scientifique et le transfert pour avoir le plus grand impact. Il emploie 2400 personnes. Ses 200 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3000 scientifiques pour relever les défis des sciences informatiques et mathématiques, souvent à l’interface d’autres disciplines. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 160 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.

Consignes pour postuler
The campaign is not open to local students who have not done any significant mobility.

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.

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.
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- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
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- Social security coverage

Rémunération