Principales activités

We propose to combine exploratory analysis, dimension reduction methods for high dimensional data, mathematical dynamical modeling and optimal control theory to answer these questions.

Informations générales

- Thème/Domaine : Modélisation et commande pour le vivant
- Ville : Talence
- Centre Inria : CRI Bordeaux - Sud-Ouest
- Date de prise de fonction souhaitée : 01/10/2018
- Durée de contrat : 3 ans
- Date limite pour postuler : 24/05/2018

Contacts

- Équipe Inria : SISTM
- Recruteur : Prague Melanie / melanie.prague@inria.fr

Conditions pour postuler

Advisors : Rodolphe Thiébaut (HDR) & Mélanie Prague

Thank you to send :

- Copy of master thesis diploma
- Master marks and ranking
- 2 pages CV
- Cover letter
- Support letter(s)

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.
Based on this general objective description, we expect to organize the work in three different tasks:

1/ Develop methods for integration and exploitation of heterogeneous data acquired on a patient and on a population. We will assimilate data from multiple sources using lasso-type methods to further understand what can be seen as a correlate of efficacy. In particular, we will be interested in identification and validation of an early correlate of late antibody response. It would allow early prediction of whether an individual, or group of individuals is likely to be a good or poor immunological responder [5]. Methods based on joint non-linear mixed models and sparse PCA will be investigate.

2/ Extend existing methods to estimate parameters in mechanistic models by using assimilation approaches based on filtering methods and compare them with penalized maximum likelihood as implemented in NIMROD [4]. In particular, we believe that these filter methods, which jointly estimate state and parameters, can help addressing the fact that biomarkers can sometimes not be observed but are only deduced from surrogate information. A particular example lies in gene expression information which may carry cells count information if proper deconvolution is used.

3/ Develop an optimal protocol to individualize and optimally choose a vaccination strategy using machine learning and particularly neural network approaches. The idea is that it is possible to build synthetic data with annotated optimal choice from the mechanistic model by using computer based simulation and that these datasets can be used as learning examples for neural network approaches. We will compare this approach with existing approaches developed in the team such as Bayesian predictions and dynamic programming based on Markov impulse theory.

These methods will be illustrated on available clinical data, and particularly on the EBL1001+EBL1003+EBL1004 and VR01 trials described in the previous section for which we have measurement of humoral response, cellular response and transcriptomic data in respectively 216 and 92 individuals. More than eight longitudinal follow-up guaranty good quantity of dynamic information. Moreover, these studies enable us to investigate the same viral vector (MVA) for different infectious diseases. We expect to publish the results in journals both theoretical and more applied to clinical practices. Finally, we expect that a software for joint analysis of multiple sources data in immunological studies will be developed and disseminated.

Keywords : Applied mathematics, Simulation and calculus, Biostatistics, Mixed effects dynamical models, control theory, vaccination

References:

Compétences
Required Knowledge and background: We seek for a very good master-level student (possibly from a French engineer school or foreign universities) with strong background in mathematics and/or statistics. We request good programming skills in any language, and a good knowledge of R. Proficient written and spoken English is needed. Previous experience in research, possibly working with differential equations or immunology, will be seen as a very competitive advantage.

Avantages sociaux
- Subsidised catering service
- Partially-reimbursed public transport

Rémunération
1982€ / month (before taxs) during the first 2 years, 2085€ / month (before taxs) during the third year