



Post-doctoral Position in Computational Statistics and Biological Modelling

Ecole Centrale Paris, France

Keywords

Functional-Structural Plant Model, Sensitivity Analysis, Bayesian Inference, Generalized State-Space Model, Hidden Markov Model, Sequential Monte Carlo, Markov Chain Monte Carlo, Model Selection

Context

Digiplante is a research team of the lab of Applied Mathematics at Ecole Centrale Paris. Its focus is the mathematical modelling of plant growth, with an expertise in the development of statistical methods and algorithms for the analysis and evaluation of plant growth models.

Univ. Göttingen (W. Kurth), IRHS – AgroCampus Ouest (G. Buck-Sorlin), INRA – Montpellier (E. Costes) and Ecole Centrale Paris (P.H. Cournède) have successfully submitted an ambitious joint research project between France and Germany (ANR-DFG project) entitled “**Multiscale functional-structural plant modelling at the example of apple trees**”. In the frame of this project, 1 postgraduate and 4 post-doc positions are open.

The main role of Ecole Centrale Paris in the project is the development of the statistical methods for the parameterization and evaluation of the complex model developed in the project to describe the functional-structural growth of apple tree.

Objectives and Missions

The objectives of the post-doctoral research are both methodological and applied. From a methodological point of view, the objective is to develop and implement specific parameterization methods and algorithms for complex systems (characterized by several interacting submodels and a potentially large number of parameters, as typically functional-structural plant models).

More specifically, the strategy will rely on the combination of sensitivity analysis, parameter estimation and model selection. The key point will concern the definition of the proper method and algorithm for parameter estimation, in a Bayesian framework. Recent progresses on the parameter estimation of structural plant models based on the analysis of architectural sequences and a specificity of the multiscale FSPMs under study will be taken advantage of for statistical inference (Trevezas and Cournède, 2013; Trevezas et al., 2014): tree architecture, described at phytomer level, keeps the track of the whole history of plant functioning. Unravelling this information can compensate for the irregularity of plant data, resulting from the experimental cost. It is a challenge that can be tackled in the frame of hidden Markov models by the estimation of hidden state variables.

From a computational point of view, sequential or Markov chain Monte Carlo algorithms will be implemented.

Finally, the defined parameterization methodology will be applied to the functional-structural apple model developed in the project and to the experimental data collected. Several questions will then be tackled based on the statistical evaluation of the model: model comparison / selection for specific purposes, test on the genotypic differentiation of parameters.

The candidate will actively participate in the project management and strongly interact with the other partners of the project.

Desired profile

- PhD degree, preferably in Statistics, or possibly in Applied Mathematics or Mathematical Modelling.
- Interest for the Modelling of Complex Systems, Plant Biology
- Experience with programming (C++)
- Project management and communication skills

Location

Laboratoire de mathématiques appliquées (MAS) at Ecole Centrale Paris (CentraleSupélec)
Grande Voie des Vignes
92290 Châtenay Malabry (Close suburb of Paris)

Remuneration

2100 – 2500 euros net per month (based on previous experiences)

Duration

12 months, with possible extension to 36 months.
The position will start April 2015 or as soon as possible.
Open until filled.

Contact

For further information regarding this position, please contact:

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Applications should include a CV, a brief description of the applicant's research interests, and a list of at least 3 references.