2017-00182 - Post doctoral / Mathematical modeling of glioblastoma for evaluation clinical prognosis and relapse

Level of qualifications required : PhD or equivalent
Fonction : Post-Doctoral Research Visit

About the research centre or Inria department
The MONC project-team aims at developing new mathematical models involving partial differential equations and statistical methods based on a precise biological and medical knowledge in order to build numerical tools based on available quantitative data about cancer. The goal is finally to be able to help clinicians and/or biologists to better understand, predict or control tumor growth and possibly evaluate the therapeutic response, in a clinical context or for pre-clinical studies. We plan to develop patient-specific approaches (mainly based on medical imaging) as well as population-type approaches in order to take advantage of available large data bases. We claim that our work may have a clinical impact that can change the way of handling certain pathologies.

For more informations : https://team.inria.fr/monc/

Context
INRIA team Monc is developing mathematical models for cancer growth and therapies in strong collaboration with clinicians. These models are based on sets of partial differential equations and calibrated for each patient using clinical data like medical images. The hired person will become a member of Monc team.

The hired person will develop a novel model for glioblastoma to help estimate the time of relapse of the disease. This project is in collaboration with the Research Center against Cancer in Toulouse.

Assignment
The hired person will use medical images (mostly MR) collected in a clinical study undergoing in Toulouse, to build new tools allowing physicians to have a better estimate of the time of relapse of the disease after therapy (standard Stupp protocol). For this matter, two approaches are planned :

- a statistical approach by considering radiological heterogeneities and their evolution
- a modeling approach by describing the disease by a mecanistic model. This could offer from the early follow-up of the patient a better estimation of the relapse time

In this project, medical image processing will be greatly eased by using our existing numerical tools and the help of a dedicated engineer hired in this project.

Main activities
The main activities will be to:

- Analyse image heterogeneities over time and their correlation with clinical prognosis
- Model response to treatment with a PDE model built in collaboration with clinicians and MR data
- Develop calibration technique for this model on MR data
- Collaborate with our clinical and biological collaborators
- Use our numerical frameworks, in which developments of this project should be incorporated
Skills
The required skills are:

- Mathematical modeling with PDE
- Scientific computing
- Data assimilation
- Good developing skills (C++, Python)

Skills in processing medical images would be a plus.

Benefits package

- Subsidised catering service
- Partially-reimbursed public transport

Remuneration

2653€ (before tax) / month