Computer Scientist contributing to the European Human Brain Project

Context:

The Human Brain Project (HBP) was launched by the European Commission in October 2013 and is scheduled to run for ten years. The HBP is a flagship which aims to put in place a cutting-edge, ICT-based scientific Research Infrastructure for brain research, cognitive neuroscience and brain-inspired computing. The HBP Consortium comprises 116 Partners from a wide range of European organizations. Neurospin is coleading one of the ten subprojects of HBP dedicated to the Human brain organization. The goal is to develop neuroscientific concepts, tools, knowledge and datasets to contribute to a better understanding of the multi-level and multi-scale organization of the human brain. This goal amounts mainly to generating a multi-facet atlas embedding all the data strategic for simulation and used as a scaffold to aggregate neuroscientific data produced around the world.

In this context, one of the tasks of Neurospin is to integrate in the framework outstanding public datasets and to allow users of the HBP's platform to process them using a High Performance Computing infrastructure aggregating several major European facilities. A current usecase targets the Human Connectome Project dataset (http://www.humanconnectome.org/data/) that shall be processed with original image analysis pipelines developed in Neuropin and elsewhere. These pipelines target the connectivity of the brain and its folding patterns. The proposed analyses can involve several modalities, have intra-individual and inter-individual processing chains, may make use of several software suites (some developed in the lab and some from the neuroimaging community). The software pipelines are thus complex and computationally demanding. Their implementation and setup for a professional production organization, in order to process large sets of data, is a challenge, and has partly be done through a software environment: BrainVisa (http://brainvisa.info). The tools are being used for large projects such as CATI (http://cati-neuroimaging.com), which aggregates and analyses longitudinal neuroimaging data acquired in 50 acquisition centers in France - over 10000 subjects have been processed to date. The HBP will provide a service to its users through a High Performance Computing (HPC) facility located in Jülich (Germany) and maybe in France (CEA).

One of the important new tools, named Constellation, is dedicated to brain parcellation based on structural connectivity information derived from diffusion MRI data. This kind of analysis is a perfect example of the mentioned complexity, as it involves all of its aspects (intra and inter-individual analysis, multimodality, combining several software environments, data formats and conventions), is computer-intensive, and needs to process large data. Within the context of HBP, we will make the software tools of the

team available for the HBP users, and allow them to process large datasets used within the HBP on the HPC in Jülich. Constellation will be a significant element of it, and its integration still requires some work.

Tasks:

The proposed position will aim at porting the BrainVisa software environment to the Jülich HPC, and to finish the integration of the Constellation toolbox to it. This will involve several tasks. Some tasks are on the infrastructure side: adaptations for the HPC infrastructure and batch system (DRMS), some optimizations in the pipeline distribution, improvements to the compilation and distribution systems for BrainVisa. Some other tasks will be more application oriented: integrating and improving the Constellation toolbox, making some test cases and quality control for it.
The position will imply some exchanges between teams in Jülich (Germany) and Neurospin (France) and some travels between both sites, and should participate to the links and communications between the teams.

Required skills:

Engineer in computer science and software development
Python and C++ languages
Clusters infrastructures and Distributed Resource Management Systems (DRMS) (Grid Engine, Condor, LSF...)
Compilation infrastructure (Cmake)
Good english speaking skills, french and/or german could help

Details:

The position contract will end at the end of March 2018 due to the HBP funding sectioning in time. This first contract will be possibly extended later, for up to 5 years.
The work will take place mainly in Neurospin (CEA Saclay, France) and will involve trips to Jülich (Germany).
The job should start as soon as possible, and administrative procedures to start a job in CEA Saclay are about 3 months long.

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