IBM Global Internship Program 2016: Zürich Internships

(1) **Computational methods for cancer personalized medicine**
Project description: Despite their great promise, high-throughput technologies in cancer research have often failed to translate into major therapeutic advances in the clinic. One challenge lies in the high level of tumor heterogeneity displayed by human cancers, which renders the identification of driving molecular alterations difficult, and thus often results in therapies that only target subsets of aggressive tumour cells. Another challenge lies in the difficulty of integrating disparate types of molecular data into mathematical disease models that can make actionable clinical statements.
The group of systems biology at the IBM Research - Zurich Lab aims to develop new mathematical and computational approaches for the analysis and exploitation of the latest generation of biomedical data. In the context of cancer, the group focuses on the integration of high-throughput molecular datasets to build comprehensive molecular disease models; the development of new approaches to reconstruct signalling protein networks from single-cell time-series proteomic data; and the application of Bayesian approaches and high-performance computing to the problem of network reconstruction.
An active line of research focuses on prostate cancer, a leading cause of cancer death amongst men in Europe, but also prone to over-treatment. This internship will focus on the analysis of molecular (genomic, transcriptomic, and proteomic) and clinical data, and the use of the Watson technology, a last generation cognitive computer developed at IBM, with the goal of characterizing tumour heterogeneity. As a secondary goal, we will aim to develop new methodologies to integrate disparate types of data into models that can help risk-stratify patients.
Desired skills: Candidates should have a strong background in computer science, mathematics or physics and be interested in cancer-related research.
Ref. code: Z-2016-01

(2) **Modelling electron transfer at the cathode of Li/air cells**
Project description: Modeling of the electron transfer from newly formed layers or nano-particles of Li2O2 to the oxygen molecule
Desired skills: Knowledge of computational chemistry methods (specifically DFT and TDDFT), Knowledge of molecular dynamics schemes, Past research in electron-transfer processes is a plus, Good programming skills in Fortran and knowledge of UNIX environments, Creative and self-motivated.
Ref. code: Z-2016-02

(3) **Large-scale analysis of large networks and graphs**
Project description: This project will focus on developing algorithms and massively parallel implementations for analysis and manipulation of very large, unstructured graphs and networks. Such networks are central in many key applications such as Web and Social networks, regulatory gene networks, transportation, supply chain and energy networks, to name only a few.
During the past 2 years we have developed very efficient techniques for computation of node centralities for extremely large graphs. This project will carry over this work in developing techniques for graph sparsification and simplification based on node centralities. The goal is to reduce highly complex networks and graphs to their essential "backbone" in order to facilitate very fast analysis and knowledge tasks.
Desired skills: The ideal candidate needs to have a solid background in programming and data structures. At least a basic knowledge of c++ and MPI is needed.
Ref. code: Z-2016-03