2018-00291 - PhD offer: Search engine for genomic sequencing data

Contract type: Public service fixed-term contract
Level of qualifications required: Graduate degree or equivalent
Fonction: PhD Position

About the research centre or Inria department

Inria, the French National Institute for computer science and applied mathematics, promotes “scientific excellence for technology transfer and society”. Graduates from the world’s top universities, Inria's 2,700 employees rise to the challenges of digital sciences. With its open, agile model, Inria is able to explore original approaches with its partners in industry and academia and provide an efficient response to the multidisciplinary and application challenges of the digital transformation. Inria is the source of many innovations that add value and create jobs.

Context

The main objective is to produce a model and a prototype dedicated to allowing users to directly query large unassembled raw sequencing data on the fly in order to tap into the largest underexploited resource in life sciences.

Assignment

For a better knowledge of the proposed research subject:

We are currently witnessing a deep knowledge revolution due to the availability of exponentially expanding sequence databases made possible by the continuously accelerating throughput of sequencing techniques. Sequencing data is accumulating faster than Moore’s Law, bringing fundamental new insights, conjecture, and understanding, with impacts in medicine, agronomy and ecology. Today, the INSDC SRA raw data archive stores more than $10^{16}$ (10 000 PB) nucleotides, in the form of short sequences (<1000 PB) which represent fragments from generally unknown genomic location (the “reads”). However, the overwhelming majority of those sequences have only been analyzed within the context of single projects addressing each a small fraction of the total resource. It is therefore of primary importance to maintain this trace of diversity for future studies and to develop technologies to interrogate these data. Moreover, providing fast access to the sum of all data would open the doors to novel discoveries that a single or a limited number of read sets do not have the power to address.

Assignments:
The recruited person will be taken to design and propose new indexing scheme, scaling up very large DNA collection (assembled or not), and offering a way to query in real time input sequences of interest. There exist methods such as Sequence Bloom Tree and as Bloom Filter Trie, that index and compress (lossless or not) such banks. In this project, we will explore the novel idea of representing the bank in a global incremental compressed index using a graph representation of all corrected reads from the whole bank read sets.

Main activities
• Datastructure model design (bloom filters, minimal perfect hash functions, ...)
• Prototype developments (C/C++)
• Tests on simulated and real data
• Interface with biologist users
• Diffusion (publications; talks)

Skills

Languages: French - English

Other valued appreciated: Pedagogy, writing skills.

Benefits package
• Subsidised catering service
• Partially-reimbursed public transport
• Social security
• Paid leave
• Sports facilities

Remuneration
Fix term contract

Duration : 36 months

Gross Salary : 1 982€/month (before taxes) during the first 2 years, 2 085€/month (before taxes) during the third year

General Information
• Theme/Domain : Computational Biology
  Scientific computing (BAP E)
• Town/city : Rennes
• Inria Center : CRI Rennes - Bretagne Atlantique
• Starting date : 10/1/18
• Duration of contract : 3 years
• Deadline to apply : 3/23/18

Contacts
• Inria Team : GENSCALE
• Recruiter :
  Peterlongo Pierre / pierre.peterlongo@inria.fr

The keys to success
We are looking for candidates with a strong background in algorithmic and development, in particular in the string algorithm area.

Experiences and/or tastes for genomic and biological applications, as well as knowledge in NGS and TGS data will be highly appreciated.

Conditions for application
Application file: Applications must be submitted online on the Inria website. Contact: pierre.peterlongo@inria.fr

**Defence Security:**
This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST). Authorisation to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

**Recruitment Policy:**
As part of its diversity policy, all Inria positions are accessible to people with disabilities.

**Warning:** you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.