Job vacancy #2023-06714

Internship (Stage): Data Science and Machine Learning to characterize workload energy profiles in high-performance computing systems

Contract type: Internship agreement

Level of qualifications required: Graduate degree or equivalent

Function: Internship Research

About the research centre or Inria department

The Centre Inria de l’Université de Grenoble groups together almost 600 people in 22 research teams and 7 research support departments.

Staff is present on three campuses in Grenoble, in close collaboration with other research and higher education institutions (Université Grenoble Alpes, CNRS, CEA, INRAE, ...), but also with key economic players in the area.

The Centre Inria de l’Université Grenoble Alpes is active in the fields of high-performance computing, verification and embedded systems, modeling of the environment at multiple levels, and data science and artificial intelligence. The center is a top-level scientific institute with an extensive network of international collaborations in Europe and the rest of the world.

Context

Context and Objectives:
High-Performance Computing (HPC) technology has become more accessible and cheap to build, which opened the door to new fields to capitalize on the large computational power afforded only by such machines. However, the energy cost did not decrease as much as the construction cost. This led to an exponential increase in consumed energy. The power consumption has become a dominating factor in the total cost of ownership of supercomputers, exceeding the cost of building the machine after just a few years of activity. Other than the monetary cost, increased energy spending translates to a high carbon footprint.

With the increase of demand for computing resources and the struggle to provide the necessary energy, power-aware resource management is becoming an increasingly important issue for the HPC community. Including reliable energy management to a supercomputer’s resource and job management system (RJMS) is not an easy task. The energy consumption of jobs is rarely known in advance and the workload of every machine is unique and different from the others. It is therefore of great importance to build a profound understanding of the energy behavior of HPC workloads. Knowing a workload’s energy behavior opens the way for new energy optimization techniques for HPC resource management, contributing to a mastered and potentially more environmentally friendly usage of HPC.

Assignment

Objective:
The objective of this internship is to leverage the Marconi100 platform data to deeply understand the energy consumption nature of High-Performance Computing workloads.

Main activities

Overview of the Tasks:

- Explore Data Science methods to analyze the different types of energy profiles of jobs that can occur in an HPC platform, using a combination of jobs’ metadata and platform’s energy monitoring data, using the Marconi100 platform data as a use-case to build insights into HPC jobs’ energy behavior.
- Use these insights and Machine-Learning methods to construct a classifier that automatically detects the energy profile of an HPC job.

Location:
The internship will take place at the DataMove team located in the IMAG building on the campus of Saint Martin d’Heres (Univ. Grenoble Alpes) near Grenoble. The DataMove team is a friendly and stimulating environment gathering Professors, Researchers, PhD and Master students all leading
research on High Performance Computing. The city of Grenoble is a student friendly city surrounded by the alps mountains, offering a high quality of life and where you can experience all kinds of mountain related outdoors activities.

**Skills**

Technical skills: Python (Pandas) or R (tidyverse), Git, scikit-learn, Jupyter notebook

Languages: French or English

**Benefits package**

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities

**Remuneration**

15% of the French Social Security ceiling, i.e. €4.05 per hour of actual presence at 1 January 2023.

**General Information**

- **Theme/Domain**: Distributed and High Performance Computing
  Scientific computing (BAP E)
- **Town/city**: Saint Martin d'Hères
- **Inria Center**: Centre Inria de l'Université Grenoble Alpes
- **Starting date**: 2024-02-01
- **Duration of contract**: 6 months
- **Deadline to apply**: 2023-11-30

**Contacts**

- **Inria Team**: DATAMOVE
- **Recruiter**: Carastan Dos Santos Danilo / danilo.carastan-dos-santos@inria.fr

**About Inria**

Inria is the French national research institute dedicated to digital science and technology. It employs 2,600 people. Its 200 agile project teams, generally run jointly with academic partners, include more than 3,500 scientists and engineers working to meet the challenges of digital technology, often at the interface with other disciplines. The Institute also employs numerous talents in over forty different professions. 900 research support staff contribute to the preparation and development of scientific and entrepreneurial projects that have a worldwide impact.

**The keys to success**

Previous knowledge in High-Performance Computing is a plus but it is not required. A good candidate has skills and keen interest in Data Science such as Python-pandas or R-tidyverse, Machine Learning methods and tools, such as clustering and classification methods, and tools such as scikit-learn. Knowledge of literate programming tools (e.g., Jupyter Notebook), Git, and past experience in research (i.e., published papers) are a plus.

**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.

**Instruction to apply**

**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.