Position description – Chair of Junior Professor
Academic year 2022/2023

Tenure-track faculty: Professor   *Position number: 4514*

Project name: End-tO-end Synthesis Modelling InfrastructUre siMulation for Environmental Data Science (OSMIUM)

CNU section: 27

Assignment faculty: UFR SEN   **Research unit of assignment: LICIIS**

Public institution partner: CEA

Starting date of the position: 31/12/2022 at the latest   **Administrative residence: Reims**

Project duration: 4 years   **Funding amount: 670 708€**

Application end date: 30/09/2022

Job profile : *Professor in computer sciences, with a HPC, scientific visualization and AI research profile*

Teaching : *general teaching in computer science for undergraduates ; specific teaching for MSc in*

Research : *fundamental and applied research on high-performance computing or high-performance graphics and artificial intelligence*

Keywords : *HPC, HPDA, HPG, Deep Learning, Scientific Visualization, Parallel Programming and Algorithmics, Optimization and Simulation*

Teaching project description:

The future chairholder will participate in current or future training programs in which URCA is involved in the fields of high-performance computing (HPC), simulation, cloud, big data, artificial intelligence, deep learning, visual computing, and scientific visualization. Mainly mobilized at the master's and PhD levels, he/she will aim to accompany students following these courses towards the very high academic and professional level.

The current training offer is based on the bachelor's and master's degrees in « High Performance Computing and Simulation » (CHPS) and the master's degree in computer engineering and digital simulation (CMI HPVC). This offer will be completed in the fall of 2022 by the participation of the URCA in the:

• first European Master's program (EUMaster4HPC - H2020 funding) in High-Performance Computing, High-Performance Data Analytics (HPDA) and AI.

• training program of the PIA3 EquipEx+ MesoNet project in HPC and AI.

Keywords: High-performance computing, Machine Learning, Scientific Visualization, Simulation

Education Department: Computer Science

Location: University of Reims Champagne-Ardenne, Reims (France)

Description of the faculty: the UFR Exact and Natural Sciences is a multidisciplinary faculty of the URCA which offers training in mathematics, computer science, physics, chemistry, biology, earth sciences and civil engineering.

Other information:

Contact information:
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Research project description:

Advances in many areas of computing, such as big data, machine learning, visualization and augmented/mixed/virtual reality, have recently given rise to several emerging concepts such as

synthetic modeling and immersive analysis. If the principle of synthetic modeling is defined in HPC environment as the intersection between conventional simulation and machine learning, immersive analysis invites the study of these technologies in support of analysis and decision making. These two concepts form a continuum able to make massive data, especially from digital simulation, intelligible and tangible by combining information visualization, machine learning and virtual environments. It is this new paradigm that we propose to explore in OSMIUM, a paradigm that could be described as « metavers for simulation ». It will involve mobilizing machine intelligence, through data mining and machine learning algorithms, to improve the accuracy of the simulation, accelerate resolution times while maintaining the models and data in a persistent universe that can be manipulated in an immersive manner. This approach will consider the architectural evolutions of supercomputers, notably the omnipresence of heterogeneous units. OSMIUM's ambition does not cover the complete development - end-to-end - of the entire processing chain. At this stage, it is rather a question of:
• formalize and prepare the algorithmic and software bricks that will constitute this environment.
• experiment the principles supporting this proposal on a use case related to environmental sciences. The application to the atmospheric modelling of greenhouse gas fluxes could, in this particular context, meet all the right conditions for a broad spectrum experimentation.

Candidate profile:

• PhD in computer science or a closely related field.
• Expert knowledge in HPC and scientific visualization, particularly with applications to uncertainty (AI) and/or multifield visualization.
• Strong mathematical skills/knowledge.
• Advanced programming skills in C++, Python, CUDA and GPGPU.
• Experience with large software development projects with OpenGL and/or Ray Tracing API for graphics and MPI, OpenMP and/or OpenCL for HPC, is a plus.

Keywords: Digital simulation, HPC – AI and data visualization coupling, new user experiences and ubiquitous interaction
Research unit: LICIIS – LRC DIGIT
Location: University of Reims Champagne-Ardenne, Reims (France)

Lab description:

The Laboratory of Computer Science in Intensive Computing and Image for Simulation (LICIIS) is a unit that develops its research within the University of Reims Champagne-Ardenne (URCA) in the fields of high-performance computing, artificial intelligence, scientific visualization, and computer graphics. Created on January 1, 2021, LICIIS is also a unit under agreement (LRC DIGIT) with the *Commissariat à l'Energie Atomique et aux énergies alternatives* (CEA). Its missions are both theoretical and applied research, training, valorization, and technology transfer. It currently has 34 members (professors, senior lecturer, researchers, BIATSS, post-doctoral students and doctoral students) including 14 permanent and 9 associated with CEA. It is the main operator of two of URCA's most important infrastructures: the ROMEO regional computing center (supercomputer ranked 249th in the world in the TOP500 and 20th in the GREEN500 when it was commissioned in 2018) and the Image Center. Its research is organized around three major technological domains and aims to address the challenges they generate and respond to the resulting uses. In direct application with simulation and scientific computing, they cover:
• performance and programming models of hybrid architectures with computational accelerators (HPC).
• artificial intelligence (AI) et big data analysis (HPDA).
• scientific visualization, meshes and their interactions.
The laboratory is also involved in the societal challenges of digital sovereignty and sustainable development, mainly through the responsible use of digital technologies.

Other information:

Since 2016, the strategic project of the University of Reims Champagne-Ardenne (URCA) has been structured around 4 scientific clusters that form a collective in the service of excellence in both research and training. The « Agro-sciences, Environment, Biotechnologies, Bioeconomy » (AEBB) cluster, central to the establishment project, is URCA's main signature. The « Digital and Engineering Sciences » (SNI), « Health » and « Human and Social Sciences » (SHS) clusters are attached to it and offer specific complementary signatures. In a region whose economy is strongly linked to the agricultural and wine industries, strengthening the interfaces between the AEBB cluster and the other three clusters is a major challenge for the URCA. It is part of a process that mobilizes the entire university community to meet both the major scientific challenges of our time and the societal expectations of our fellow citizens. This global strategy around the bioeconomy and the environment is positioned on a complete chain of values to which digital technology is now contributing more and more significantly. The emergence of this new space for collaboration and innovation is the result of a convergence between a succession of technological revolutions (intensive computing, « big data », machine learning, visualization, and mixed reality) and a deep need for change in the face of new challenges (climate, food security ...). The OSMIUM project is perfectly in line with this proactive policy of the institution. Developing an environment conducive to synthetic simulation for environmental sciences is an original approach that (i) contributes to the scientific signature of the URCA and (ii) represents a unifying element for the university community of Champagne-Ardenne and the Grand Est region.

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Content of the application :
• Online application form
• Photo ID
• PhD certificate
• Examination report, with a translation if it is written in a foreign language, which the candidate certifies on his or her honor.
• Complete CV of the candidate

Audition modality: on-site preferably, by videoconference if necessary
Duration: 20 minutes of presentation + 20 minutes of discussion with the selection committee
Presence of external person(s) on the selection committee: □ Yes ☑No
Real life work situation: □ Yes ☑ No
If yes, please specify:

Other:

WILL BE INVITED TO THE AUDITION THE CANDIDATES SELECTED ON APPLICATION BY THE SELECTION COMMITTEE