Dept. of Mechanical & Manufacturing Engineering
Post-Graduate Researcher

Title : Special Scientist - Post-Graduate Researcher (Research Assistant)
No. of Positions : One (1)
Category : Employment contract
Location : University of Cyprus, Nicosia, Cyprus

We seek to fill the vacancy for one (1) Special Scientist - **Post-Graduate Researcher** position**,** for full-time employment to carry out their PhD studies in mathematical biology and computational neuroscience. The successful candidate will conduct fundamental and/or applied research as part of the R&D project "Brain Neuronal Networks Development via Multiscale Agent-based Modelling (REASON)" that is funded by the FORESIGHT Institute (https://foresight.org).

This work will be carried out with UCY's *In Silico Modelling Group* (ISMG; https://in-silico-modelling.ucy.ac.cy). The group has expertise in mathematical modelling, computational mechanics, medical image processing, biomechanics, model/imaging data analysis and high-performance computing technologies. The Post-Graduate Researcher will be under the supervision of Dr Vasileios Vavourakis (UCY) and Dr Roman Bauer (University of Surrey).

The Project
Brains are extremely complex: they comprise large numbers of neurons, interconnected in irregular ways. Neurons have axons and dendrites that form connections and allow for signals to propagate. Computational models of neural networks (NNs) constitute a powerful approach to make sense of biological NNs and gain insights into the workings of the brain. However, to this date, such computational models have remained rather abstract, without a strong correspondence to their biological counterparts.

In this project, REASON, we will demonstrate an innovative computational approach to model and emulate biological NNs: rather than directly modelling a brain with all its complexity, we will model NN development from a single precursor cell. In other words, by leveraging the same approach that nature uses to build brains, we aim to reproduce challenging neural complexities. Inspired by the biological brain, we will make use of developmental rules that are encoded in a gene-type manner. For instance, a rule could be that a given neural stem cell should divide under certain conditions while they could migrate under others. Similarly, neural connections develop according to well-conserved mechanisms that are adaptive to individual neurons' activities and wiring patterns.

To inform the computational modelling, we will make use of data from experimental studies as well as synthetic, simulated data. Well-established characteristics of biological NNs will be used to inform realistic NNs, both structurally as well as functionally. We will make use of innovative machine learning techniques to match the in-silico NNs with specific organisms. In the early stages, we will employ synthetically generated NNs as a test scenario, and iteratively increase biological correspondence. We will make use of the agent-based modelling software BioDynaMo (www.biodynamo.org), an open-source software we have been actively developing for almost a decade. Notably, this project builds on previous work of the supervisory team, including for instance the simulation of a spatially embedded, functional, and biologically realistic neural network that self-organized from a single precursor cell (https://doi.org/10.1371/journal.pcbi.1003994). The combination of machine learning techniques with agent-based learning is being explored by the group;

notably, this PhD research is expected to generate a novel modelling approach to generate biologically realistic NNs using heterogeneous experimental data.

We are looking for a highly motivated post-graduate researcher to carry out their PhD studies. The post-graduate researcher should have a background in computer science, mathematical modelling and numerical methods to work in a very ambitious R&D project in computational neuroscience.

Duties and Responsibilities:
The successful candidates are expected to:

- Develop novel *in silico* modelling procedures in either two of the following R&D directions:
  - high-performance computing of neural development models,
  - multiscale model that couples different spatial scales in neuronal cells development, proteins, etc.,
  - simulation algorithms for surrogate models pertinent to simulation-based optimization.
- Collaborate closely with post-graduate and post-doctoral group members working in this project
- Supervise post-graduate students of the *ISMG*.
- Disseminate project results (internally and externally):
  - write research articles in high-impact factor journals,
  - write proceedings and give talks in prominent international conferences / congresses,
  - compile technical reports for the project.
- Participate and contribute in grant proposals and become in networking.

Profile and Experience

- Bachelor's and/or Master's degree in either Computer Science, Medical Physics, Engineering, Applied Mathematics, or any other relevant field from an accredited institution.
- Experience in computer programming – good knowledge in C++ and Python is considered a great advantage.
- Sound foundations in numerical methods and simulations (e.g., Agent-Based Modelling, Finite Element Method, Finite Volumes Method), while experience with machine learning techniques is a great advantage.
- Previous relevant research work experience is a great advantage.
- Strong motivation is a must.
- Willingness to work at interdisciplinary boundaries!
- Be reliable and a trustworthy team member, with good communication and organizational skills, and with a strong eagerness to learn.
- Very good skills in English (written and oral) are required.

Employment Terms
The position is on a contract basis (36 months) to fully cover the period of the PhD studies, which can be extended based on successful progress and performance. The gross monthly salary will be within the range €1,800 – €2,200 depending on experience and qualifications, while a 13th salary bonus is being incorporated in the monthly salary. Employee contributions to the various Government Funds will be deducted from the aforementioned amounts. Maternity leave will be granted according to Maternity Protection Law 1997(N.100(I)/1997), and the existing amendment laws.

Application
Interested candidates should submit the following documentation (in English) online through UCY's

recruitment website (https://applications.ucy.ac.cy/recruitment) by **May 31, 2024**:

- Cover letter explaining the interest of the applicant for this post, a short summary of prior work experience, R&D activities, accomplishments, and their employment availability date (max. 2 pages).
- Curriculum Vitae: CV that clearly indicates studies record, job posts, publications and talks, participation in research projects and awards (max. 4 pages).
- Contactable referees: Details of at least two academia- or/and industry-based referees (provide their names, emails, telephone number, affiliation, ORCID).

The best three candidates will be interviewed by a 3-member Committee. Candidates shall be informed of the result of their application by the relevant entity soon after interviews.

The University of Cyprus shall collect and process your personal data according to the provisions of the General Regulation on Personal Data 2016/679 (EU).

UCY is committed to promoting inclusivity, diversity, and equality, as well as the elimination of all forms of discrimination to provide a fair, safe, and pleasant environment for the entire university community, where students and staff members will feel supported both in their professional and personal development, within and beyond their multiple identities. UCY seeks to create the necessary conditions that will encourage and respect diversity and ensure dignity both in the workplace and society at large. Moreover, UCY has adopted specific policies to promote equal opportunities, as well as respect and understanding of diversity, while it is committed to promoting and maintaining a working, teaching and learning healthy environment.

Applicants need not be citizens of the Republic of Cyprus. Applicants should however ensure, before applying, that in case they are selected they will be residing in Cyprus on a full-time basis during the employment period. Submission of application implies acceptance of this condition.

Applications should be submitted by (including) 31 May 2024. Evaluation of the applications will begin immediately with interviews taking place a week after application submission deadline, and candidates shall be informed of the result of their application by the Department of Mechanical & Manufacturing Engineering. For more information, interested candidates can contact directly the project investigators: Dr V. Vavourakis (vavourakis.vasileios@ucy.ac.cy) and Dr R. Bauer (r.bauer@surrey.ac.uk).