A THREE-YEAR POSTDOCTORAL POSITION

RESEARCH AND ADVANCE EXPANDED POLYGENIC RISK SCORES (PRS), INCORPORATING PATHWAY ANALYSIS AND NON-LINEAR PHENOMENA TO ENHANCE CLINICAL UTILITY

AREA: LIFE SCIENCES AND MEDICINE

START DATE: BEFORE 12/31/2024

DEADLINE: POSTION REMAINS OPEN UNTIL FILLED

Located in the French-speaking part of Belgium, the University of Liège welcomes nearly 27,000 students of 123 different nationalities in a dynamic, multicultural city less than an hour away from Brussels and Cologne, two hours from Paris and three hours from London and Amsterdam. ULiège is spread across 4 campuses and boasts over 5,700 staff members, including 3,600 teachers and researchers active in all areas of the humanities and social sciences, science and technology, and health sciences.

As a key player in social change and environmental awareness, ULiège promotes ethical, transdisciplinary and open science. It contributes to the socio-economic development of its region through numerous partnerships with several institutions, including the university hospital (CHU). Given its international orientation, the University participates in the European University of Post-Industrial Cities (UNIC) initiative and has one of the most extensive collaborative networks in the world.

ULiège offers attractive career prospects in a high-quality working environment where well-being, diversity and equality of opportunity are promoted. Since 2011, ULiège has been proud to display the European *Human resources strategy for researchers* (HRS4R) label, which reflects its commitment to open, transparent and merit-based procedures. In addition, it upholds quality and diversity in line with the recommendations of the *Coalition for Advancing Research Assessment* (CoARA). ULiège encourages its academic staff to travel internationally and welcomes international researchers through its EURAXESS center.

ABOUT THE RESEARCH PROJECT

Derived from comprehensive genome-wide association studies (GWASs), polygenic risk scores (PRS) condenses complex genetic data into a single numeric value, potentially revolutionising diagnostics and treatment decisions in clinical settings. While PRS has shown promise, there's still much ground to cover. This project aims to enhance the discriminative power of PRS in the general population, contribute to mapping out lifetime risk trajectories, and uncover nuanced substructures within patient populations.

Combining disease-specific molecular networks with large-scale epistasis screening from GWAS data, we're pioneering the development of expanded pathway-PRSs. These innovative composite scores integrate multidimensional genetic information and undergo rigorous optimisation to maximise predictive accuracy and refine disease subtyping. Beyond advancing PRS technology, this project promises invaluable insights into the utility of pathway-oriented epistasis screening and navigating complex genetic landscapes.

Expected Result(s):

Molecular interactions play an essential role in bodily functions. Understanding such interactions and their alterations contributes to understanding heterogeneity between individuals, including their disease risk, disease progression, or patient treatment response. In short, in terms of personalised medicine. Epistasis analyses have become an increasingly popular type of analysis to recycle data from genomewide association studies. Rather than looking at one variant at a time in its relation to a phenotype, the interplay between them about the phenotype is modelled or inferred. Intuitively, it is plausible to assume that such interplays between SNPs affect downstream molecular interactions, leading to positive or negative effects on a trait. However, how can the interpretability and utility of such studies (GWAIS) be increased, and what is their added value to “polygenic risk scores”? In this project, we aim to answer these questions.

JOB DESCRIPTION

Join us on the frontier of genomic medicine as we unlock new possibilities for precision healthcare and achieve the following goals of the research project:

[I]: *Unprecedented disease-biology informed GWAIS* on AD/CD to increase our understanding of disease mechanisms via identifying gene-gene interactions. Focus: pathway-driven GWAIS while efficiently handling significant genetic effects (APOE/HLA), reducing multiple testing, and at the same time increasing interpretability and translation potential of epistasis findings.

[II]: *A novel pathway-oriented PRS workflow that fills a vacuum* between testing the contribution of genomewide PRS to disease risk and disease variant-induced PRS testing. Focus pathway-PRS; gene sets via the integration of GWAS results, a meta-analysis of available high-throughput gene expression studies, and disease-specific background networks; comparison with hypothesis-free testing with 1000nds of curated (not necessarily disease-specific) gene sets.

[III]: *A novel protocol for integrating GWAIS findings into pathway-PRSs*. Focus: expanded pathway-PRS by combining 1-dimensional (SNPs) PRS with 2-dimensional PRS (“interaction PRS”); from simulation to real-life contexts; formal assessment of the relative importance of 1D and 2D contributions to risk.

The work will be performed closely with scientists from two international consortiums: the international IBD Genetics consortium (IIBDGC) and the European Alzheimer's disease DNA biobank Consortium (EADB).

SPECIFIC DUTIES AND ACTIVITIES

- To achieve the specific activities related to the abovementioned goals, we seek individuals passionate about driving scientific innovation to join our team. As a member of BIO3, you will have the opportunity to collaborate with leading researchers, contribute to groundbreaking discoveries, and make a tangible impact on human health research and education. Whether you're a seasoned expert or a rising star in the field, we welcome scientists with a PhD degree and a multidisciplinary track record who share our vision and are eager to push the boundaries of scientific knowledge.

PROFILE

REQUIRED SKILLS :

- Professional experience: Mandatory qualifications include Bachelor's, Master's, and PhD degrees spanning multiple disciplines, with expertise in machine learning/statistical genetics, bioinformatics/molecular biology, or biotechnology/bioinformatics.
- Expertise in statistical modelling of large data sets (such as those available from international consortiums on complex or rare diseases).
- Proficiency in R/Bioconductor packages and familiarity with scripting/programming languages such as Bash and Python, as well as experience with Linux environments and computing clusters, is essential
- Proficiency in utilising electronic notebooks like Jupyter Notebook or its successor, JupyterLab, is considered essential for candidates in the role of a data scientist or bioinformatician on this project. These tools facilitate accessibility and streamline the integration of scientific explanations with executable code, thereby enabling the creation of reproducible research narratives.
- You can handle Big Omics Data (at least DNA, RNA) and are skilled in crafting novel methodologies and algorithms customised for extensive data analysis, especially within precision medicine.

DESIRABLE SKILLS :

- Understanding TinyML fundamentals and their application in edge devices like Raspberry
- A strong foundation in machine learning for statistical genetics is advantageous.
- Experience with containerisation with Docker or similar.
- You have strong organisational skills.

- **HUMAN SKILLS :**
  - You exhibit strong motivation, creativity, and a proven track record of excellence. You are keen to collaborate within an interdisciplinary setting, bridging the fields of Biostatistics, Bioinformatics, and Biomedicine.
  - You can work autonomously and collaboratively within an international team environment.
  - You are a team player with excellent project management skills.

- **LANGUAGES :**
  - Exceptional communication skills in both written and spoken English are a prerequisite …

TERMS OF EMPLOYMENT

- **TYPE OF CONTRACT:**
  Appointment to the post-doctoral position requires that the applicant has a PhD within the position's specifications at the time of employment decision. The doctoral degree should have been obtained no more than 10 years before the start of the position. Post-doctoral researcher. Notably, the candidate should be in a situation of international mobility: he/she should not have worked or lived in Belgium for more than 24 months during the three years preceding his/her start date.

- **WORK SCHEDULE :** full-time ; 38 hrs/week
- **CONTRACT DURATION :** 3 years
- **EXPECTED START DATE :** before 31 December 2024

OUR OFFER

With your career path and personal details, ULiège Human Resources Department can assess the gross monthly salary. Employment benefits such as reimbursement of public transportation fees and access to a variety of training opportunities are also included.

WORK ENVIRONMENT: BIO3 (http://bio3.giga.ulg.ac.be/) is a dynamic small to medium-sized research team at the forefront of precision medicine, nestled within the GIGA Biomedical Research Center at the University of Liège. GIGA is an interdisciplinary powerhouse with a mission to drive medical innovation. With over 500 members, including principal investigators, senior researchers, post-doctoral scientists, and technicians, GIGA boasts expertise spanning medical genomics, in-silico medicine, neuroscience, oncology, infection and immunity, and cardiovascular sciences. **At BIO3, we are committed to empowering biomedical researchers by providing expert data analysis, designing innovative statistical and bioinformatics methods, and optimising algorithms**. We thrive at the interface of systems medicine and translational science, continually pushing the boundaries of what's possible.

HOW TO APPLY?

If you are ready to embark on an exciting journey at the forefront of translational precision medicine, we invite you to apply for this position.

Please submit a complete application as 1 PDF attachment to **rh.giga@uliege.be**, using the reference BIO3.PRS (including in the subject title of the e-mail)..

Your application should include 1) your CV, 2) contact details of at least two referees relevant to the job description, and 3) a motivation letter (up to 2 pages long) in which you explain which publications of the lab you are most interested in and why and motivate why you are passionate about joining BIO3.

SELECTION PROCEDURE

- **Evaluation Timeline:** Submitted dossiers will be assessed for excellence, profile matching, and eligibility within one month of submission.
- **Evaluation Team:** K Van Steen and at least one current team member will conduct the evaluation.
- **Interview Process:** Shortlisted candidates will be invited for an online video interview (in English). The interview will focus on technical, behavioural, and research-specific questions. The interview date will be arranged by mutual agreement.
- **Selection Completion:** The selection process will conclude once the appropriate candidate has been identified.

Our corporate policy is based on diversity and equal opportunity. We select candidates based on their skills and do not discriminate on grounds of age, sexual orientation, origin, beliefs, disability or nationality.

CONTACT DETAILS

Informal inquiries about the project are welcome. Please feel free to contact Prof Dr Dr K Van Steen by email at kristel.vansteen@uliege.be, using the subject title “Inquiry BIO3 Job Offer”.

Release date: 05/28/2024

Privacy policy

Personal data collected following your application will be processed by application will be processed by the reviewing jury, at the University of Liège for the sole purpose of recruitment.

The data will be processed within the framework of pre-contractual measures (art. 6-1, b. of the General Data Protection Regulation) and kept for up to 9 months after the publication of the vacancy. Your personal data will not be passed on to any third parties.

In accordance with the provisions of the GDPR (EU 2016/679), you may exercise your data protection rights (right of access, rectification, erasure, restriction, and portability) by contacting ULiège Data Protection Officer (dpo@uliege.be - Mr. Data Protection Officer, Bât. B9 Cellule "GDPR", Quartier Village 3, Boulevard de Colonster 2, 4000 Liège, Belgium). You may also lodge a complaint with the Data Protection Authority (https://www.autoriteprotectiondonnees.be , contact@apd-gba.be).