PhD Position in AI-Driven Exposomic Risk Prediction and Longitudinal Health Monitoring

Brussels Environmental Exposome (BEE) Project

We invite applications for a fully funded PhD position in machine learning, AI, and data science for public health within the **Electronics & Informatics Department (ETRO)** of **Vrije Universiteit Brussel (VUB)**. The PhD is embedded in the **Brussels Environmental Exposome (BEE)** project, a large interdisciplinary research project funded by Innoviris, involving **VUB, UzB, ULB and Sciensano**.

The goal of BEE is to develop a **next-generation exposomic risk modelling framework** that integrates **environmental exposures, socioeconomic context, and health data** to understand, predict and prevent **cardiovascular, neurovascular and other non-communicable diseases (NCDs)** in the **Brussels Capital Region**.

Research Context

Urban populations are exposed to a complex mixture of environmental stressors, including air pollution, heat, noise, green space, and light pollution, that interact with **socioeconomic vulnerability and health history** to shape disease risk. Yet most clinical risk models ignore this exposome.

In BEE, we will build **explainable, physics-guided, GeoAI-driven models** that:

- Predict **acute and chronic NCD risks** at the population scale
- Identify **vulnerable neighbourhoods and subgroups**
- Support **public health policy, prevention and hospital planning**
- Provide **meaningful feedback** to patients, clinicians and policymakers

The PhD will work at the interface of **machine learning, deep learning, geospatial AI, causal modelling, and digital health systems**.

Your Role

You will develop the **core AI and data-driven models** that transform large-scale exposomic and health data into **actionable risk predictions and feedback systems**.

You will:

- Design **spatio-temporal machine learning models** that integrate:
  - Air pollution, weather, noise, green space, urban form
  - Socioeconomic and demographic data

    - Hospital admissions and mortality records
- Develop **physics-guided and graph-based models** for high-resolution environmental exposure estimation
- Build **explainable AI** pipelines to identify which exposures matter most, and which populations and locations are most vulnerable
- Combine **deep learning with causal inference** to distinguish correlation from **causal environmental effects**
- Extend the population-level models to **longitudinal patient trajectories**
- Design **dynamic risk models** that evolve over time with changing exposures
- Develop **feedback mechanisms** that translate AI predictions into citizen-facing environmental health insights and clinician- and policymaker-relevant risk dashboards.

What You Will Work With

You will have access to one of the richest exposomic datasets in Belgium, including:

- **Nationwide hospital admission data** (ICD-coded CVD, NVD, NCDs)
- **High-resolution environmental maps** (PM2.5, NO2, UFP, noise, temperature, greenspace)
- **Socioeconomic and neighbourhood indicators**
- **Influenza-like illness and mortality records**

All data are geocoded, anonymised and linked through a secure RedCap-based ecosystem.

Your Profile

We are looking for a highly motivated PhD candidate with:

- A **Master's degree** in Computer Science, AI, Data Science, Engineering, Biomedical Engineering, or a related field
- Strong interest in **machine learning for health, environment or public policy**
- Experience with Deep learning, Time-series or spatio-temporal modelling, Graph neural networks or geospatial data and Explainable AI or causal inference
- Strong programming skills (Python required)
- Ability to work in an **interdisciplinary medical–AI–public-health team**
- Good command of **English**

Experience with environmental data, epidemiology, or health informatics is a plus, but not required.

What We Offer

- A **4-year fully funded PhD position**
- A unique position at the intersection of: AI, Environmental science, Medicine and Public health policy

- Daily supervision within **VUB-ETRO** and close collaboration with UZ Brussel clinicians and IT department, ULB environmental epidemiologists, and Sciensano public-health scientists
- Access to real-world hospital and exposome data
- A strong publication and international conference trajectory
- A stimulating, international research environment at **ETRO-VUB.**

Your main workplace will be **the VUB Etterbeek campus (Pleinlaan 2, Brussels), with regular interaction with hospital and public health** partners.

About ETRO-VUB:

ETRO, the Department of Electronics and Informatics (http://www.etrovub.be/) at the Vrije Universiteit Brussel (VUB), conducts fundamental and applied research in micro- and optoelectronics, multidimensional signal processing, and audiovisual computing.

ETRO closely collaborates with UZ Brussel, a top-rated university hospital that has gained recognition at national and international levels. We are a core member of imec, the world-leading research and innovation hub in nano-electronics and digital technologies. Our team is currently a fruitful mixture of people from different nationalities. The primary working language is English.

How to Apply

To apply, please send: CV, Motivation letter, Academic transcripts and (Optional) links to GitHub, publications, or previous projects

to:

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Join us in our mission to advance precision medicine for COPD patients through cutting-edge AI research!