SUBJECT MATH–DEV 4: Emulation of a Biological Model Simulator

Background:
Novadiscovery evaluates the outcome of treatments by applying them in silico to a population of virtual patients. This relies on a complex mathematical representation of the interactions between: a) biological entities in the human body, b) a model of the disease, and c) a model of the treatment. This computational model acts as a simulator. It takes as input a vector of descriptors (ie: a “virtual” patient), and outcomes the time series of patient descriptors that are relevant to evaluate the progression of the disease. An emulator is a statistical model, built on a training set, that approximates the behavior of a computationally expensive computer-based simulator. We would like to evaluate the performance of such emulators against the outputs of our actual simulations.

Objective:
The objective of this project is to train a model able to approximate the outputs of simulations at a low computational cost. Several approaches can be considered such as gaussian process approximation, kernel regression, Bayesian neural network. They will be discussed and discriminated against based on the specifics of our problem.

Work Process:
- Literature review on the subject of time series forecasting
- Choice of a relevant method for the emulation of a simulator
Implementation of the chosen method (preferably in Python).
Evaluation of the performance of the emulator against the outputs of actual simulations
(optionally) Investigation of how to use for such an emulator (for instance sensitivity analysis)

Deliverables:
A trained model able to approximate the outputs of our biological model simulator.

You are

➔ A **team player**, a good listener, and an effective communicator: *Join a growing multidisciplinary team of enthusiastic innovators*
➔ **Curious and proactive** with a solid grounding in biology: *Particularly in cell biology, molecular biology, and omics, to address real-life clinical issues.*
➔ **Autonomous and self-motivated** with strong analytical and problem-solving skills: *Find innovative solutions to science and engineering problems*
➔ **Eager to learn** and use mathematical methods for the modeling of biological systems: *Simulate virtual diseases and treatments with ODE, PDE, Monte-Carlo Simulations*
➔ **Willing to explore** and exploit large datasets and virtual populations: *Apply machine learning, statistical analysis, and outliers detection*
➔ **Responsive** and capable of facing time-sensitive challenges: *Project management with client-facing opportunities are awaiting you*

You will

➔ **Contribute** actively to the creation of in silico pathophysiological models
➔ **Impact** the development of the company’s simulation platform
➔ **Analyze** and exploit large simulation results
➔ **Participate** in weekly and monthly project meetings and reporting

Details

➔ **Apply directly on** [our careers page](#) ➔ **Type:** Internship
➔ **Contact:** recruitment@novadiscovery.com
➔ **Salary:** Competitive
➔ **Start date:** Flexible

Technologies & languages
Python, Numerical Simulation, Machine Learning, Predictive analysis
Keywords
Modeling and Simulation, Numerical Simulation, in silico, Statistical Modeling, Machine Learning, Artificial Intelligence, Predictive analysis