Interdisciplinary Project

Bayesian Optimization for Biomedical Laboratories

Project Description

Biocentral is an open-source bioinformatics platform designed to bridge the gap between the latest developments in bioinformatics and applications in molecular biology and diagnostic medicine. This project aims to develop a powerful new module for *Biocentral* that leverages **Bayesian Optimization** and **Sequential Learning** to improve experimental design in biological and medical laboratories. In other fields, such as material sciences, this principle has already been successfully applied and could now significantly enhance efficiency and resource utilization in life science research.

The IDP is designed to promote research projects at Rostlab and our microbiology partner lab at LMU (Exotoxins lab – Prof. Jiménez-Soto) . At the same time, we want to create an encouraging and interesting learning experience for master students and allow you to explore the possibilities of machine learning in the field of biomedical science. A successfully completed IDP can be extended into a master thesis, if desired.

IDP Project

We offer:

- A well defined project with clear milestones, outlined for a group of 2-4 students
- Combination of frontend and backend engineering (Dart/Flutter) with application of machine learning
- An encouraging work environment using agile methods
- Opportunity to create real-world impact in biological and medical research

You suit the project perfectly, if:

- You have experience in an OOP language (Dart, Java, C++, C#, ...)
- You have basic knowledge in machine and deep learning and coding experience in Python
- You are interested in biology and medical lab work and how to improve it using computer science methods
- You have strong teamwork and communication skills

Project Goals

The following milestones should be achieved at the end of the project:

- Develop a functional Bayesian Optimization module for Biocentral
- Integrate the module seamlessly with the existing platform
- Enhance the employed backend machine learning framework to be applicable for Bayesian Optimization
- Successfully apply the module on a test dataset

Lectures

Relevant lectures to support your project work, based on your preferences and timeline (choose one of the following):

- Allgemeine Mikrobiologie I+II - Lehrstuhl für Mikrobiologie (Prof. Liebl)
- Grundlagen der Biologie für Nebenfächer I+II - Professur für Pilz-Biotechnologie in der Holzwissenschaft (Prof. Benz)
- Advanced Data Handling and Visualization Techniques (IN2379) - Lehrstuhl für Bioinformatik (Prof. Rost)

Application

Please send a mail with your CV, relevant experiences and motivation to: **sebastian.franz@tum.de** (Expected start: **Winter term 2024)**

I am looking forward to your applications. Together we can build a strong team and find new ways to study biology using machine learning. Please don't hesitate to ask any questions.

Further information

You can find further information about the project and Bayesian Optimization here:

- Project issue in Biocentral GitHub repository: https://github.com/biocentral/biocentral/issues/38
- Existing sequential learning app for material sciences: http://slamd-demo.herokuapp.com/
- Paper about concrete design with sequential learning: https://doi.org/10.1016/j.jclepro.2023.138221

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