Behzad Karkaria

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EXPERIENCE

Postdoctoral Research Associate Sep. 2021 – Present
University of Cambridge | Cambridge, UK

Developing machine learning pipelines to analyse microbial community data and predict experiments across several projects. In all projects I am working collaboratively with experimentalists in a continuous manner:

1) I am performing genome-scale metabolic model reconstruction to produce mechanistic models that can explain microbial community composition. I have developed a software package to parameterise these models using multi-omic data. This software can explain cooperation and competition of metabolic pathways and can infer the existence of antimicrobial interactions.
2) I have implemented machine learning models that predict microbe nutrient requirements using genome sequences only, to improve our ability to culture previously 'unculturable' species.
3) Artificial sweeteners can have a profound effect on gut microbiota. I have developed models to predict compound-microbe inhibition with explainable mechanism of action.

Skill Highlights: genome-scale metabolic models, Autoencoders, PyTorch, Git, MLflow, Optuna, Facebook-Hydra, Plotly, SLURM, Scikit-Learn, Pandas

Director July. 2021 – Present
BDK Supplies Ltd | London, UK

I launched an online retail business selling sports equipment having identified underserved markets. I run this in my spare time and have used my software development skills automate pricing, analytics and advertising strategies. Our first set of products went live in February 2022 and we are already profitable in our first season of trading, giving us an opportunity to expand our product range.

Skill Highlights: Procurement, commerce dashboards, stakeholder management, negotiation, product niche analysis

Data Scientist / Bioinformatics Intern Mar. 2021 – Jun. 2021
Hummingbird Diagnostics | Heidelberg, Germany

Developed machine learning pipelines for early-stage lung cancer diagnosis using bulk RNAseq data from blood samples. Used PyTorch extensively to build, train and test ML architectures. I found success in implementing variational-autoencoders to improve disease classification metrics. Worked extensively on batch effect removal and developed methods to test how assess how our models compensate for batch effects. Gained valuable experience of working in a start-up environment and working on collaborative code being used in production.

Skill Highlights: PyTorch, Git, MLflow, Scikit-Learn, Pandas, RNAseq, R, DEseq2, Anndata, Optuna, Facebook-Hydra, SLURM (HPC)

PhD Student – Computational Biology Sep. 2016 – Mar. 2021
University College London | London, UK

Implemented approximate Bayesian computation methods to perform model selection, and parameter estimation. I used these methods to design genetic circuits for bacteria, intended to stabilise microbial communities. I extensively studied and implemented different microbial ecology models. I developed a methodology to design engineering strategies that can be used to produce different community population dynamics, resulting in several publications.

- Used Python and C++, successfully optimised for parallelism
- Focused on my work to support decision making in wet lab projects, resulting in successful collaborative publications.
- Managed Undergraduate and Masters' thesis projects

Publications and Presented Talks:

- Chaos in small microbial communities – PLOS Computational Biology (accepted, awaiting publication)
- Automated Design of Synthetic Microbial Communities - Nature Communications, 2021
- Single strain control of microbial consortia - Nature Communications, 2021
- From Microbial Communities to Distributed Computing Systems - Frontiers in Bioengineering and Biotechnology 2020

- Computational Design of Synthetic Microbial Communities Incorporating Competitive and Cooperative Interactions - 2nd International Conference on Microbiome Engineering (ICME 2019)

Skill Highlights: Scipy, CUDA, C++, Boost C++, Scikit-Learn, Numpy, Pandas, Bayesian statistics, model selection, parameter estimation, matplotlib, ggplot, seaborn, Sun Grid Engine (HPC)

Vision and AI Summer Placement Mar. 2019 - Jun. 2019
Imagination Technologies | London, UK

Developed model systems and algorithms to improve the compilation time and resource efficiency of neural networks being run on dedicated hardware designed for smartphones and autonomous vehicles. Gained experience working in an Agile development team.

- Learned about architectures used in leading convolution neural networks used for image classification.
- Learned to build and train deep learning models using Tensorflow and Keras frameworks.
- Expanded and applied my knowledge of numerical optimisation algorithms, improved performance of company hardware.

Skill Highlights: PyTorch, Keras, Caffe, Tensorflow, CNNs, Computer Vision, Agile, Perforce (version control), parameter optimization

Innovation Consultant Sep. 2015 – Jul. 2016
Agilisys | London, UK

- Performed research to support technology board decision making regarding new product development and company acquisitions.
- Worked with the bid team to compete for new contracts and assess industry competition.
- Developed visualisations and data reporting dashboards from SQL databases, providing clients with customer insights and working with clients to improve customer engagement.

Skill Highlights: SQL, competitor analysis, acquisition analysis, bid development, stake-holder development, partner management

Undergraduate Research Experience July. 2013 – July. 2015
King's College London | London, UK

- Conducted miRNA knockout screen in *Drosophila* to identify candidates that control neural stem cell proliferation.
- Participated in UCL iGEM 2014. Our team designed and executed a synthetic biology project from scratch. I performed genetic engineering, stakeholder engagement and metabolic modelling. Our team were awarded Gold for our combined achievements.
- Awarded *Gowland Hopkins Biochemistry Prize* for my dissertation project, analysing fission yeast membrane composition by combining a small knockout screen with image-based biophysics techniques to analyse lipid membranes of fission yeast.

Skill Highlights: Image segmentation, confocal microscopy, *Drosophila* husbandry, molecular biology, cloning

TEACHING

SYSMIC | Teaching maths and data science to biology PhD students Sep. 2016 – Mar. 2021
iGEM | Teaching mathematical modelling and mentoring projects of summer students Sep. 2016 – July. 2020

EDUCATION

University College London | PhD Sep. 2016 – Mar. 2021
King's College London | Bachelor of Science in Biomedical Science Sep. 2012 – July. 2015

- Upper second-class Hons.