The Institute of Cancer Research
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Marwane Bourdim

Master's in Mathematics, Université Paris-Cité and Sorbonne Université

Education

Master's degree in Statistics and Machine Learning, *2021-2022*
Université Paris-Cité, Paris, France
Ranked 1^{st} *(1/21), with distinction*
Relevant modules: *High-dimensional statistics, Classification, Stochastic algorithms, Deterministic Optimisation, Nonparametric statistics, Brownian motion and stochastic calculus, Computer vision for biomedical image analysis.*

Master's degree in Mathematical Modelling *2020-2021*
Sorbonne Université, Paris, France
Upper second class honours
Relevant modules: *Functional Analysis, Partial differential equations, Markov processes in discrete state spaces, Bayesian Networks applied to medicine, Agent-based models for cellular proliferation.*

Bachelor's degree in Pure Mathematics *2018-2019*
Université Paris-Cité, Paris, France
Relevant modules: *Abstract algebra, Probability, Advanced calculus, Complex analysis, Set theory, Topology.*

Classes Préparatoires aux Grandes Écoles, MPSI-MP *2016-2018*
Lycée Jacques Decour, Paris, France
Two years of intensive preparation in mathematics, physics, and computer science.

Research Interests

Machine learning, Synthetic Biology, Probabilistic modelling, Mathematical and Computational Biology, Cancer Genomics, Global Health.

Research Experience

Software for multiplex imaging and scRNA-seq data integration for multi-modal barcoding method,
Institution: The Institute of Cancer Research (ICR)
Supervisor: Dr. Marco Bezzi *September 2024 - ongoing*

Developing software for integrating cytometry and spatial data, namely CyTOF and CODEX, with scRNA barcode data to better characterise heterogeneity across different modalities in single-cell experiments.

Ambient RNA removal deep generative algorithm,
Institution: The Institute of Cancer Research (ICR)
Supervisor: Prof. Trevor Graham *September 2024 - ongoing*

Testing an unsupervised deep generative algorithm to remove background noise from cell-free mRNA molecules using stochastic variational inference. The aim is to iterate on the CellBender algorithm, making it applicable to BAM files and leveraging metadata to improve the model.

Lineage barcode retrieval and analysis Python library for single-cell analysis,
Institution: The Institute of Cancer Research (ICR)
Supervisor: Across teams at ICR *May 2024 - ongoing*

Developing a lineage barcode library to enable non-specialist labs to study evolution in single-cell barcode experiments. The library improves scRNA-seq quality control by leveraging barcode data, particularly for addressing ambient RNA challenges. *(Publication in preparation)*

scRNA-seq evolutionary barcode analysis to study drug resistance in high-grade serous ovarian cancer,
Institution: The Institute of Cancer Research (ICR)
Supervisors: Prof. Udai Banerji and Dr. Alvaro Ingles Russo *June 2024 - September 2024*

Integrated scRNA-seq and lineage barcoding data to study drug resistance in ovarian cancer. Analysis revealed how rare cell subpopulations contribute to resistance, providing insights into the heterogeneity of patient responses to chemotherapy as reflected in RECIST data. *(Preprint under final revisions, set for release in December.)*

Methylation-based cellular deconvolution algorithms,
Institution: European Bioinformatics Institute (EMBL-EBI) in the Cancer Genomics group
Supervisor: Dr. Isidro Cortés-Ciriano *February 2022 - January 2023*

Designed and implemented a suite of methylation deconvolution algorithms to elucidate the tumour microenvironment and denoise methylation data for potential clinical applications, including methylation-based tumour classification. *(Preprint under final revisions, set for release in December.)*

Mathematical and computational modelling of the Covid-19 pandemic in France using a spatio-temporal stochastic framework,
Institution: French Institute for Research in Computer Science (INRIA) in the SIMBIOTX lab
Supervisors: Prof. Dirk Drasdo and Postdoc Jules Dichamp *April 2021 - September 2021*

Designed and implemented a simulation of a spatio-temporal stochastic model of COVID-19 spread in France.

Work Experience

Data Scientist,
Institution: Institute of Cancer Research (ICR) *March 2024 - ongoing*

As part of the Data Science Team, I collaborate with research groups across the institute to provide data analysis expertise and co-develop research projects. This role involves designing and implementing machine learning tools for analysing diverse omics data and integrating multi-modal datasets.

Mathematics Teacher,
Institution: École Alsacienne *February 2023 - June 2023*

Taught mathematics to year 4èmes and 2ndes (ages 13-15). Participated in several outreach initiatives to make mathematics more accessible and engaging for younger audiences.

Relevant Skills

Programming skills: Python, SQL, R, Bash, LaTeX, Numpy, Matplotlib, Scikit-Learn, Pandas, Pytorch, tidyverse, Bioconductor...

Biomedical Data Handling: Extensive experience handling DNA, RNA, methylation, imaging, cytometry, and clinical data, including DGE and GSEA analysis, through work at EMBL-EBI and the Institute of Cancer Research.

Science Outreach and Teaching: Experience as a high school mathematics teacher and in organising machine learning workshops and data carpentry sessions at the ICR, alongside outreach presentations inspiring minority students.

Languages: Native French and fluent English (IELTS Academic 8/9)

Fellowship and Awards

Mathematics, Modelling, and Learning: Best Master's Thesis Award *September 2022*
Awarded the best grade in my cohort for my Master's thesis, recognising excellence in research and presentation.

EMBL-EBI / Embassy of France in London Internships Programme *January 2022*
Competitive fellowship for paid internships at EMBL-EBI for computer science, statistics, and bioinformatics students at the Master's level or equivalent at French universities or Grandes Écoles.

Workshops

Introduction to Machine Learning Workshop *November 2024*
Co-organised a workshop introducing non-specialist cancer researchers and PhD students to machine learning concepts, helping attendees apply these techniques to their research.

Graduate School of Translational Bioinformatics Workshop *November 2022*
Presented my suite of methylation deconvolution algorithms at Université Paris-Cité.

Public Engagement

Math Career Awareness Initiative *May 2023*
I have delivered presentations aimed at introducing students from minority backgrounds to the possibilities in mathematics and research careers.

Extra Interests

Philosophy of science, History of economics, Political theory, Cinema, Painting.