

FATHIMA NUZLA ISMAIL

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RESEARCH INTERESTS

Machine learning and bioinformatics applied to genomics, pangenome analysis, gene co-expression networks, mucosal immunology, and infectious disease. Interdisciplinary research at the intersection of computational methods, big data, and translational biomedical science, with growing focus on single-cell and spatial transcriptomics.

EDUCATION

Doctor of Philosophy — Information Science

2017 – 2022

University of Otago, Dunedin, New Zealand

Thesis: Novel machine learning approaches for wildfire prediction to overcome the drawbacks of equation-based forecasting.

BEng (Hons) — Software Engineering

2012 – 2015

Staffordshire University, United Kingdom · GPA: 4.0 / 4.0

BSc — Applied Science

2012 – 2015

University of Sri Jayewardenepura, Sri Lanka

ACADEMIC & RESEARCH POSITIONS

Postdoctoral Fellow — Gastroenterology & Hepatology

Dec 2025 – Present

Tulane University School of Medicine, New Orleans, LA, USA (remote work)

- Investigate mucosal immunology in infectious and gastrointestinal diseases (COVID-19, RSV, IBD, colorectal cancer).
- Advance translational insights into disease pathogenesis and novel therapeutic targets using single-cell and spatial transcriptomic approaches.

Postdoctoral Research Fellow — Department of Mathematics

Jan 2025 – Nov 2025

State University of New York at Buffalo, Buffalo, NY, USA

- Applied bioinformatics and computational biology to dissect complex genetic networks.
- Developed predictive models for disease dynamics using advanced statistical and machine learning approaches.

Postdoctoral Research Fellow — Department of Biochemistry

Mar 2022 – Oct 2023

University of Otago, Dunedin, New Zealand

- Developed and evaluated genome graph analytic tools across diverse datasets.
- Enhanced structural variant detection in admixed populations for disease risk prediction.
- Led a collaborative project on genetic variation analysis of *Neisseria meningitidis*.
- Constructed genome graphs for the critically endangered kākāpō, contributing to biodiversity conservation.

TEACHING EXPERIENCE & MENTORSHIP

Certified Carpentries Instructor

2023 – Present

The Carpentries (Data, Library & Software Carpentry)

- Deliver evidence-based instruction in data analysis, programming, and reproducible research.
- Qualified to teach the core curricula of Data Carpentry, Library Carpentry, and Software Carpentry.

Lecturer in Robotics

Mar 2015 – Mar 2016

Auston Institute of Management Ceylon Ltd, Colombo, Sri Lanka

- Designed and delivered robotics and programming lectures for university and secondary-school students.
- Founded and presided over the Auston Robotics Club; mentored teams for national and international competitions including the World Robot Olympiad.

Technical Support Specialist — Online MBA Program

Mar 2018 – Mar 2019

University of Otago, Dunedin, New Zealand

- Supported faculty and students with course technology, orientations, and real-time troubleshooting.

PUBLICATIONS

Peer-Reviewed Journal Articles

- Ismail, F. N., Sengupta, A., & Amarasoma, S. (2026). Deep learning for regulatory genomics: A survey of models, challenges, and applications. *Bioinformatics Advances*, 6(1), vbaf271. <https://doi.org/10.1093/bioadv/vbaf271>
- Sengupta, A., Ismail, F. N., & Amarasoma, S. (2025). AI-driven methane emission prediction in rice paddies: A machine learning and explainability framework. *Methane*, 4(4), 28. <https://doi.org/10.3390/methane4040028>
- Ismail, F. N., & Amarasoma, S. (2025). MARS: Simplifying bioinformatics workflows through a containerized approach to tool integration and management. *Bioinformatics Advances*, 5(1), vbaf074. <https://doi.org/10.1093/bioadv/vbaf074>
- Ismail, F. N., Woodford, B. J., & Licorish, S. A. (2025). Atmospheric modeling for wildfire prediction. *Atmosphere*, 16(4), 441. <https://doi.org/10.3390/atmos16040441>
- Ismail, F. N., Woodford, B. J., Licorish, S. A., & Miller, A. D. (2024). An assessment of existing wildfire danger indices in comparison to one-class machine learning models. *Natural Hazards*, 1–32. <https://doi.org/10.1007/s11069-024-06738-3>
- Ismail, F. N., & Amarasoma, S. (2023). One-class classification-based machine learning model for estimating the probability of wildfire risk. *Procedia Computer Science*, 222, 341–352 (INNS DLIA 2023). <https://doi.org/10.1016/j.procs.2023.08.173>
- Yang, Z., Guarracino, A., Biggs, P. J., Ismail, F. N., et al. (2023). Pangenome graphs in infectious disease: A comprehensive genetic variation analysis of *Neisseria meningitidis*. *Frontiers in Genetics*, 14, 1225248. <https://doi.org/10.3389/fgene.2023.1225248>
- Ismail, F. N., & De Silva, R. (2015). A framework to estimate the water content in leaves by image processing and data mining. <hdl.handle.net/10018/1043973>
- Ismail, F. N., & Amarasoma, S. (2025). Recent trends and tools in pangenome graph analysis: A comprehensive review. *MDPI Pathogens*.

Refereed Conference Proceedings

- Ismail, F. N., Sengupta, A., & Amarasoma, S. (2025). Machine learning models for predicting post-wildfire methane emissions in Australia using multivariate data. *Image and Vision Computing New Zealand (IVCNZ)*.
- Sengupta, A., & Ismail, F. N. (2025). Software as a medical device: Design and compliance. *17th International Conference on Computer and Automation Engineering (ICCAE), IEEE*, 321–325. <https://doi.org/10.1109/ICCAE64891.2025.10980506>
- Sengupta, A., & Ismail, F. N. (2024). Modelling methane emissions from rice paddies using machine learning. *39th IVCNZ, IEEE*. <https://doi.org/10.1109/IVCNZ64857.2024.10794457>
- Ismail, F. N., & Amarasoma, S. (2024). An integrated genomics workflow tool: Simulating reads, evaluating read alignments, and optimizing variant calling algorithms. *12th International Conference on Bioinformatics and Computational Biology (ICBCB)*, 49–56. <https://doi.org/10.1109/ICBCB61507.2024.11012112>
- Ismail, F. N., Sengupta, A., Woodford, B. J., & Licorish, S. A. (2023). A comparison of one-class versus two-class machine learning models for wildfire prediction in California. *Australasian Conference on Data Science and Machine Learning (AusDM), Springer*, 239–253. https://doi.org/10.1007/978-981-99-8696-5_17
- Ismail, F. N., Woodford, B. J., & Licorish, S. A. (2019). Evaluating the boundaries of big data environments for machine learning. *AI 2019: Advances in Artificial Intelligence, Springer*, 253–264. https://doi.org/10.1007/978-3-030-35288-2_21

Papers Under Review / In Preparation

- Ismail, F. N., & Sengupta, A. (2025). Revolutionising bacterial genomics: Graph-based strategies for improved variant identification. *12th International Symposium on Applied Computing for Software and Smart Systems*. arXiv:2505.07919
- Ismail, F. N., Sengupta, A., & Amarasoma, S. (2025). Big data blueprint architecture for large organisations. *24th Industrial Conference on Data Mining*. arXiv:2505.04717
- Ismail, F. N., & Amarasoma, S. (2025). Generative AI for bioinformatics: Foundations, applications, tools, and future directions. *Briefings in Bioinformatics*.
- Ismail, F. N., Woodford, B. J., & Licorish, S. A. (2025). The power of one-class classification models in wildfire risk prediction. *International Journal of Wildland Fire*.
- Ismail, F. N., Sengupta, A., & Amarasoma, S. (2025). Blockchain in healthcare: Improving transparency, efficiency, and security of data. *IEEE International Conference on Distributed Ledger Technologies*.
- Ismail, F. N., et al. (2025). Leveraging explainable AI for rainfall prediction and its impact on methane emissions from rice paddies. *CICBA 2025*.

GRANTS & FUNDING

UUP Individual Development Award — United University Professions, USA (2025)	\$1,600
NITMB Convergence Conference Travel Award — National Institute for Theory and Mathematics in Biology, USA (2025)	\$800
ACM Richard Tapia Celebration of Diversity in Computing Award — ACM, USA (2017)	\$1,000
Google Anita Borg Memorial Scholarship — Google, Japan (2014)	\$2,000
University of Otago Doctoral Scholarship — University of Otago, New Zealand (2017)	\$75000

INVITED TALKS & PRESENTATIONS

- Multilayer Co-Expression Networks: Mathematical Insights into Gene Expression Variability — NITMB MathBio Convergence Conference, Chicago, 2025 (Podium).
- Multi-Layer Co-Expression Networks: Insights into Gene Expression Variability — NERCCS Eighth Northeast Regional Conference on Complex Systems, 2025 (Extended Abstract Poster).
- A Real-Time Sign-Language Learning Tool for Sri Lanka — Grace Hopper Celebration India (GHCI), 2016.
- Real-Time Sign-Language Learning Tool for Sri Lanka — Grace Hopper Celebration, Poster, 2015.
- Leap Motion-Based Gesture Recognition for Sri Lankan Sign Language — Business & Technology Conference, APIIT, 2015.
- Guest Speaker — Women TechMakers Event, Sri Lanka, 2014.

RESEARCH PROJECTS

Ongoing (2025)

- WGCNA Beta Parameter Validation: Evaluating biological validity of scale-free topology in gene co-expression networks across 27 human tissues (autism, Alzheimer's applications).
- Epidemic Infection Rate Forecasting: Collaborative project with New York University developing predictive systems for epidemic spread and emergent viral strain modeling.

Completed

- Social Network Visualization: Research administration, reporting, and interactive web-based visualization of social network datasets, University of Otago (2021–2022).
- Managed Computer Deployment: Led enterprise-scale device rollout for thousands of staff at University of Otago, with direct customer support (2024).

PROFESSIONAL SERVICE

Pan Genome Workshop Organizer

2023

University of Otago, New Zealand

- Designed and delivered a hands-on workshop on pangenome graph construction and analysis for computational biologists, covering whole-genome assembly methods and complex multi-genome comparisons.

Community & Cultural Service

- Organizer, Cultural Events — Dunedin Tamil Society, New Zealand (2023–2024).

PROFESSIONAL MEMBERSHIPS

- IEEE Member (2025)
- American Society of Human Genetics (ASHG) Member (2025)
- International Association of Engineers (2025)
- Models of Infectious Disease Agent Study (MIDAS) Network Member (2025)
- Certified Carpentries Instructor (2023 – Present)

SELECTED HONORS & AWARDS

- Grace Hopper Scholar, Google — USA (2016)
- First Sri Lankan selected for NYUAD Hackathon for Social Good in the Arab World — NYUAD (2016)
- CERN Port Humanitarian Hackathon Scholar — Geneva, Switzerland (2016)
- ACM Richard Tapia Celebration of Diversity in Computing Scholar — USA (2017)
- Best Innovator Award — MillenniumIT, Sri Lanka (2015)
- Academic Colors Award — APIIT / Staffordshire University, Sri Lanka (2015)

CERTIFICATIONS & PROFESSIONAL DEVELOPMENT

- Medical Neuroscience — Duke University / Coursera (2025)
- Certified Carpentries Instructor — Data, Library, Software Carpentry (2023)
- Cloudera Data Analyst Training (2016)
- Data Warehouse with Microsoft SQL Server 2014 (2016)
- Linux Systems and Network Administration (2016)
- Postgraduate Certificate in Business Administration (2014)
- Certificate in Business Accounting — CIMA (2014)

TECHNICAL SKILLS

Programming: Python, R, Unix, SQL, Java, C/C++

Bioinformatics: Genome graph tools, pangenome analysis, structural variant detection, WGCNA, gene co-expression networks, GTEx workflows, read alignment, variant calling, single-cell and spatial transcriptomics (Seurat, Scanpy)

Machine Learning: Deep learning, one-class classification, ensemble methods, explainable AI (XAI), predictive modeling, foundation models for genomics

Data Engineering: ETL pipelines, cloud environments, containerization (Docker, Singularity), big data systems

Tools & Platforms: GitHub, HPC clusters, Nextflow, Coursera, Carpentries teaching platform