Yoseph Tereda
Machine Learning | Numerical Simulation Specialist
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Profile Summary

Machine Learning and Numerical Simulation Specialist with dual M.Sc. degrees in Mathematics and Computer Science, and hands-on experience in Python-based modeling, data analysis, and algorithm development. Strong background in applied mathematics and scientific computing, with expertise in simulating complex systems. Motivated to translate theoretical models into scalable, practical solutions.

Technical Skills

Programming & Machine Learning: Python, MATLAB, C++, R, SQL (MySQL, PostgreSQL), TensorFlow, PyTorch, JAX (with `jit`/vectorization), scikit-learn, Git/GitHub
Computational & Systems: Numerical linear algebra, FEM/FDM, PDE modeling, CNNs, LSTMs, BiLSTMs, Parallel computing, GPU acceleration, Linux, Matplotlib, Jupyter, Numerical optimization, Computational mechanics

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Projects

Hybrid CNN–BiLSTM for Reservoir Outflow Forecasting
Global Water Futures (GWF), University of Saskatchewan | 2019–2020; extended independently in 2025

- Developed ML models to forecast reservoir outflows using large-scale multivariate time-series data from the Waterton Reservoir (Southern Alberta), consisting of over 21 years of hourly observations (Jan 1998–Jan 2019).
- Designed and trained LSTM and BiLSTM models (2019–2020) to capture nonlinear temporal dependencies in reservoir dynamics.
- Extended the original GWF work in 2025 by developing a hybrid CNN–BiLSTM architecture for automated feature extraction and long-range temporal modeling.
- Achieved improved predictive performance with the CNN–BiLSTM model (MAE = 4.86, RMSE = 8.74, R^2 = 0.828), outperforming LSTM and BiLSTM baselines.
- Improved peak-flow and extreme-event prediction accuracy, increasing robustness under extreme hydrological conditions.

Fuzzy Logic Controller for Physical Distance Detection
University of Saskatchewan, Saskatoon, Canada | 2019–2020

- Designed an interpretable AI system based on fuzzy logic to estimate physical distance in simulated pandemic scenarios.
- Formulated a rule-based inference engine using linguistic variables, membership functions, and IF–THEN rules.
- Implemented fuzzy membership functions and centroid-based defuzzification for control and decision-making.
- Analyzed core components of fuzzy systems, including knowledge bases, inference mechanisms, and working memory.
- Demonstrated fuzzy logic as an alternative to data-driven ML approaches under limited labeled data conditions.

Selected Experience

Machine Learning Researcher / Numerical Simulation Engineer
University of Saskatchewan, Saskatoon, Canada | 2019–2021
Fast Simulations of Cardiac Electrophysiology Models

- Designed high-performance computational pipelines for large-scale numerical simulation of cardiac electrophysiology using coupled ODE–PDE models.
- Developed an automated, stability-aware optimization framework that reduced simulation runtime by 40–60%, analogous to hyperparameter tuning in ML workflows.
- Implemented and benchmarked multiple time-integration solvers (Runge–Kutta, SSP, and RKC) using systematic evaluation pipelines analogous to ML model selection.
- Applied Jacobian eigenvalue analysis and numerical linear algebra to improve solver stability, convergence, and scalability across 1D, 2D, and 3D simulations.
- Built reproducible experimentation frameworks in Python and MATLAB, conducting large-scale benchmarking across 37 validated models with strict accuracy constraints (<5% error).

Machine Learning Researcher / Numerical Simulation Engineer
Global Water Futures (GWF), Saskatoon, Canada | 2018–2021
Invertible Approximations of the Standard Normal CDF

- Developed high-accuracy, explicitly invertible mathematical models for approximating the standard normal CDF, enabling efficient stochastic simulation.
- Formulated parameter estimation as a least-squares optimization problem over the full input domain.
- Solved large-scale nonlinear optimization problems using deterministic global optimization (BARON) and multi-start global search strategies.

- Achieved state-of-the-art accuracy with maximum absolute error 2.73×10^{-5}, outperforming existing invertible approximations.
- Built reproducible benchmarking and sensitivity-analysis pipelines to evaluate accuracy, robustness, and runtime performance in Monte Carlo simulations.

Teaching Assistant
University of Saskatchewan, Saskatoon, Canada | 2017–2018

- Assisted in undergraduate courses including Linear Algebra, Calculus, Applied Mathematics, and Abstract Algebra.
- Used Python and MATLAB to demonstrate numerical methods, simulations, and the link between theory and computation.
- Developed computational examples and simulations to illustrate mathematical modeling and quantitative reasoning.
- Led tutorial and problem-solving sessions; evaluated assignments and exams with constructive feedback.

Teaching Assistant
King Fahd University of Petroleum & Minerals (KFUPM), Dhahran, Saudi Arabia | 2016–2017

- Supported undergraduate instruction in Numerical Methods for ODEs, PDEs, Calculus, Complex Analysis, Abstract Algebra, and Applied Mathematics for Engineering.
- Used Python and MATLAB to demonstrate numerical solutions of ODEs and connect theory with computational experiments.
- Developed simulations to illustrate convergence, stability, and error behavior of numerical methods.
- Led tutorials and problem-solving sessions; evaluated assignments and examinations.

Graduate Researcher
King Fahd University of Petroleum & Minerals (KFUPM), Dhahran, Saudi Arabia | 2014–2016
Numerical Solutions for Sub-Diffusion Problems

- Conducted research on numerical solvers for time-fractional sub-diffusion equations arising in anomalous transport phenomena.
- Developed finite element spatial discretizations coupled with time-stepping schemes for fractional PDEs.
- Analyzed stability, convergence, and error behavior of numerical methods for nonlocal fractional operators.
- Implemented numerical experiments and applied numerical linear algebra techniques to validate theory and improve solver robustness.

Numerical Simulation Researcher
King Fahd University of Petroleum & Minerals (KFUPM), Dhahran, Saudi Arabia | 2015–2016
Particle Pair Diffusion of Inertial Particles such as Dust in the Atmosphere

- Developed mathematical and computational models for inertial particle dynamics in turbulent flows using Lagrangian formulations.
- Implemented large-scale numerical simulations of stochastic particle trajectories based on the Maxey–Riley framework.
- Conducted parametric studies over Stokes number and turbulence scales to characterize dispersion regimes and scaling behavior.
- Applied ensemble-based statistical analysis and regression to quantify particle separation, diffusivity, and nonlinear growth dynamics.
- Implemented kinematic simulation methods to model multiscale turbulent velocity fields and assess nonlocal diffusion effects.

Earlier Experience

Sessional Lecturer
Arba Minch University, Arba Minch, Ethiopia | 2009–2014

- Taught undergraduate courses in Numerical Analysis, Partial Differential Equations (PDEs), Applied Mathematics, and Mathematical Modeling.
- Integrated MATLAB-based computational laboratories to translate mathematical theory into numerical algorithms and simulations.
- Supervised undergraduate projects involving numerical simulation, optimization, and model validation.

Database Developer
Arba Minch University, Arba Minch, Ethiopia | 2009–2013

- Designed and maintained relational databases supporting academic, administrative, and research data systems.
- Optimized T-SQL queries, stored procedures, and indexing strategies to improve data retrieval performance and reliability.
- Implemented data integrity, validation, and testing procedures to ensure accuracy and consistency of database-driven workflows.

Publications

- Lipoth, J., Tereda, Y., Papalexiou, S. M., & Spiteri, R. J. (2022). A new very simple explicitly invertible approximation for the standard normal cumulative distribution function. *AIMS Mathematics*, 7(7), 11635–11646. doi:10.3934/math.2022648.
- Malik, N., Tereda, Y., & Usama, S. (2016). Particle pair diffusion of inertial particles such as dust in the atmosphere. Presentation at the EGU General Assembly 2016 (EGU2016-7264). ADS Abstract.

Education

- **M.Sc. in Computer Science** – University of Saskatchewan, Saskatoon, Canada | 2019–2021
- **M.Sc. in Mathematics** – King Fahd University of Petroleum & Minerals (KFUPM), Dhahran, Saudi Arabia | 2014–2016
- **B.Sc. in Mathematics** – Hawassa University, Hawassa, Ethiopia

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Honors & Awards

- Graduate Teaching Assistantship Scholarship, University of Saskatchewan
- Full-Time Student Scholarship, King Fahd University of Petroleum & Minerals (KFUPM)