

Kehelwala D. G. Maduranga, Ph.D.

Assistant Professor of Mathematics
Applied Mathematics, Statistics, and Deep Learning

Cookeville, TN

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Professional Summary

Applied mathematician specializing in optimization, statistics, and Deep learning, with emphasis on spatio-temporal modeling, stochastic systems, and scientifically grounded AI. Experienced educator with a strong commitment to undergraduate teaching, inclusive pedagogy, and student-centered research mentoring.

Education

Ph.D. in Mathematics	2020
University of Kentucky	
Dissertation: <i>Unitary and Symmetric Structure in Deep Neural Networks</i>	
M.S. in Mathematics	2017
University of Kentucky	
M.S. in Mathematics	2013
Tennessee Technological University	
B.S. (Honors) in Mathematics	2009
University of Sri Jayewardenepura	
Minor: Computer Science, Physics	

Academic Appointments

Assistant Professor of Mathematics	Aug. 2022 – Jan. 2026
Tennessee Technological University, Cookeville, TN	
Postdoctoral Research Associate	Sep. 2020 – Jul. 2022
University of Notre Dame, Notre Dame, IN	
Research Area: Computer Vision/ Hyperparameter optimization	
Project title: Multi- Objective Meta -Learning for Integrating Machine Learning and Domain Knowledge	

Research Interests

Optimization for Deep Learning; Statistical and Stochastic Modeling; Spatio-Temporal Data Analysis; Graph Neural Networks; Scientific Deep Learning; Environmental and Public Health Applications; Reliable and Reproducible AI

Research Experience

- **CAREER: Adaptive Deep Learning in the Wild: Optimization, Architectures, and Generalization Beyond Closed Worlds.** Principal Investigator, NSF CAREER Proposal, Computational Mathematics Program, Tennessee Technological University. Submitted July 18, 2025 (Under Review). Requested \$761,370 to develop curvature-adaptive optimization methods and integrative neural architectures beyond closed-world assumptions. Project integrates RNNs, CNNs,

GANs, and reinforcement learning, with strong broader impacts through curriculum development, mentoring, and rural STEM outreach.

- **Energy-Aware Deep Learning: Greener AI Training through Curvature-Adaptive and Homotopy-Based Optimization.** Principal Investigator, Amazon Research Awards (ARA), Sustainability Track, Tennessee Technological University. Submitted November 2025 (Under Review). Proposal requests \$100,000 in funding and \$40,000 in AWS computing credits to develop energy-efficient deep learning methods benchmarked on AWS Trainium and EC2 platforms.
- **External Grant Proposals Submitted (2024).** Tennessee Technological University.
 - NSF Computational Mathematics (CM): *Advancing Optimization through Preconditioned Algorithms*. Submitted December 2, 2024 (Not funded).
 - NSF Information Integration and Informatics (III), Medium: *Enhancing Deep Learning Integrative Architectures*. Submitted October 23, 2024 (Returned Without Review; missing BPC plan).
 - NSF LEAPS-MPS: *Mathematical Innovation and Hyperparameter Optimization*. Submitted January 25, 2024 (Not funded).
 - Ralph E. Powe Junior Faculty Award: *Enhancing Deep Learning through Mathematical Structures*. Submitted 2024 (Not funded).
- **KriGNN: A Hybrid Kriging and Graph Neural Network Framework for Spatio-Temporal Air Pollution Forecasting.** IEEE ICDM 2025, 11th Workshop on Data Mining in Earth System Science (DMESS), Washington, D.C. Co-authored accepted paper with MS student Belguutei Ariuntugs; served as On-Site Chair coordinating in-person and hybrid sessions and representing Tennessee Tech in both research and leadership roles.
- **Optimization of Actuarial Neural Networks with Response Surface Methodology.** Actuarial Research Conference (ARC 2024), Tennessee Technological University, Cookeville, TN. Co-authored research on RSM-based hyperparameter optimization; accepted for oral presentation and published on arXiv (arXiv:2410.12824). Work demonstrated significant computational efficiency gains; MS student Belguutei Ariuntugs presented the results.
- **Utilizing RNNs for Real-Time Cryptocurrency Forecasting and Trading Strategy Optimization.** Actuarial Research Conference (ARC 2024), Tennessee Technological University, Cookeville, TN. Conducted research on RNN-based time-series modeling for volatile financial data; poster presentation and arXiv publication (arXiv:2411.05829). Mentored MS student Shamima Nasrin Tumpa.
- **Student Research Mentoring and Supervision.** Tennessee Technological University, Cookeville, TN. Mentored undergraduate and graduate research projects presented at Research and Creative Inquiry Day 2025, supporting project design, data analysis, coding, abstract preparation, and poster development. Advised award-winning posters including:
 - Shamima Nasrin Tumpa, Best Graduate Poster (Mathematics): *Utilizing RNN for Real-Time Cryptocurrency Prediction and Trading Strategy Optimization*.
 - Nolan Holbrook, Best Undergraduate Poster (Mathematics): *Analyzing Crime in Berlin with Poisson Regression*.
 - Abhijeet Solanki, Best Poster (Mathematics, 2024): *Optimizing Airfare Forecasting Using Machine Learning Techniques*.

Supported additional projects in 3D printing anomaly detection, cardiovascular risk modeling, credit card fraud detection with GANs, and deep learning for image recognition.

- **HomOpt: A Homotopy-Based Hyperparameter Optimization Method.** Tennessee Technological University (in collaboration with the University of Notre Dame). Developed a novel homotopy-based hyperparameter optimization framework; submitted to a major machine learning journal and accepted in 2025.
- **Nonlinear Convex Quadrature Surrogate Hyperparameter Optimization.** Postdoctoral

Research, University of Notre Dame, Notre Dame, IN. Developed convex quadrature surrogate-based optimization methods aligned with Army Research Laboratory objectives; collaborated through regular research meetings.

- **Unitary and Symmetric Structure in Deep Neural Networks.** Ph.D. Dissertation Research, University of Kentucky, Lexington, KY. Developed a novel unitary RNN architecture and a symmetry-structured CNN framework with improved performance and stability.
- **Graph Coloring and Applications.** Undergraduate Research, University of Sri Jayewardenepura, Sri Lanka. Studied graph coloring algorithms and chromatic number computation; developed a C# program to compute chromatic numbers.

Teaching Experience

Tennessee Technological University, Cookeville, TN

Assistant Professor of Mathematics

Aug. 2022 – Present

- **Graduate Courses**
 - MATH 6910 / CSC 6903: Special Topics in Deep Learning (Fall 2023, Fall 2024, Fall 2025)
 - MATH 6920 / CSC 6220: Special Topics in Data Mining (Spring 2024)
 - MATH 6990: Research & Thesis (Spring 2025)
- **Upper-Division Undergraduate Courses**
 - MATH 3080: Statistical Methods II (Fall 2023, Spring 2024, Spring 2025)
 - MATH 3070: Statistical Methods I (Fall 2022 [3 sections], Spring 2023, Summer 2023, Fall 2023, Fall 2024, Spring 2025, Summer 2025 [online], Fall 2025)
 - MATH 3470: Introductory Probability and Statistics (Summer 2023 [online], Fall 2024, Summer 2024 [online], Summer 2025 [online])
- **Lower-Division Undergraduate Courses**
 - MATH 1910: Calculus I (Spring 2025)
 - MATH 1720: Precalculus Trigonometry (Fall 2025)
- Responsibilities include course design, learning outcomes development, assessment creation, grading, and continuous student feedback using iLearn.

University of Kentucky, Lexington, KY

Graduate Teaching Assistant / Primary Instructor

Aug. 2014 – 2020

- MA 201: Mathematics for Elementary School Teachers (Spring 2020)
- MA 123: Elementary Calculus and Its Applications (Summer II 2018)
- MA 214: Calculus IV (Summer II 2017)
- MA 213: Calculus III (Summer II 2015, Summer II 2016)
- Independently instructed courses (10–20 students), developed syllabi, assessments, and transitioned instruction to online delivery during Spring 2020.

University of Kentucky, Lexington, KY

Graduate Teaching Assistant / Recitation Leader and Grader

Aug. 2014 – 2020

- MA 113: Calculus I
- MA 123: Elementary Calculus and Its Applications
- MA 162: Finite Mathematics and Its Applications
- Responsibilities included leading recitations, grading quizzes and exams, providing feedback, and supporting a collaborative learning environment.

Idaho State University, Pocatello, ID

Graduate Teaching Assistant / Lab Assistant

Aug. 2013 – May 2014

- MATH 1108: Intermediate Algebra
- Assisted undergraduate lab sessions and provided tutoring support at the Mathematics Center.

University of Kelaniya, Sri Lanka

Instructor, Department of Mathematics

2010 – 2011

- Conducted tutorial sessions for undergraduate mathematics majors.
- Courses included Vector Analysis, Linear Algebra, and Ordinary Differential Equations.

University of Sri Jayewardenepura, Sri Lanka

Instructor, Department of Mathematics

2009 – 2010

- Taught tutorial and laboratory sessions for undergraduate mathematics majors.
- Courses included Differential Equations, Calculus II, Real Analysis, Complex Analysis, Linear Algebra, Computer Programming, Applicable Mathematics, and Quantum Mechanics I.

Presentations

- **KriGNN: A Hybrid Kriging and Graph Neural Network Framework for Spatio-Temporal Air Pollution Forecasting.** 11th Workshop on Data Mining in Earth System Science (DMESS), IEEE ICDM 2025, Capital Hilton, Washington, D.C., November 2025.
- **Curvature-Adaptive Learning Rate Optimizer: Theoretical Insights and Empirical Evaluation on Neural Network Training.** FLAIRS-38 Conference (Florida Artificial Intelligence Research Society), Daytona Beach, FL, May 2025.
- **Getting Started with Tennessee Tech's HPC Cluster: A Practical Guide for Research and Coursework.** Graduate Seminar, Department of Mathematics, Tennessee Technological University, Cookeville, TN, Fall 2025.
- **Introduction to Deep Reinforcement Learning.** Graduate Seminar, Tennessee Technological University, Cookeville, TN, September 2024.
- **Optimization Techniques in Deep Learning.** Graduate Seminar, Tennessee Technological University, Cookeville, TN, February 2024.
- **NCQS: Nonlinear Convex Quadrature Surrogate Hyperparameter Optimization.** Graduate Seminar, Tennessee Technological University, Cookeville, TN, October 2023.
- **Unitary and Symmetric Structure in Deep Neural Networks.** Graduate Seminar, Tennessee Technological University, Cookeville, TN, November 2022.
- **Nonlinear Convex Quadrature Surrogate for Hyperparameter Optimization.** SIAM Annual Meeting (SIAM-AG21), Notre Dame, IN, August 2021.
- **Computer Vision Research Laboratory (CVRL) Presentations.** University of Notre Dame, Notre Dame, IN, September 2020 – July 2022. Topics included hyperparameter optimization, surrogate modeling, and nonlinear convex quadrature methods.
- **Unitary and Symmetric Structure in Deep Neural Networks.** Ph.D. Dissertation Defense, University of Kentucky, Lexington, KY, July 2020.
- **Complex Unitary Recurrent Neural Networks Using the Scaled Cayley Transform.** AAAI-2019 Conference, Honolulu, HI, January 2019 (Spotlight and Poster Presentation).
- **Complex Unitary Recurrent Neural Networks Using the Scaled Cayley Transform.** Ph.D. Qualifying Examination, University of Kentucky, Lexington, KY, April 2018.
- **Theory of Inexact Krylov Subspace Methods and Applications to Scientific Computing.** Master's Seminar, University of Kentucky, Lexington, KY, March 2017.
- **Representations and Characters of Salingaros' Vee Groups of Low Order.** Master's Thesis Defense, Tennessee Technological University, Cookeville, TN, May 2013.
- **Solving Quadratic Equations.** Teaching Seminar Presentation, Tennessee Technological University, Cookeville, TN, May 2012.

External and Internal Awards & Fellowships

- Mathematics Teaching Assistantship, Tennessee Technological University (2011–2013)
- Stanley Dolzycki Memorial Scholarship Award (2012)
- Mathematics Teaching Assistantship, Idaho State University (2014)
- Mathematics Teaching Assistantship, University of Kentucky (2015–2020)
- Mathematics Research Assistantship, University of Kentucky (Summer 2019)

Professional Memberships

- Society for Industrial and Applied Mathematics (SIAM), Member (2020–2022)
- American Mathematical Society (AMS), Member (2014–2020)
- Association for Women in Mathematics (AWM), Member (2020–2024)
- Mathematical Association of America (MAA), Member (2020–2022)
- Reviewer, *Neural Computing and Applications* (Springer), 2022–Present

Publications

- Ariuntugs, B., & Maduranga, K. D. G. (2025). KriGNN: A Hybrid Kriging and Graph Neural Network Framework for Spatio-Temporal Air Pollution Forecasting. *Proceedings of the 11th Workshop on Data Mining in Earth System Science (DMESS 2025), IEEE ICDM Workshops*, Washington, D.C. DOI: 10.1109/ICDMW69685.2025.00104.
- Maduranga, K. D. G. (2025). Curvature-Adaptive Learning Rate Optimizer: Theoretical Insights and Empirical Evaluation on Neural Network Training. *Proceedings of the 38th International Florida Artificial Intelligence Research Society Conference (FLAIRS-38)*.
- Nasrin Tumpa, S., & Maduranga, K. D. G. (2025). Advanced Hybrid RNN Architectures for Real-Time Cryptocurrency Forecasting and Strategic Trading Optimization. *Proceedings of the 38th International Florida Artificial Intelligence Research Society Conference (FLAIRS-38)*.
- Tumpa, S. N., & Maduranga, K. D. G. (2024). Utilizing RNNs for Real-Time Cryptocurrency Price Prediction and Trading Strategy Optimization. *arXiv preprint*, arXiv:2411.05829. <https://arxiv.org/abs/2411.05829>
- Maduranga, K. D. G., & Ariuntugs, B. (2024). Optimization of Actuarial Neural Networks with Response Surface Methodology. *arXiv preprint*, arXiv:2410.12824. <https://arxiv.org/abs/2410.12824>
- Abraham, S. J., Maduranga, K. D. G., Kinnison, J., Carmichael, Z., Hauenstein, J. D., & Scheirer, W. J. (2023). HomOpt: A Homotopy-Based Hyperparameter Optimization Method. Accepted (2025). <https://www3.nd.edu/~jhauenst/preprints/amkchsHomOpt.pdf>
- Abraham, S., Maduranga, K. D. G., Kinnison, J., Hauenstein, J. D., & Scheirer, W. J. (2023). NCQS: Nonlinear Convex Quadrature Surrogate Hyperparameter Optimization. In *Proceedings of the IEEE/CVF International Conference on Computer Vision (ICCV) Workshops*.
- Maduranga, K. D. G., Zadorozhnyy, V., & Ye, Q. (2022). Symmetry Structured Convolutional Neural Networks. *Neural Computing and Applications*. <https://doi.org/10.1007/s00521-022-08168-3>
- Maduranga, K. D. G., Helfrich, K. E., & Ye, Q. (2019). Complex Unitary Recurrent Neural Networks Using the Scaled Cayley Transform. *Proceedings of the AAAI Conference on Artificial Intelligence*. <https://doi.org/10.1609/aaai.v33i01.33014528>
- Maduranga, K. D. G., & Ablamowicz, R. (2016). Representations and Characters of Salingaros' Vee Groups of Low Order. *Bulletin of the Society of Sciences and Letters of Łódź, Series: Mathematical Sciences*, 66(1), 43–75.

Service and Outreach

- **Reviewer, *Neural Computing and Applications* (Springer)** 2023–Present
Reviewed research articles for an international peer-reviewed journal, contributing to the evaluation of methods in machine learning, optimization, and applied artificial intelligence.
- **Workshop Reviewer, ICCV 2023** 2023 Reviewer for the 1st Workshop on Resource-Efficient Deep Learning for Computer Vision, held in conjunction with the IEEE/CVF International Conference on Computer Vision.
- **Review Committee Member, ASBIRES** 2021 Served as a reviewer for the Applied Science, Business, and Industrial Research Symposium (ASBIRES), Wayamba University of Sri Lanka.
- **Science Exhibition Committee Member, Vidujaya Exhibition** 2009 University of Sri Jayewardenepura, Sri Lanka. Participated in organizing and presenting exhibits celebrating the University's Golden Jubilee, including demonstrations connecting mathematics with real-world and cultural applications.
- **Industrial Internship Trainee, Lanka Plastic Industries (PVT) Ltd.** 2009
Gained hands-on industrial experience and developed a stock control system using Visual Basic 6.0 and SQL Server.
- **Project Team Member, Strategic Planning Study** 2008 Conducted a strategic planning analysis of Richard Pieris and Company PLC, Sri Lanka, and prepared a comprehensive project report.
- **Project Team Member, Leadership and Motivation Study** 2008 Completed a case study on leadership and motivation at McLarens Holdings Limited, Sri Lanka, including data analysis and report preparation.

Skills

- **Programming:** Python, R, C/C++, C#, SQL, Visual Basic 6.0, MATLAB
- **Machine Learning:** PyTorch, TensorFlow, Keras
- **Statistics & Data Analysis:** R, SPSS
- **Scientific Computing & Tools:** LaTeX, Mathematica, Maple
- **Operating Systems:** Linux, Windows
- **Languages:** English (fluent), Sinhala (fluent)
- **Productivity Software:** Microsoft Word, Excel, PowerPoint

References

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