Julia V.E. Kim

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Education

Stanford University *Palo Alto, USA*
PH.D. IN PHYSICS, PH.D. MINORS IN STATISTICS AND COMPUTER SCIENCE *Sep. 2025-Jun. 2030 (expected)*

Trinity College, University of Cambridge *Cambridge, UK*
MASTERS OF MATHEMATICS *Oct. 2024 - Jun. 2025 (expected)*

- **Scholarship**: Trinity Studentship in Mathematics

University of Toronto *Toronto, CA*
HONOURS BACHELORS OF SCIENCE IN PHYSICS, MATHEMATICS AND STATISTICS *Sep. 2019-Jun.2024*

- **Cumulative GPA: 4.00/4.00**, **Average: 97.6%**, **Rank: 1/16,000**
- **Thesis**: "Likelihood-Based Statistical Tests in C++ for Use in the Analysis of Dark Matter LIP Signals"
- **Scholarship**: Rose Sheinin Award for *top female student* in science at UofT
- **Relevant Courses**: Quantum Computation, Probability, Machine Learning, Nonlinear Optimisation, Python Programming

Professional Experience

Astrophysics Machine Learning Researcher *Toronto, CA*
UNIVERSITY OF TORONTO *May 2024-present*

- Designed and trained deep convolutional neural networks in **PyTorch** to predict stellar parameters with high precision and accuracy
- Developed self-supervised model under **contrastive learning**, successfully embedding cross-modal data into a shared latent space
- Achieved an R^2 accuracy of over 95% on one-shot stellar property estimation tasks, outperforming traditional baselines by 19%

Biophysics Machine Learning Researcher *Toronto, CA*
UNIVERSITY OF TORONTO *May 2023-May 2024*

- Built a stochastic model in **TensorFlow** to simulate receptor signalling pathways with cross-talk and pleiotropy
- Applied information theory and statistical inference to investigate the impact of feedback and molecular noise on signalling specificity
- Improved model accuracy by 30% through hyperparameter tuning, feature selection and optimising neural network architecture

Dark Matter Particle Physics Researcher *Toronto, CA*
SUPERCDMS SNOLAB & UNIVERSITY OF TORONTO *Sep. 2021-Apr.202*

- Developed likelihood-based statistical models in **C++** to establish sensitivity projections for detecting dark matter signals
- Performed over $1,000$ Monte Carlo simulations to generate test statistics for LIP detection at 95% confidence level
- Leveraged **RooFit** and **RooStats** to estimate an upper limit of 120 signal events, validating results with χ^2 and Gaussian distributions

Skills

Languages: Python, MATLAB, R, bash/command line, LaTeX
Libraries/Frameworks: PyTorch, TensorFlow, Numpy, Pandas, Matplotlib, Scikit-learn, Seaborn
Tools: Git, XCode, Microsoft Office Suite

Publications

1. Julia V.E. Kim & John R. Percy, "Pulsating Red Giants in a Globular Cluster: ω Centauri", 2022, JAAVSO, 50, 2. Link.
2. Julia V.E. Kim & Nathan R. Sandford. 'A Contrastive Deep Learning Approach for the Analysis of Stellar Spectra.' (in progress)
3. Natasha Leclerc, Julia V.E. Kim et al. 'Barium Depletion in Canadian Coastal Waters Points to Planktonic Phytoplankton Bloom Intensification in the Arctic'. (in progress)
4. Julia V.E. Kim. 'Patterns and Trends in Endangered Species Listing Heavily Biased Towards Imperiled Vertebrates with High Utility Value to Humans.' Featured in Alexander, R. (2024) *Telling Stories with Data with Applications in R*. Milton: CRC Press LLC. Link.
5. Julia V.E. Kim. 'Significant Declines in Standardised Test Scores due to COVID-19 School Closures Disproportionately Affect Vulnerable Students.' Featured in Alexander, R. (2024) *Telling Stories with Data with Applications in R*. Milton: CRC Press LLC. Link.

Projects

Using a Deep Deterministic Gradient Policy (DDPG) to Control a Two-Joint Arm *University of Toronto*
MACHINE LEARNING COURSE PROJECT *Mar.-Apr. 2023*

- Implemented DDPG reinforcement learning algorithm in MATLAB to optimise the motion of a two-joint robotic arm
- Developed and trained neural networks with ReLU activation, stochastic gradient descent and Adam optimisation

- Achieved improved policy returns from $G = -208$ to $G > -25$ over 1000 rollouts, by leveraging test policies and minibatch learning with replay buffer

Learning MNIST Handwritten Digits with a Retinotopic Map *University of Toronto*
MACHINE LEARNING COURSE PROJECT *Feb.-Mar. 2023*

- Implemented neural network to recognise digits, using backpropagation with Adam and Nesterov in MATLAB
- Developed 3-layer mapnet with ReLU activations, applying softmax for classification and training through minibatch learning
- Reduced classification error from 480 to below 170 incorrect guesses over 10 epochs across $60,000$ training and $10,000$ test examples

Awards

University of Toronto Dean's List Scholar, University of Toronto 2020-2024
Rose Sheinin Award, University of Toronto Jun. 2024
St Micheal's College Achievement Award in Maths and Physical Sciences, University of Toronto Jun. 2024
Governor General Silver Medal Nominee, University of Toronto Jun. 2024
University of Toronto Excellence Award, University of Toronto Jun. 2023, Jun. 2024
Trinity Studentship in Mathematics, University of Cambridge Apr. 2024
John J Sebisty Scholarship, University of Toronto Mar. 2024
David and Louise Fraser Scholarship, University of Toronto Mar. 2024
Hymie and Roslyn Mida Student Award in Theoretical Physics, University of Toronto Mar. 2024
Stirling Prize Graduate Fellowship, Yale University Feb. 2024
Lucilla Colavita Memorial Scholarship, University of Toronto Jun. 2023
Jackman Scholars-in-Residence Award, Victoria College Jun. 2023
The 3T0 M.&.P. and Associates Scholarship, University of Toronto Dec. 2021, Feb. 2023
Patricia Massel 5T1 Bursary, University of Toronto Jun. 2022
NSERC USRA and University of Toronto Chair Scholar, NSERC May 2022
St Micheal's College In Course Scholarship, University of Toronto Mar. 2022
University of Toronto In-Course Scholarship, University of Toronto Sep. 2021
University of Toronto Scholar's Award, University of Toronto Aug. 2021
Samuel Beatty In-Course Scholarship, University of Toronto Jan. 2021
Joseph Alfred Whealy In-course Scholarship, University of Toronto Sep. 2020
Ontario Scholar & Governor's General Academic Medal, Humberside Collegiate Institute Jun. 2018
Certificat d'Honneur d'Études Bilingues en Français Immersion, Humberside Collegiate Institute Jun. 2018
Diplôme National du Brevet des Collèges avec Mention Très Bien, Toronto French School Jun. 2016

Teaching

Scholar Radiance Youth Club, Mathematics Instructor Jan. 2023-present
OCAD University, SCTM-2003: Astronomy–Scales & Structures TA May-Jul. 2023
University of Toronto, MAT137Y1: Calculus! TA Sep. 2023-May 2021
University of Toronto, MAT233: Linear Algebra I workbook editor May-Jul. 2020

Talks

1. 'Applying Self-Supervised Learning to the Analysis of Stellar Spectra', SURP Presentation Day. University of Toronto (Aug. 2024).
2. 'Replication Analysis of COVID-19 Test Scores', DSI Reproducibility Challenge. Data Science Institute, University of Toronto (May 2024).
3. 'Ba-Ca and stable C isotope ratios in *C. compactum* suggest increase in Artic primary productivity driven by sea loss and higher nutrient input from permafrost melt and terrestrial run-off', ALSO Conference, Madison, Wisconsin, USA (Feb. 2024).
4. 'Investigating *C. compactum* as an Artic Erosion Proxy', UTM Indicium Talk. University of Toronto (Jul. 2023).
5. 'Generalising M_{T2}^{DC} for Decay Chains and Mass Measurements', ATLAS Talk. University of Toronto (Jul. 2022).

Outreach

Girls in STEAM, Vice President of Content Jan. 2023-May 2024
University of Toronto Machine Intelligence Team, Academic Coordinator Jan. 2023-May 2024
University of Toronto Aerospace Team, Structures Division Assistant Jun. 2021-May 2023
Assistant Canada's C3 CyberSTEAM Challenge, Director of Virtual Design Team Sep. 2022-Jun. 2023
The Varsity, University of Toronto Newspaper Science Writer Jun. 2022- Jun.2023

Media

Kaster, J. (2024) *St. Mike's Julia Kim wins top U of T science award*, St. Micheal's College, University of Toronto. Link.