

CHRISTOPHER SHALLUE

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SUMMARY

- **Experienced researcher:** 10+ years across cosmology, astrophysics, machine learning, and mathematics. 1900+ citations (900+ as first author).
- **Senior software engineer:** former Google Senior Software Engineer experienced in code design, parallel computing, unit testing, and collaborative coding.
- **Machine learning specialist:** extensive experience designing, implementing, and improving machine learning models for both research and production.

EXPERIENCE

Harvard University

Graduate Research Fellow

Cambridge, MA, USA

September 2019—present

- Developed a new method to reconstruct the conditions of the early universe by combining physics with deep neural networks, achieving substantial improvements over prior techniques.

Google Brain Research Team (now Google DeepMind)

Senior Research Software Engineer

Mountain View, CA, USA

March 2016—October 2019

Independent researcher in a collaborative lab focused on machine learning and AI.

- Conceived and designed a deep neural network for detecting extrasolar planets. Discovered the first planet ever found with machine learning, as well as the first extra-solar system with 8 known planets. Integrated the model into the production pipeline for NASA's TESS mission, which has discovered 400+ new planets to date.
- Co-led a multi-year research program aimed at understanding and improving neural network training. Published 5 papers on data parallelism, optimization methods, and hyperparameter tuning as a primary author.
- Co-advised 3 junior researchers in the Google AI residency program, resulting in 3 publications and 1 patent.

Google Display Ads

Software Engineer

Mountain View, CA, USA

January 2014—March 2016

Technical lead of machine learning modeling team for Gmail ads (9 people).

- Developed machine learning models for global personalized ad targeting. Personally designed and launched new models with \$10M+/year in revenue gains.
- Led weekly group meetings, gave guidance and feedback on projects, mentored junior team members.

EDUCATION

Harvard University

PhD in Astrophysics (GPA: 3.81)

Cambridge, MA, USA

2019—May 2025 (expected)

- Honors: Quad Fellowship (*leaders in science and technology committed to innovation and collaboration*), Ardis and Robert James Graduate Fellowship (*exceptional Harvard graduate students*)

Monash University

BS (Hons) in Mathematics (GPA: 4.00)

Clayton, VIC, Australia

2009—2012

- Honors: Carl Moppert Prize for Mathematics (*top mathematics honors student*), Monash University Medal for Excellence (*top science student university-wide*), Highest Academic Performance in a Science Course (6 time recipient), Monash University Scholarship for Excellence.

TECHNICAL SKILLS

Programming languages: Python, C++

ML frameworks: JAX, TensorFlow

ML implementation: Architecture design, GPU acceleration

ML training: Hyperparameter tuning, training algorithms

PUBLICATIONS

1900+ citations (900+ as first author). [Google scholar](#).

Astrophysics and Cosmology (selected order)

- **Shallue** and Eisenstein. “Reconstructing Cosmological Initial Conditions from Late-Time Structure with Convolutional Neural Networks.” *Monthly Notices of the Royal Astronomical Society*, 520, 4 (2023). [arXiv](#)
- **Shallue** et al. “Warm Hawking Relics From Primordial Black Hole Domination” *Journal of Cosmology and Astroparticle Physics*, submitted (2024). [arXiv](#)
- **Shallue** and Vanderburg. “Identifying Exoplanets with Deep Learning: A Five Planet Resonant Chain around Kepler-80 and an Eighth Planet around Kepler-90.” *The Astronomical Journal*, 155, 94 (2018). [arXiv](#)
- de Beurs et al, including **Shallue**. “Characterization of K2-167 b and CALM, a new stellar activity mitigation method.” *Monthly Notices of the Royal Astronomical Society*, 529, 2 (2024). [arXiv](#)
- de Beurs, Vanderburg, **Shallue**, et al. “Identifying Exoplanets with Deep Learning. IV. Removing Stellar Activity Signals from Radial Velocity Measurements Using Neural Networks.” *The Astronomical Journal*, 164, 49 (2022). [arXiv](#)
- Yu et al, including **Shallue**. “Identifying Exoplanets with Deep Learning III: Automated Triage and Vetting of TESS Candidates.” *The Astronomical Journal*, 158, 1 (2019). [arXiv](#)
- Dattilo, Vanderburg, **Shallue**, et al. “Identifying Exoplanets with Deep Learning II: Two New Super-Earths Uncovered by a Neural Network in K2 Data.” *The Astronomical Journal*, 157, 5 (2019). [arXiv](#)

Machine Learning (selected order)

- **Shallue** et al. “Measuring the Effects of Data Parallelism on Neural Network Training.” *Journal of Machine Learning Research*, 20, 112 (2019). [arXiv](#)
- Choi, **Shallue**, et al. “On Empirical Comparisons of Optimizers for Deep Learning.” *Technical report* (2020). [arXiv](#)
- Dhingra, **Shallue**, et al. “Embedding Text in Hyperbolic Spaces.” *Twelfth Workshop on Graph-Based Methods for Natural Language Processing*, 59 (2018). [arXiv](#)
- Godbole et al, including **Shallue**. “Deep Learning Tuning Playbook.” *Field guide* (2023). [GitHub](#)
- Zhang et al, including **Shallue**. “Which Algorithmic Choices Matter at Which Batch Sizes? Insights From a Noisy Quadratic Model.” *Neural Information Processing Systems*, 8194 (2019). [arXiv](#)
- Choi, Passos, **Shallue**, et al. “Faster Neural Network Training with Data Echoing.” *Technical report* (2019). [arXiv](#)
- Nado, Gilmer, **Shallue** et al. “A Large Batch Optimizer Reality Check: Traditional, Generic Optimizers Suffice Across Batch Sizes.” *Technical report* (2021). [arXiv](#)

Mathematics

- **Shallue** and Wanless. “Permutation Polynomials and Orthomorphism Polynomials of Degree Six.” *Finite Fields and Their Applications*, 20, 84 (2013). [Publisher](#)
- **Shallue**. “Permutation Polynomials of Finite Fields.” *Honors Thesis* (2012). [arXiv](#)

PATENTS

- “Systems and Methods for Reducing Idleness in a Machine-Learning Training System using Data Echoing.” *US Patent 11,537,949* (2022).

OPEN SOURCE CODE

- **AstroNet**: A deep neural network library for identifying exoplanets in stellar light curves. [GitHub](#)
- **recon-cnn**: A convolutional neural network library for reconstructing cosmological initial conditions. [GitHub](#)