Christopher Shallue

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EXPERTISE

- **Senior software engineer** experienced with Google infrastructure, TPUs, robust code design, readability, unit testing, and working in large codebases.
- **Machine learning engineer** with 11 years of experience developing ML models at Google (both research and production) and in academia.
- **Experienced researcher** in machine learning and ML for astrophysics (2200+ citations, 1000+ first author).

EMPLOYMENT

Massachusetts Institute of Technology **Cambridge, MA, USA**
Postdoctoral Associate Feb. 2025—present

Developing machine learning methods to detect exoplanets using data from the NASA Kepler mission.

Harvard University **Cambridge, MA, USA**
PhD Candidate Sep. 2019—Dec. 2024

Developed machine learning and other numerical methods for astrophysics.

- Trained a neural network to reconstruct the early cosmological density field from observational data.
- Co-authored the *Google Deep Learning Tuning Playbook*. (Also published as a *Google Developers' Guide*).

Google Brain **Mountain View, CA, USA**
Senior Research Software Engineer Mar. 2016—Oct. 2019

- Co-led a research program with George Dahl to understand and improve neural network training. Published 5 papers on data parallelism (batch size), optimization, and hyperparameter tuning as a primary author.
- Proposed and designed a neural network for detecting exoplanets. Discovered the first planet ever found with machine learning.
- Co-advised 3 junior researchers in the Google AI residency program. Hired and managed one intern.

Google Display Ads **Mountain View, CA, USA**
Software Engineer Jan. 2014—Mar. 2016

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

- Personally designed and launched new models for global ad selection.

EDUCATION

Harvard University **Cambridge, MA, USA**
PhD in Astronomy & Astrophysics Sep. 2019—Dec. 2024
MA in Astronomy & Astrophysics (*GPA:* 3.81) Sep. 2019—Nov. 2023

- Honors: Quad Fellowship (*leaders in science and technology*); Ardis and Robert James Graduate Fellowship.

Monash University **Clayton, VIC, Australia**
BS (Hons) in Mathematics (*GPA:* 4.00) Mar. 2009—Jun. 2012

- Honors: Carl Moppert Prize for Mathematics; Monash University Medal for Excellence; First Class Honours; Highest Academic Performance in a Science Course (6 times); Monash University Scholarship for Excellence.

TECHNICAL SKILLS

ML frameworks: JAX, TensorFlow
ML implementation: TPUs and Google infrastructure
Programming languages: Python, C++
ML development: Architecture design, tuning

PUBLICATIONS (*Google scholar*)

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" (2020). *arXiv*
- Godbole et al., inc. **Shallue**. "Deep Learning Tuning Playbook" (2023). *google-research/tuning_playbook*. *Also a Google Developers' Guide: Deep Learning Tuning Playbook.*
- Zhang et al, inc. **Shallue**. "Which Algorithmic Choices Matter at Which Batch Sizes? Insights From a Noisy Quadratic Model." *Neural Information Processing Systems*, 8194 (2019). *arXiv*
- Dhingra, **Shallue**, et al. "Embedding Text in Hyperbolic Spaces." *Twelfth Workshop on Graph-Based Methods for Natural Language Processing*, 59 (2018). *arXiv*
- Choi, Passos, **Shallue**, et al. "Faster Neural Network Training with Data Echoing" (2019). *arXiv*
- Nado, Gilmer, **Shallue** et al. "A Large Batch Optimizer Reality Check: Traditional, Generic Optimizers Suffice Across Batch Sizes" (2021). *arXiv*

Astrophysics (selected order)

- **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*
- **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*
- 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*
- Yu et al, inc. **Shallue**. "Identifying Exoplanets with Deep Learning III: Automated Triage and Vetting of TESS Candidates." *The Astronomical Journal*, 158, 1 (2019). *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*
- de Beurs et al, inc. **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*
- **Shallue** et al. "Warm Hawking Relics From Primordial Black Hole Domination" *Journal of Cosmology and Astroparticle Physics*, 02, 026 (2025). *arXiv*
- **Shallue** and Carroll. "What Hawking Radiation Looks Like as You Fall into a Black Hole" (2025). *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 neural network library for identifying exoplanets in stellar light curves. *GitHub*
- `recon-cnn`: A neural network library for reconstructing cosmological initial conditions. *GitHub*
- `hawking-radiation`: A numerical library for calculating Hawking radiation near a black hole. *GitHub*