Christopher Shallue

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SUMMARY

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

EXPERIENCE

Harvard University **Cambridge, MA, USA**
Graduate Research Fellow 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) **Mountain View, CA, USA**
Senior Research Software Engineer 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 **Mountain View, CA, USA**
Software Engineer 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 **Cambridge, MA, USA**
PhD in Astrophysics (*GPA:* 3.81) 2019—May 2025 (expected)

- Honors: Quad Fellowship (*leaders in science and technology committed to innovation and collaboration; 3% acceptance rate*), Ardis and Robert James Graduate Fellowship (*exceptional Harvard graduate students*)

Monash University **Clayton, VIC, Australia**
BS (Hons) in Mathematics (*GPA:* 4.00) 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*

Last updated July 27, 2024