

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

Harvard University

Cambridge, MA, USA

Research Assistant

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, achieving substantial improvements over prior techniques.
- Designed a neural network for reducing stellar activity from radial velocity measurements to detect exoplanets.

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.
- 5-time instructor for the *Machine Learning Crash Course*.

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.
- Led weekly group meetings, gave guidance and feedback on projects, mentored junior team members.

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*, accepted for publication (2025). [arXiv](#)
- Shallue and Carroll. “What Hawking Radiation Looks Like as You Fall into a Black Hole.” *Physical Review D*, under review (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](#)

MEDIA AND OUTREACH

Press Releases

- “Artificial Intelligence, NASA Data Used to Discover Eighth Planet Circling Distant Star.” Joint release by NASA, Google, and the University of Texas. Presented in a live teleconference to 44 journalists and 300,000 listeners. Dec. 14, 2017. <https://go.nasa.gov/39JuyiI>.

Press Coverage & Interviews

- “Google AI Helped Find the First Solar System Outside Our Own with 8 Planets.” Dec. 14, 2017. Featured in outlets including the New York Times, Washington Post, CNN, National Geographic, BBC, Wired, Popular Science, and UT Austin’s “Research that Changed the World in 2017.” Follow up interviews and coverage in Korea (Jan., 2018), Taiwan (Feb., 2018), Japan (Aug., 2018), and China (Sep., 2018).

TV, Podcast, & Radio Appearances

- “Hunting for Planets with Machine Learning.” Televised interview for Cosmic Front on NHK (Japan). Aired Sep. 13, 2018.
- “Detecting Planets with Deep Learning.” Practical AI podcast. Aired Jul. 16, 2018.
- “Discovering Exoplanets with Deep Learning.” This Week in Machine Learning & AI. Aired Mar. 8, 2018.
- “Discovering Planets with Machine Learning.” ABC Australia Radio interview. Aired Dec. 15, 2017.

TALKS / PRESENTATIONS

- “Machine Learning for Extreme Precision Radial Velocity Researchers.” NASA EPRV + Machine Learning Workshop, Jun. 2024.
- “Hawking Relics from Evaporating Primordial Black Holes.” University of Texas at Austin, Mar. 2024.
- “Can Deep Learning Help Find Earth Analogues?” Kepler & K2 Science Conference, Mar. 2019.
- “Using Deep Learning to Search for Earths in Kepler and K2 data.” University of California Santa Cruz, Nov. 26, 2018.
- “The Effects of Batch Size on Neural Network Training.” NASA Frontier Development Lab, Jul. 23, 2018.
- “Hunting for Exoplanets with AI” (*part of Google’s keynote*). World AI Conference, Shanghai, Sep. 18, 2018.
- “Hunting for Exoplanets with Machine Learning” (*keynote*). Chicago Booth ML Summit, Apr. 12, 2018.
- “Big Astronomy Begins: Searching for Exoplanets with AI.” SETI Talks, Feb. 21, 2018. https://youtu.be/V_rcLEBW1ro.
- “Classifying Kepler Light Curves Using Deep Learning.” Bay Area Exoplanet Meeting at NASA, Dec. 1, 2017.
- “Deep Learning for Planet Transits.” NASA Frontier Development Lab, Jul. 20, 2017.

JOURNAL / CONFERENCE REFEREE

- Referee for *Neural Information Processing Systems* (2021, 2019).
- Referee for *Monthly Notices of the Royal Astronomical Society* (2024).
- Referee for *Computational Astrophysics and Cosmology* (2018).
- Referee for the *Astronomical Journal* (2018).

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