

# David Ettel

[linkedin.com/in/david-ettel](https://www.linkedin.com/in/david-ettel) | <https://github.com/ilstudente> | [Website](#)

## EDUCATION

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- University of Cambridge** Incoming Oct. 2026 – June 2027  
*MASt in Pure Mathematics (Part III), Fitzwilliam College* Cambridge, UK
- Harvard University** Sept. 2022 – May 2026  
*Bachelor of Arts in Mathematics, Minor in Computer Science, GPA: 3.91* Cambridge, MA
- **Coursework:** Math 55A/B, Algorithms and Data Structures, Machine Learning (MIT), Interpretability in ML (G), Systems Programming and Machine Organization, Geometric Methods in Machine Learning (G), Probability
- Sir Karl Popper School** Sept. 2017 – June 2021  
*High School* Vienna, Austria

## RESEARCH & PUBLICATIONS

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- Counting with Theta Characteristics** Spring 2026  
*Senior Thesis, advised by Thomas Brazelton* Cambridge, MA
- Investigated theta characteristics on smooth and singular curves, applying modern algebraic geometry to geometric counting problems.
  - Produced a 50-page expository manuscript synthesizing graduate literature and bridging undergraduate and advanced algebraic geometry.
  - Nominated for the Hoopes Prize, one of Harvard's highest honors for undergraduate research.

- HARDMath2: A Benchmark for Applied Mathematics** NeurIPS 2025  
*Datasets & Benchmarks Track* San Diego, CA
- Co-wrote background and experimental-setup sections; shaped coverage of boundary-layer analysis, WKB methods, nonlinear-PDE asymptotics, and oscillatory-integral approximations.
  - Authored 10 graduate-level benchmark problems requiring multi-step asymptotic analysis; peer-verified 30+ solutions.
  - Sole student member on the rebuttal team, coordinating point-by-point responses to reviewer feedback under 6-day deadlines.
  - arXiv: <https://arxiv.org/abs/2505.11774>

- Non-conflicting Flows on Cubic Bridgeless Graphs** Summer 2025  
*Independent research with Prof. Philip Matchett Wood, Harvard* Cambridge, MA
- Independent investigation of a 2025 conjecture in graph theory; designed problem framing, literature synthesis, and proof strategy.
  - Developed partial results on structural conditions for non-conflicting flow existence; manuscript in preparation.
  - Manuscript draft: [ilstudente.github.io/Mathematics\\_REU\\_2025-3.pdf](https://github.com/ilstudente/Mathematics_REU_2025-3.pdf)

- Effects of Network Pruning on LLM Interpretability** Spring 2025  
*The Harvard Undergraduate Research Journal (THURJ)* Cambridge, MA
- Co-authored published analysis of how network pruning affects SHAP and IG explanation faithfulness in DistilBERT and RoBERTa.
  - Found that explanation reliability is more sensitive to architecture and pruning randomness than to magnitude-based sparsity.
  - Investigated geometric underpinnings of interpretability via Hessian-based curvature analysis.
  - [doi.org/10.62571/gujf5t1klb25jbcdbde](https://doi.org/10.62571/gujf5t1klb25jbcdbde) — code

- Appendix: Leray Spectral Sequences** 2025  
*Contribution to Math 231Br lecture notes (T. Brazelton)* Cambridge, MA
- Wrote an appendix on Leray spectral sequences for the graduate algebraic topology lecture notes.
  - [github.com/tbrazel/math231br](https://github.com/tbrazel/math231br)

## EXPERIENCE

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**Research Assistant, Almost Equivariant Machine Learning** Oct. 2024 – Present  
*Melanie Weber Group, Harvard University* Cambridge, MA

- Principal investigator on a \$6,000 Harvard KURE grant studying scalability of approximately equivariant neural networks.
- Extending results from equivariant ML to the almost-equivariant regime; designing and running scaling experiments.
- Implementing architectures in PyTorch / PyTorch Geometric; benchmarking against equivariant and non-equivariant baselines.

**Research Assistant, Topological Deep Learning** June 2024 – Aug. 2024  
*Vikas Garg Group, Aalto University* Espoo, Finland

- Original research on neural approximators for persistent homotopy; formulated the research question via extensive literature review in previously unmapped territory.
- Built the theoretical foundation for the expressiveness of the approximators and designed the corresponding network architecture.
- Selected from 4,300 applicants for a 60-person cohort.

**Teaching Assistant, Pure & Applied Mathematics** Jan. 2024 – Present  
*Department of Mathematics & SEAS, Harvard University* Cambridge, MA

- TA for Physical Mathematics (Graduate), Differential Topology, Real Analysis, Algebra I, Algebra II, and Classical Geometry.
- Grade problem sets for up to 80 students weekly; lead office hours and review sections covering supplementary material.

**Alternative Civilian Service, Kindergarten Assistant** Oct. 2021 – June 2022  
*City of Vienna* Vienna, Austria

- Supervised and instructed groups of up to 20 children aged 1–10, 40 hours per week; served 200+ children overall.
- Taught reading, counting, basic math, and chess; led group activities and event planning.

**Firmware Engineering Intern (High School)** Summer 2019  
*MedAustron Ion Therapy Centre* Wiener Neustadt, Austria

- End-to-end shipped firmware for a water phantom: a submerged robotic positioning system used in research and dosimetric commissioning of proton and carbon-ion radiation therapy.
- Implemented motion control and user interface in C++ and Python.

## PROJECTS

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**comath** | *Python, multi-agent systems*

- Faithful reconstruction of DeepMind’s AI co-mathematician harness (Zheng et al., arXiv:2605.06651): four-layer agent hierarchy, shared versioned workspace, formal verification layer, and reviewer consensus loop.
- [github.com/ilstudente/comath](https://github.com/ilstudente/comath)

**DIY Carbon-Fiber Drone** | *CAD, 3D printing, embedded systems*

- Designed and built a 70mm carbon-fiber drone with 3D-printed propellers for Harvard’s PS70.
- Write-up | original report

## EXTRACURRICULAR ACTIVITIES

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**Technical Fellow** Sept. 2024 – Present  
*Harvard AI Safety Club* Cambridge, MA

- Weekly technical reading group on AI safety papers; monthly workshops with researchers from Redwood Research, OpenAI, Anthropic, and others.

**Problem Writer and Tester** Sept. 2023 – May 2024  
*Harvard-MIT Math Tournament* Cambridge, MA

- Invented and developed problems for the biannual HMMT, attended by 1,000+ high school students worldwide.
- Test-solved and evaluated 76 questions per competition; graded 700+ exams on competition day.

**Best Actor, “The Fifth” (dir. Silas Camp)** 2024  
*Harvard East Asian Cinema (150+ students)* Cambridge, MA

## AWARDS

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### Mathematics Olympiads

2020 – 2021

*National & International*

- **Cyber Mathematical Competition 2020** (deferred-IMO compensatory, top 8 per country): Honorable Mention, second-best Austrian result.
- **Middle European Mathematical Olympiad 2020** (top 6 non-IMO students per country): Honorable Mention, best Austrian result.
- Top-ten placements in Austrian National Mathematical Olympiad finals, 2020 and 2021; first in qualifying round.

### Pre-scientific Paper (Austrian Matura VWA)

2021

*“Comparison of the geometries resulting from a modification of the Euclidean Parallel Postulate”*

- 1st place, Hans-Riegel-Fachpreis for mathematical pre-scientific papers, University of Vienna.
- Best Mathematical Pre-scientific Paper in Austria, Austrian Mathematical Society (ÖMG).

## SKILLS & LANGUAGES

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**Languages (programming):** Python, C/C++, SQL, JavaScript, Bash.

**Libraries:** PyTorch, PyTorch Geometric, NumPy, Matplotlib, SymPy, NetworkX.

**Tools:** Git, Docker, L<sup>A</sup>T<sub>E</sub>X, Jupyter, Weights & Biases.

**Languages (spoken):** German (native), English (C2), Italian (B1), French (A1).