David (Fengning) Ding | Curriculum Vitae

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Education

- **Harvard University** — **Cambridge, MA**
  S.M in Computer Science, GPA: 4.0. — *2012–2016*
- **Harvard University** — **Cambridge, MA**
  A.B in Mathematics, GPA: 3.97, Major GPA: 4.0. Graduated Magna Cum Laude. — *2012–2016*
- **Phillips Academy** — **Andover, MA**
  High school, Graduated Cum Laude. — *2010–2012*

Industry Experience

- **DeepMind** — **London, UK**
  Research Engineer — *August 2018–Now*

  Led research on solving visual causal reasoning tasks using transformer architectures (paper published). Part of research team on a project to improve exploration for reinforcement learning agents. Contributed to various engineering projects.
- **Vatic Labs** — **New York, NY**
  Quantitative Researcher — *July 2016–July 2018*

  Implemented high frequency trading strategies. Designed a framework for machine learning and strategy development. Developed signals and designed objectives for model training. Helped implement a cloud-based optimization framework and experimented with optimization algorithms.
- **Dropbox** — **San Francisco, CA**
  Software Engineering Intern — *May 2015–Aug 2015*

  Worked on frontend and backend for a new scalable email and mobile notifications platform. Migrated Dropbox's old email campaigns to new system. Integrated AWS Cloudsearch into platform to allow searching by email content.
- **Google** — **Mountain View, CA**
  Software Engineering Intern — *May 2014 – Aug 2014*

  Worked for the Search Quality team to extend functionality of a compiler for a Matlab-like language used to develop ranking algorithms. Project enabled the compilation of a significant fraction of experimental ranking algorithms for production usage.
- **Heyzap** — **San Francisco, CA**
  Software Engineering Intern — *May 2013 – Aug 2013*

  Various front-end work, including extending the image upload system to allow cropping. Maintained Android app to test the Heyzap framework. Rewrote logging code for efficiency to fix site downtime.

Teaching Experience

- **Harvard** — **Cambridge, MA**
  Teaching Fellow — *Jan 2015 – May 2016*

Teaching fellow for:
- CS 124 (Algorithms and Data Structures)
- CS 61 (Systems Programming)
- CS 161 (Operating Systems)

Graded problem sets and exams, hosted office hours, and led sections.

Awards

- Phi Beta Kappa Junior 24 (2015)
- John Harvard Scholar (2013, 2014, 2015)
- Harvard ACM ICPC team (2013)
- Harvard Detur Prize (2013)
- National Merit Finalist (2012)
- US Physics Team Member (2012)
- Davidson Fellow, $50000 scholarship (2012)
- Intel Science Talent Search, 4th Place ($40000 scholarship) (2012)
- Math Olympiad Program Participant (2009)

Projects

Published Papers

- **Object-based attention for spatio-temporal reasoning**

  Led research on applying transformers to object representations to solve visual understanding tasks like CLEVRER and CATER. Our model significantly outperformed state of the art and challenged the notion that certain tasks, such as causal reasoning, require "symbolic reasoning" to solve.

  David Ding, Felix Hill, Adam Santoro, Matt Botvinick. *Object-based attention for spatio-temporal reasoning: Outperforming neuro-symbolic models with flexible distributed architectures.* arXiV, 2020. https://arxiv.org/abs/2012.08508

- **Adapting Behavior for Learning Progress**

  Part of research team on improving exploration strategies for reinforcement learning agents. We developed an algorithm to adaptively explore large sets of hyper-parameters.

  Tom Schaul, Diana Borsa, David Ding, David Szepesvari, Georg Ostrovski, Will Dabney, Simon Osindero *Adapting Behavior for Learning Progress* arXiV, 2019. https://arxiv.org/pdf/1912.06910.pdf

- **OpenSpiel**

  Contributed to open source RL framework for board games.

  Lanctot et al. *OpenSpiel: A Framework for Reinforcement Learning in Games*. arXiv, 2019. https://arxiv.org/abs/1908.09453

- **Representations of Infinitesimal Cherednik algebras**

  Research on the representation theory of infinitesimal Cherednik algebras with Alexander Tsymbaliuk. Won fourth-place at the Intel Science Talent Search ($40000 scholarship) and $50000 scholarship Davidson Fellow scholarship.

  Fengning Ding and Alexander Tsymbaliuk. *Representations of infinitesimal Cherednik algebras*, Represent. Theory 17 (2013), 557-583. Available at `http://www.ams.org/journals/ert/2013-17-19/`

S1088-4165-2013-00443-0/

Course Projects

- **Ranks of Elliptic Curves via the Shioda-Tate Theorem**

  Senior Thesis for B.A. in Mathematics. A survey of results on elliptic surfaces and the Shioda-Tate theorem, with applications towards constructing elliptic curves of high rank.
  Paper: `https://fding.github.io/thesis.pdf`

- **The Hirzebruch Riemann Roch Theorem**

  Junior Thesis for B.A. in Mathematics. Exposition on the Atiyah-Hirzebruch formulation of the Rieman-Roch theorem for smooth algebraic varieties.
  Paper: `https://fding.github.io/junior_thesis.pdf`

- **Password Prediction from Keyboard Acoustics: Unsupervised and Supervised Approaches**

  Trained models to predict typed characters from keystroke sounds, using both labeled and unlabeled data. Improved upon an existing approach by using soft-clustering instead of hard-clustering.
  Paper: `https://fding.github.io/281.pdf`

- **Evopoker: Evolutionary Opponent-Modeling Poker Playing Agent**

  Created a no-limit poker playing agent that chooses moves with probability output by a neural network. Implemented stochastic gradient descent to initialize network weights, and evolutionary algorithm to improve weights based on self-play. Source code: `https://github.com/fding/evilpoker`

- **Buffer Management for LLAMA: A Graph Analytics System**

  Implemented a buffer management system for LLAMA, a graph database. Demonstrated that the buffer management strategy significantly improved performance on a variety of workloads.
  Paper: `https://fding.github.io/261.pdf`

- **A review of text detection using stroke width constancy**

  Implemented a text detection algorithm using the principle of stroke-width constancy.
  Paper: `https://fding.github.io/283.pdf`

Misc Projects

- **Declarative UI library for Python**

  Designed and implemented a React-inspired declarative UI library for Python: `https://github.com/fding/pyedifice`

- **Computer Chess Engine**

  Implemented a UCI-compatible chess engine using classical alpha-beta search: `https://github.com/fding/ace`

- **n-body Simulator**

  Implemented a n-body simulator to simulate solar system orbits: `https://github.com/fding/nbody`

Technical skills

- **Programming Languages:** C, C++, Python, Matlab, OCaml
- **Machine Learning Frameworks:** Tensorflow, JAX, Sci-kit Learn, XGBoost, CMA-ES