

Koundinya Vajjha, CQF, Ph.D.

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Summary

A highly motivated individual with strong background in mathematics and nearly seven years of experience in formal verification of software, hardware and mathematics across academia and industry.

Work experience

- **Formal Verification Engineer** Intel Corp.
San Francisco Bay Area, USA 2024 - present
 - Arithmetic formal verification in CPUs using theorem provers/model checkers via symbolic simulation.
- **R&D Engineer** Imandra
San Francisco Bay Area, USA 2022 - 2024
 - Formally verifying a trading venue's matching logic from the system specification in an automated reasoning engine/theorem prover.
 - Re-using the formally verified model to optimize order placement via Reinforcement Learning using OCaml.
- **Quantitative Analyst** CRISIL, an S&P Global Company
Chennai, India 2016 - 2017
 - Verification and validation of Anti-Money Laundering models deployed on **payments/transaction databases**.

Education

- **University of Pittsburgh** Pittsburgh, Pennsylvania
Ph.D. Mathematics 2018-2022
 - **Advisor** : Thomas Hales.
 - Received the **Andrew W. Mellon Predoctoral Fellowship** for 2021-22.
 - Research in Formal Verification of Optimal Control and Discrete Geometry.
- **University of Western Ontario** London, Ontario
MSc. Mathematics 2017 - 2018
- **Fitch Learning** 2017
Certificate in Quantitative Finance
- **Indian Statistical Institute** Kolkata, West Bengal
Master of Mathematics 2014 - 2016
- **Indian Statistical Institute** Bangalore, Karnataka
Bachelor of Mathematics 2011 - 2014

Technical Skills

OCaml, Python, Coq, Lean, Haskell, Mathematica, R, Matlab, SAS, Octave.

Books

- *Packings of Smoothed Polygons* (with Thomas Hales):

An extension of my PhD thesis, this book studies the Reinhardt problem in Discrete Geometry by reformulating it as a problem in Optimal Control Theory. Using this framework, we prove that the minimizer of this problem is a smoothed polygon, which settles a 1947 conjecture of Kurt Mahler.

Academic Publications

1. *Formal Verification of a Stochastic Approximation Theorem* (with Barry Trager, Avi Shinnar and Vasily Pestun) accepted to **ITP 2022**.
2. *CertRL: Formalizing Convergence Proofs for Value and Policy Iteration in Coq* (with Avi Shinnar, Barry Trager, Vasily Pestun and Nathan Fulton) presented at **CPP 2021**.
3. *A formal proof of PAC Learnability of Decision Stumps* (with Joseph Tassarotti and Jean-Baptiste Tristan) presented at **CPP 2021**.
4. *On a Definite Integral of the Fractional Part Function* in **Resonance**, May 2012, Volume 17, Number 05.
5. *On Pythagorean Triples of the Form $(i, i + 1, k)$* in **Resonance**, September 2009, Volume 15, Number 09.

Internships

1. **MIT-IBM Watson AI Lab, IBM Research**, 2020.
 - Formal verification of Reinforcement Learning algorithms in the Coq theorem prover. **Mentors:** Barry Trager, Avi Shinnar.
2. **Oracle Labs**, 2019.
 - Formal verification of Statistical Learning Theory in the Lean theorem prover. **Mentor:** Jean-Baptiste Tristan

Conferences/Talks

1. Participant at the **DeepSpec Summer School, 2018**, July 2018 at Princeton University.
2. Participant at the **Vladimir Voevodsky Memorial Conference** at the Institute for Advanced Study, Princeton, September 2018.
3. Participant at **Homotopy Type Theory - 2019** at Carnegie Mellon University, August 2019.
4. Participant at **Optimal Control, Optimal Transport, and Data Science - Institute for Mathematics and Applications – University of Minnesota**, November 09 - 13, 2020.
5. Participant at the **Certified Programs and Proofs, 2021**, January 2021.
6. Selected to participate in the **2021 Galois Summer School for Trustworthy Machine Learning, Artificial Intelligence, and Data Science**, June 2021.
7. Invited talk at the **Systems and Control (SysCon)** group at IIT Bombay, October 2023.
8. Participant at the **OCaml Hacking Day, 2023**, October 2023 at Tarides, India.