Mohan Krishnamoorthy, **PhD**

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R&D specialist with over 15 years of experience in applied AI, optimization and decision science. Advises startup founders and leads engineering teams, turning complex, uncertain problems into solutions people can use. Abides by a strong work ethic and a pragmatic philosophy of using AI tools to work faster without cutting corners on quality.

Skills

Technical Skills Machine learning, decision guidance, AI-fluent building, mixed integer linear programming, stochastic optimization, Monte Carlo simulation, surrogate modeling, backtesting and walk forward testing, fairness auditing, data quality assessment, responsible AI, human-AI orchestration, algorithm engineering

Languages Python, MATLAB, HTML, CSS

Tech Stack FastAPI, React, pandas, NumPy, SciPy, statsmodels, scikit-learn, PyTorch, Pyomo, Gurobi, MLflow, Matplotlib, AWS (EC2, RDS, S3, IAM), Docker, Git, cron, Claude Code

Leadership Skills Technology leadership, engineering team leadership, architecture and security direction, company strategy and go-to-market, strategic advisory, founder advisory, partnership building, cross-functional collaboration

Experience

Synod IntelliCare — *Toronto, ON*

Chief Technology Officer & Founding Engineer — *Apr 2026 – Sep 2026*

- Provided technology leadership in taking a healthcare AI fairness auditing platform from design to live use on AWS (EC2, RDS, S3, IAM) in 5 weeks. Redesigned fairness auditing metrics around the confusion matrix with five fold cross validation, separating data bias from model bias, as part of a responsible AI approach.
- Defined a data quality assessment plan covering imputation, reweighing and duplicate removal, plus a sourcing strategy for real and synthetic datasets.
- Led partnership building with the Vector Institute and Sheridan College, and identified university fairness researchers to advise on metric design.
- Led a 5 person engineering team across backend, infrastructure and frontend, with Software Requirements Specification (SRS) gap analysis reviews and cross-functional collaboration. Used AI coding assistants including Claude Code across FastAPI/Python and React/TypeScript, with code in Git, to ship features about 30% faster.
- Set architecture and security direction (OAuth2/PKCE, RBAC, audit logging) and shaped compliance approach with advisors across PHIPA, PIPEDA and OCAP.
- Shaped company strategy, product positioning and go-to-market priorities with the executive team.

Self-employed — *Greater Toronto Area, ON*

Freelance Consultant & Strategic Advisor — *Nov 2025 – Present*

- Built an AI portfolio allocation model in Python, using PyTorch machine learning to project long term performance and mixed integer linear programming (Pyomo, Gurobi) with Monte Carlo simulation to optimize allocations, supported by pandas, NumPy, SciPy, statsmodels and scikit-learn.
- Validated it through backtesting and walk forward testing on 10 years of market data, then forward testing on new data, measuring Sharpe ratio, maximum drawdown and return against a benchmark. Tracked experiments in MLflow, charted results in Matplotlib, versioned code in Git and deployed as a Docker job run by cron.
- Built Python budgeting models (pandas, NumPy, SciPy) using mixed integer optimization and Monte Carlo simulation, reducing planned costs by about 15%.
- Provided decision guidance and founder advisory, using AI-fluent building with Claude Code to turn founders' questions into working models in days instead of weeks.

University of Ottawa — *Ottawa, ON*

Researcher — *Sep 2024 – Sep 2025*

- Designed a Human-AI orchestration framework assigning collaboration modes (HITL, HOTL, HITLFE, HOOTL) by decision criticality and latitude.
- Applied a 4C model (Communication, Coordination, Cooperation, Collaboration) to allocate responsibility between people and AI, advancing responsible AI by reducing automation bias in high stakes work.

Self-employed — *Greater Toronto Area, ON*

Consultant — *Oct 2023 – Sep 2024*

- Built mathematical programming and machine learning models for workforce staffing optimization, reducing overtime and idle time for a client.

Argonne National Laboratory — *Lemont, IL*

Postdoctoral Appointee, then Research Consultant — *Oct 2018 – Jun 2023*

- Built MÆSTRO, an open-source stochastic optimization solver that fits Monte Carlo simulations to experimental data using active machine learning and verifiable local approximations.
- Applied algorithm engineering to build and publish Apprentice and Outer Optimization for surrogate modeling and automated weight tuning, packaged into an HPC workflow adopted for derivative-free stochastic optimization.

George Mason University *Fairfax, VA*

Graduate Research Assistant, PhD Candidate *Jan 2013 – Jul 2018*

- Developed SODA, a stochastic optimization algorithm based on deterministic approximations, for control settings in large manufacturing service networks.

National Institute of Standards and Technology (NIST) *Gaithersburg, MD*

Guest Researcher *Jan 2015 – Dec 2017*

- Built FactoryOptima, a web-based prototype for composing, optimizing and trade-off analysis of manufacturing service networks.

Los Alamos National Laboratory *Los Alamos, NM*

Research Assistant, then Research Technologist *Jul 2008 – Jun 2012*

- Built bioinformatics tools (Tree Viewer, Pruner, Decorator) for Influenza sequence annotation, designed the sequence database schema, and redesigned the HIV project website with HTML and CSS using an MVC framework and web services.

Education

Ph.D., Computer Science, George Mason University, Fairfax, VA, USA *2012 – 2018*

Software Packages

MÆSTRO (Multi-fidelity Adaptive Ensemble Stochastic Trust Region Optimization) *DOC* *CODE*

Open-source solver that tunes slow, noisy computer simulations until they match real experiment data. It builds a simple stand-in for the simulation as it goes and checks each step against it, so results can be verified rather than trusted blindly. It repeats until the fit is good enough.

Apprentice *DOC* *CODE*

Open-source tool that builds fast, simple formulas to stand in for slow, costly simulations. Because the formulas are quick to run, they can be optimized quickly.

Outer Optimization *CODE*

Open-source tool that decides how much weight each piece of data deserves when tuning a model. It sets the weights automatically instead of by experience and intuition, so results are reached efficiently and are less subjective.

SODA (Stochastic Optimization based on Deterministic Approximations) *CODE*

Open-source method that finds the best control settings for large manufacturing networks where outcomes are uncertain. It swaps the uncertain parts for simple estimates so answers arrive quickly, while staying within required limits.

FactoryOptima *PAPER*

Web prototype where manufacturing engineers build, optimize and compare factory designs. It draws on a reusable library of performance models and shows the trade-offs between options.

Selected Publications

BROOD: Bilevel and Robust Optimization and Outlier Detection for Efficient Tuning of High-Energy Physics Event Generators *PAPER*

W. Wang, **M. Krishnamoorthy**, J. Muller, S. Mrenna, H. Schulz, X. Ju, S. Leyffer, Z. Marshall. *SciPost Physics*, 2022.

Stochastic Decision Optimization based on Deterministic Approximations of Processes described as Closed-form Arithmetic Simulation *PAPER*

M. Krishnamoorthy, A. Brodsky, D. Menascé. *Journal of Decision Systems*, 2018. Conference version received the Best Paper Award at IFIP WG 8.3 Decision Support Systems, 2018.

Practical algorithms for multivariate rational approximation *PAPER*

A. Austin, **M. Krishnamoorthy**, S. Leyffer, S. Mrenna, J. Muller, H. Schulz. *Computer Physics Communications*, 2020.

Factory optima: a web-based system for composition and analysis of manufacturing service networks based on a reusable model repository *PAPER*

A. Brodsky, M. O. Nachawati, **M. Krishnamoorthy**, W. Z. Bernstein, D. A. Menascé. *International Journal of Computer Integrated Manufacturing*, 2019.

Apprentice for Event Generator Tuning *PAPER*

M. Krishnamoorthy, H. Schulz, X. Ju, W. Wang, S. Leyffer, Z. Marshall, S. Mrenna, J. Muller, J. B. Kowalkowski. *25th International Conference on Computing in High-Energy and Nuclear Physics (CHEP)*, 2021.

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