# Sivaramakrishnan Swaminathan

## Education

Ph.D., Physics, *The University of Texas at Austin,* USA — *2011 – 2017*
- ⋆ Perimeter Institute Visiting Graduate Fellowship (2016)
- ⋆ Dean's Excellence Fellowship (2012)
- ⋆ Communicated physics as an active contributor (top 4%) on the Physics StackExchange forum, reaching over 350k people so far

B.Tech., Electrical Engineering, *Indian Institute of Technology (IIT) Madras,* India — *2007 – 2011*
- ⋆ Winner of *'How Things Work'* (2009), a leading inter-collegiate technical quiz competition combining engineering and creative problem solving

## Work experience

Research Engineer at Google DeepMind — *2022 – now*

*Artificial Intelligence, Graphical models: inference and learning, Reinforcement learning, World models*
- ⋆ Exploiting model sparsity, and implementing computational algorithms to optimally exploit GPU/TPU hardware and scale to 1000× larger datasets.
- ⋆ Demystifying "in-context learning" capability in sequence models (accepted at NeurIPS 2023 as a spotlight).
- ⋆ Model-building, active exploration and planning in partially observable environments.
- ⋆ Diffusion models for robotic policies and world models. Explored accelerated sampling strategies and simpler generative models.
- ⋆ Planning for embodied agents: Model Predictive Control, exploring planning strategies for scaling inference-time compute.

Research Scientist & Team Lead at Vicarious Inc. — *2017 – 2022*

*2D & 3D Computer Vision, Computational Geometry, Graphics, Optimization, Graphical models: inference and learning*
- ⋆ Scene reconstruction and sensor calibration using techniques such as bundle adjustment, variational optimization, differentiable rendering, etc.
- ⋆ Fast and robust multi-scale inference algorithm for the neuroscience-inspired 'Recursive Cortical Network'.
- ⋆ Methods to exploit generalizable inductive biases to learn structured graphical models for images.
- ⋆ Responsible for the performance and robustness of reconstruction and model generation pipeline for production use cases.
- ⋆ Managed and mentored team members on a variety of projects related to the above themes.

Graduate Student Researcher at The University of Texas at Austin — *2011 – 2017*

*Particle Physics, Holographic Quantum Gravity & Tensor Networks, Physics ↔Machine Learning*
- ⋆ Particle physics models applied to explaining early-universe cosmology, and the origin and properties of dark matter.
- ⋆ Analysis of the holographic emergence of spacetime from quantum mechanics, based on the causal structure of information flow under recursive coarse-graining of high-dimensional systems, leading to a novel variational ansatz ('Rayed MERA') consistent with the symmetries.
- ⋆ Implemented a program to algorithmically 'learn' the ground state of a critical quantum system, exploiting sparsity in entanglement to represent the state as a 'MERA' tensor network data structure, optimized using an 'alternating minimization' like technique.

Classroom Instructor at The University of Texas at Austin — *2014 – 2016*

*Physical Sciences*
- ⋆ Taught a course aimed at introducing liberal arts majors to scientific and quantitative thinking.
  - Independently managed end-to-end, from designing curriculum to assigning grades; successfully graduated approx. 250 students to date.
  - Received extremely positive reviews for initiating an innovative curriculum to communicate mathematical modeling concepts such as exponential growth, statistics, and data analysis, to students with minimal quantitative proficiency and a resigned distaste towards math.

## Knowledge and skills

- ⋆ Programming: Python, Julia, C/C++, Mathematica, Matlab; basic familiarity with Lisp/Racket, Haskell
- ⋆ Math/Physics/Engineering: Abstract algebra, Linear algebra, Probability and stochastic processes, Statistical mechanics, Quantum field theory, Nonlinear dynamics, Quantum information and quantum computation, Analog and digital signal processing, Statistical signal processing, Control systems, Numerical methods
- ⋆ Machine Learning: Graduate course on Machine Learning; self-taught on a range of topics (eg: graphical models, variational inference, message passing, probabilistic programming).

## Selected extra-vocational / volunteer activity

Research paper reviewer — *2019-now*
- ⋆ At premier machine learning conferences such as NeurIPS, ICLR and ICML

Co-founder and convener, *IIT Madras Astronomy Club* — *2007 – 2011*
- ⋆ Organized a four day astronomy workshop for over a thousand participants
- ⋆ Actively mentored future leaders, to ensure sustained growth of the club over the past ten years

Active public speaker, *at various clubs, discussion groups and meetings* — *2007 – now*

Startup consultant, *Texas Venture Labs practicum* — *Jan-Apr 2016*
- ⋆ Led a team of 4 people to direct the social-media platforms diversification strategy for a 'conversational commerce' startup.
- ⋆ Delivered the highest scored practicum project presentation among twelve teams.

+1 512 200 6215 • siva.rk.sw@gmail.com • sivark.me • sivark • Google Scholar

Updated March 2025