

Prathyush Poduval

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EDUCATION

University of California, Irvine

PhD in CS | GPA: —

Selected Coursework: Deep Generative Models, Networks and Communications, Database Systems

Irvine, CA
08/2023 – Present

University of Maryland, College Park (Transferred)

PhD in Physics | GPA: 3.8

Selected Coursework: Supersymmetry and Higher Dimensions, Science and Technology Policy

College Park, MD
08/2022 – 07/2023

Indian Institute of Science, Bangalore

B.S in Physics | GPA: 3.64 (3.92 Major)

Selected Coursework: Quantum Field Theory, General Relativity, Multivariable Calculus and Linear Algebra

Bangalore, India
07/2018-07/2022

PUBLICATIONS (Machine Learning and Physics)

- **Poduval PP**, Laubscher K, Das Sarma S. Apparent Kondo effect in Moiré transition metal dichalcogenide bilayers: Heavy fermions versus disorder. *Physical Review B*.
- **Poduval PP**, Das Sarma S. Anderson localization in doped semiconductors. *Physical Review B*.
- **Poduval PP**, Schmidt TL, Haller A, Perfectly localized Majorana corner modes in fermionic lattices. *Physical Review B*.
- **Poduval PP**, Scheurer MS. Vestigial singlet pairing in a fluctuating magnetic triplet superconductor: Applications to graphene moiré systems. arXiv preprint arXiv:2301.01344.
- **Poduval PP**, Samanta A, Gupta P, Trivedi N, Sensarma R. Subgap two-particle spectral weight in disordered s-wave superconductors: Insights from mode coupling approach. *Physical Review B*.
- Imani M, Zakeri A, Chen H, Kim T, **Poduval PP**, Lee H, Kim Y, Sadredini E, Imani F. Neural computation for robust and holographic face detection. In *Proceedings of the 59th ACM/IEEE Design Automation Conference*.
- **Poduval PP**, Ni Y, Kim Y, Ni K, Kumar R, Cammarota R, Imani M. Adaptive neural recovery for highly robust brain-like representation. In *Proceedings of the 59th ACM/IEEE Design Automation Conference*.
- Zou Z, Chen H, **Poduval PP**, Kim Y, Imani M, Sadredini E, Cammarota R, Imani M. Biohd: an efficient genome sequence search platform using hyperdimensional memorization. In *Proceedings of the 49th Annual International Symposium on Computer Architecture*.
- **Poduval PP**, Zakeri A, Imani F, Alimohamadi H, Imani M. Graphd: Graph-based hyperdimensional memorization for brain-like cognitive learning. *Frontiers in Neuroscience*.
- **Poduval PP**, Zou Z, Yin X, Sadredini E, Imani M. Cognitive correlative encoding for genome sequence matching in hyperdimensional system. In *2021 58th ACM/IEEE Design Automation Conference (DAC)*.
- **Poduval PP**, Zou Z, Najafi H, Homayoun H, Imani M. Stochd: Stochastic hyperdimensional system for efficient and robust learning from raw data. In *2021 58th ACM/IEEE Design Automation Conference (DAC)*.
- **Poduval PP**, Issa M, Imani F, Zhuo C, Yin X, Najafi H, Imani M. Robust In-Memory Computing with Hyperdimensional Stochastic Representation. In *2021 IEEE/ACM International Symposium on Nanoscale Architectures (NANOARCH)*.
- **Poduval PP**, Ni Y, Kim Y, Ni K, Kumar R, Cammarota R. Hyperdimensional self-learning systems robust to technology noise and bit-flip attacks. In *IEEE/ACM International Conference on Computer-Aided Design (ICCAD) 2021*.

RESEARCH INTERESTS

Hyperdimensional computing (HDC), vector symbolic architectures (VSA), deep generative models and quantum computing

- Improving efficiency of transformer models in combination with HDC framework.
- Differentially private HDC learning algorithms.
- Cryptography based secure HDC learning algorithms to ensure security of data.
- Custom Kernel learning and representations over large dimensional similarity space.
- Quantum-classical algorithms to enable enhanced HDC learning tasks.

RESEARCH PROJECTS

Graph Encoding

- Constructing HDC graph representations and designing graph algorithms using HDC operations.
- Using traditional graph embeddings to generate large dimensional holographic representations.
- Constructing representations useful for neural network.

Adversarial Attacks on HDC

- Designing adversarial methods that can efficiently attack HDC encoders and learning models.
- Analyzing the efficiency of such adversarial attacks and optimizing them.
- Designing countering mechanisms to protect HDC learning models against adversaries.

Sequence Memorization and Pattern Recognition

- Designing HDC memorization solutions for storing sequences and patterns (with particular emphasis on DNA sequences).
- Optimizing the pattern encoders with a combination of inclusiveness and exclusiveness in encoding to use correlations in sequences for improving efficiency of memorization.
- Designing pattern recognition algorithms over the HDC memorization models.

TEACHING AND EMPLOYMENT

The University of Luxembourg

Luxembourg, Luxembourg

Research Assistant

July 2021-May 2022

- Research on topological, Majorana and semiclassical physics.
- Used Julia and Mathematica for linear algebra and simulation tasks.

The Art of Problem Solving

Online

Grader and Course Assistant

November 2019 - July 2022

- Assisted in online courses about topics in number theory, algebra, probability and olympiad physics.
- Graded and provided feedback to the homework responses to students.
- Answered queries of students in the online forum and have received positive reviews.

The Ross Mathematics Program

Columbus, OH and Online

Counsellor and Member of Admission Committee

June 2020 - July 2022

- Led daily discussion meetings on advanced Number Theory topics for high school students.
- Delivered talks on assorted topics in mathematics, physics and computer science.
- Organized social events to improve student interactions in the online mode.
- Evaluated about 100 applicants for the program.

The Indian Olympiad Program in Astronomy and Physics

Mumbai, India

Facilitator, Organizer and Grader

April 2018 - April 2021

- Facilitated the team selection camp for the International Olympiad in Astronomy and Astrophysics by guiding students, organizing tutorial sessions, preparing examinations and social events.
- Participated in the question generation camp for the Indian selection examinations for the astronomy olympiad.
- Grader for the Indian National Olympiad in Astronomy (INAO) and Physics (INPhO).

HONOURS

- Silver Medal at the International Olympiad in Astronomy and Astrophysics 2018, Beijing.
- NIUS Research Fellowship.
- All India Rank of 7 in the KVPY SX Fellowship Program 2017.
- All India Rank of 26 in the KVPY SA Fellowship Program 2016.

SKILLS

Programming Languages: Julia, Python, C, C++, LaTeX

Tools and Platforms: Pytorch, Tensorflow, Git, Visual Studio