Prateek P Kulkarni

Personal Mail | University Mail | Website | LinkedIn

Education

2022 - Present BTech (Electronics Engineering) at **PES University, India**
2021 - 2022 Grade 12th at **Kendriya Vidyalaya Hebbal, India**

Coursework

Relevant Course Work At University: Quantum Mechanics, Engineering Mathematics, Analog Circuit Design, Computer Aided Digital Design, Signals and Systems, Computational Problem-Solving with C/Python, Digital VLSI, Linear Algebra

Elective(s): Chip - Level Photonics, Quantum Computing and Quantum Entanglement

Self-Learning Courses On: Topology, Graph Theory.

Skills

Languages and Tools: Python, C, HTML, CSS, MatLab, Simulink, Tanner EDA, Vivado Design Suite
Self-Learning: ROS, Java, R, C++, TensorFlow, Lumerical, Comsol
Writing: LaTeX

Research Interests

1. Theoretical Computer Science
2. Networks-on-Chip
3. Quantum Communication and Information Theory
4. Hardware for ML

Experience

Visitng Research Student - CSA, IISc—(Mar. 2024 - Present)
Part of the *Future Computing Systems Lab* led by Prof. Sumit K. Mandal in the Department of Computer Science and Automation at the Indian Institute of Science, Bangalore, working in the areas of quantum multi-core architecture.

Research Assistant, PES University—(Apr. 2024 - Present)
Part of the Photonics and Quantum Technology Lab at PES University, with Prof. Kaustav Bhowmick. Working on hardware accelerators for Quantum Neural Networks.

Research Intern, ISFCR - PES University—(Feb. 2024 - Present)
Part of the *Cryptography and Blockchain Lab* led by Prof. Indu Radhakrishnan in the Center for Information Security, Forensics and Cyber Resilience at PES University, working in the areas of quantum and post-quantum cryptography.

Research Intern, IIT Tirupati—(Oct. 2023 -) *On a hiatus*
Worked on aspects of Quantum Causality and implications, with a focus on its applications in Quantum Cryptography frameworks under Prof. S Aravinda, of Department of Physics and CAMOST, at IIT Tirupati.

Publications

Recreational

A Non-Rigorous Proof of Fermat's Last Theorem for Some Special Cases
This paper presents a non-rigorous geometric analysis of Fermat's Last Theorem for specific cases where n is even and for when n is odd but x, y, and z are perfect squares.

Investigating Factorial Sums and their Connection with the Laplace Transform
This article presents a formula for the sum of first n factorials, and also establishes a closed-form for the sum of consecutive gamma functions.

In Preparation

Factors of Morphic Words – The Quantum Way
Joint work with Prof. Sivasankar M at PESU, we develop quantum circuits and algorithms towards finding arbitrary – length factors of words that can be generated by a defined morphism. We show results in some such popular words.

Fully – Quantum Communication for Quantum Multicore Processors
Joint work with Prof. Sumit Kumar Mandal at CSA, IISc. We propose a fully quantum Network-on-Chip (NoC) framework for superconducting qubit-based systems, integrating quantum communication pathways directly into multi-core architectures. This approach enhances quantum coherence and interaction across cores, overcoming classical communication bottlenecks to unlock the full potential of scalable quantum processors.

Workshops and Conferences

Present and Future Computing Systems – Jan. '24, IISc, CSA
Was one of about 80 participants selected to attend the workshop organized by the Dept. of Computer Science and Automation at the Indian Institute of Science. The workshop included talks on several aspects of computing systems (including but not limited to HPC, Supercomputing, GPUs, Heterogeneous systems), current research forefront and a hands-on demonstration of DIR–V VEGA Processor, India's indigenous microcontroller development board, by the C-DAC.

Projects

Field-Induced Isomorphic Optimization Algorithms
Developed a new class of optimization algorithms which shares in philosophy similar spirits to the Nature-Inspired Optimization Algorithms (NIOAs). FIIOs induces a property-preserving field for the dataset, and exploits the nature of the field itself to extract desired solutions. It is a visually-powerful and elegant way of looking at optimizing problems with vast potential applications. [*Work In Progress*]

RegDyno.Ai
Co-founded a company that offers a robust predcition model, and aims at reducing noises and errors in a time-series data plot drastically with introduction of a new regression model that uses a custom probability distribution. Currently focused on satellite-relevant data, we are under the process of finishing the framework. The company was pitched as a part of the PESU Venture Labs Any Body Can Create (PVL-ABC) challenge, drawing attention from IP lawyers and investors.[*Patent under filing*]

TESSCrypt
Tessellated Encryption is a new, advanced technique of encrypting data securely exploiting the properties of tessellations. With the first truly aperiodic monotile being discovered, TESSCrypt uses a framework emulating such advances and offers a robust protocol that works in spirit similar to the traditional *trapdoor functions* but more secure and harder to re-trace, or compute the key back. [*Work In Progress*]

MyMath
Built a fully functional advanced scientific calculator, with high precision using Python, (team of 3) for my first semester Python mini project.

Volunteering and Clubs

|Q>Forest (Jan. '24 - Apr. '24) Club head and a core member of the *Technical* domain of the flagship Quantum Computing club at my University.

EncodeAi (Dec. '23-) A core member of the *AIML technical domain* of the club associated with the department of Computer Science and Engineering (AIML) at my University. Besides, I also *co-head* the Content Domain of the club.

SPIRAL (Nov. '23-) A core member of the technical club under Signal Processing and Systems Engineering (SPaSE) Domain at my University, under the department of Electronics and Communication Engineering.

HackeZee 2023 (Oct. '23 - Nov. '23) Was part of the *Operations Team* for the flagship hardware design hackathon organised by the Department of Electronics and Communication Engineering at my university.

Research Et. Al (Sept. '23 -) I am the Content Head at the research club of the Computer Science and Engineering Department, PES University. My contributions include blog articles and podcast appearances, primarily focused on topics in Mathematics, Physics, or Data Science. I tend to cover current events that intersect with these areas.

Student Volunteer (Aug. '23) Was actively involved in the *Bootstrap Program* organised for Freshers, batch of 2023 at my University, as a part of the Quantum Photonics and Technology Lab, under Department of Electronics and Communications Engineering. It involved demonstrations and brief explanations about the major concepts, tools and devices used heavily in the aforementioned field.

TedXPESU (Oct. '22) Was a part of the *Organising Team*, for the event hosted by TedX chapter at my University, where a lot of emerging leaders and leading researchers from academia and industry were invited over, to talk about their fields of expertise.

Literary Club, President (Apr. '20 - Feb. '22) Was the *President* of the Literary Club at my school, from Grade 10 through Grade 12. My responsibilities involved editing, curating and supervising the publications of the club magazine. It also involved organizing several events, like discussions, writing sessions and the like.

Awards and Honors

Pravega 2019 Won the Second prize, nationally, in *Explain The Concept* event at the Undergraduate Fest organized by Indian Institute of Science, while in high-school. The event consisted of picking a relatively complex topic, in sciences or mathematics, and trying to explain it to a layman audience in a very accessible and interactive manner.

ISFCR 2024 Was awarded one of the 10 funded long-term internships at the *Center for Information Security, Forensics and Cyber Resilience* at my University entailing research in the fields of quantum/post-quantum cryptography.

Other Interests

Writing: I am a free-time writer and poet. I have written about a 100 poems, and have a novel in progress. I also have a small collection of short stories. I am hoping to publish them online soon!
Trekking: I love trekking, off-road cycling. It doesn't fail for once to feel overwhelming and proud to have conquered peaks, and yet realise how minuscule we stand to them.
Sports: I am a huge enthusiast of Basketball and Chess. I have also played in several tournaments! I am a long-standing fan of Golden State Warriors since I've gotten into basketball!