Shubhankar Varshney

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About Me

I am a graduate student in Computer Science Department of Purdue University. I am interested in problems which lie in the intersection of multiple fields like Computer Science, Mathematics, Biology, Economics, etc. My current research interest is in Computational Topology.

Education

Purdue University, West Lafayette **August 2024 – Present**
PhD Computer Science

Chennai Mathematical Institute, Chennai **August 2022 – Jun 2024**
M.Sc. Theoretical Computer Science
Master's Thesis Topic: Making sense of Sample Points in Euclidean Domain
Advisor: Prof. Priyavrat C Deshpande

CGPA: 9.12/10

Indian Statistical Institute, Bangalore **July 2019 – May 2022**
Bachelor of Mathematics (Hons.)

90% (First Division with Distinction)

Courses Undertaken (ISI and CMI)

Mathematics

- Group, Ring and Field Theory
- Linear Algebra
- Galois Theory
- Graph Theory
- Optimization
- Topology
- Real and Complex Analysis
- Differential Geometry
- Probability Theory
- Statistics
- Finite Field Combinatorics
- Enumerative Combinatorics
- Mathematical Logic

Computer Science

- Theory of Computation
- Programming Language Concepts
- Advanced Algorithms
- Concurrent Programming
- Topological Data Analysis
- Infinite State Verification
- Formal Security Analysis
- Algorithmic Coding Theory

Internships

Verification of Event-Driven Sequentially Consistent Memory Models **May 2023 - Present**
Uppsala University, Sweden

- Worked under the guidance of Prof. Mohamed Faouzi Atig, Prof. Parosh Aziz Abdulla and Prof. Ramanathan Thinniyam.
- Defined syntax and semantics of Event-driven model and proved complexity results for some models which were made by adding different constraints.
- Work is ongoing to publish a paper on it.

Efficient Transmission of TCU Data with Special emphasis on GPU data **May 2022 - July 2022**
Maruti Suzuki India Limited

- Worked on Telematics data to make driving score which could be used for usage-based insurance (UBI).
- Then developed an algorithm to reduce the bandwidth used for transmission of GPS data with almost no compromise with precision and accuracy.
- Deployed the algorithm on an embedded system based on Yocto Project sumo 4.14.

Projects

Kernel method for Persistence Diagrams via kernel embedding and weight factor **November 2023**

This was done as part of Topological Data Analysis Course. A paper with the same name was presented. In the paper a new kernel method was proposed for persistence diagrams which had many stability properties which other kernel methods lacked. Experiments were shown that pointed to the fact that this method had better classification rates than other methods.

Decoration of Shi Threshold Arrangements **December 2022**

This was done as part of Enumerative Combinatorics course. The problem was to calculate the number of regions formed by Shi hyperplanes in d-dimension. A bijection was constructed from the regions to a decorated permutation of d elements, where decorated means that some more information is provided in addition of the permutation. I used arcs between 2 elements in the permutation as decorations.

Winter and Power Trends in South Korea **October 2020**

This was done as a group project in Statistics-I course. We plotted quantile graphs and did quantile regression on total electric power load vs temperature. Here we found sample bias in the paper that we had to present. The report can be found *here*.

Academic Achievements

TIFR Entrance Exam **2022**

Got selected for interview in TIFR GS2022-IPhd CS admissions.

Teacher's Appreciation Contingency Grant **2019**

Got contingency grant of 2000 INR for books because I came 3rd in B.Math first semester.

Regional Mathematical Olympiad (RMO) **2018**

Cleared RMO 2018 for XII class students being among the top 6 students in the Uttar Pradesh state.

Merit Scholarship **2017**

Was among 20 students out of 3000 of Aligarh Muslim University to get selected for Scholarship for the duration of $11^{th} - 12^{th}$ standard based on scholarship test.

Teaching Experience

Theory of Computation **Sept 2023 – Present**

- Teaching Assistant (TA) for the TOC course for B.Sc 2nd year and M.Sc CS 1st year students. (Instructor for the course is Prof. V. Arvind)

Limit Camp Mentor **June 2021 – July 2021**

- Limit is a test organised by students of ISI Bangalore. I was one of the mentors for students who got selected for the Limit camp.

Seminars Attended

Workshop on Applied Topology and Complex Networks **2024**

There were two workshops. One was on using Borsuk-Ulam Theorem to prove multiple results and the other entailed a survey for methods and algorithms for temporal networks.

Technical Skills

- **Programming languages**: C, C++, Python, Haskell, Java. **Tools**: LaTeX