Ritesh Kumar

Ph.D Communication and Signal Processing

भारतीय प्रौद्योगिकी संस्थान हैदराबाद
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Academic Qualifications

Year	Degree/Certificate	Institute	CPI/%
2020 - present	Ph.D	IIT, Hyderabad	9/10
2018 - 2020	M.Tech	IIT, Patna	8.31/10
2013 - 2017	B.Tech	SBSSTC, Ferozepur	76.77 %
2010 - 2012	BSEB Patna(XII)	Maharaja College, Ara	71.6%
2010	BSEB Patna(X)	H N K +2 High School Ara	79.4%

Publications

- **Ritesh Kumar**, Shashank Vatedka, " Mean Estimation of Log-Concave Distributions with limited communication"(Under preparation).

- **Ritesh Kumar**, Shashank Vatedka, "One-Bit Distributed Mean Estimation with Unknown Variance" (Submitted to Transactions on Machine Learning Research (TMLR)).

- Swaraj Srivastava, **Ritesh Kumar**, Pavan Reddy M., Abhinav Kumar, **"RIS-Assisted Hybrid NOMA-OMA System with Imperfections in SIC and Phase Compensation "**,*IEEE Vehicular Technology Conference (VTC) 2025.*

- Nithish S*, **Ritesh Kumar***, Shashank Vatedka, **"Unbiased Quantization of the L_1 Ball for Distributed Mean Estimation "**, *International Conference on Artificial Intelligence and Statistics* (AISTATS 2025).

- **Ritesh Kumar**, Shashank Vatedka, **" Communication-Constrained Distributed Mean Estimation of Log-Concave Distributions ",** 29th National Conference on Communications (NCC) 2023.

- **Ritesh Kumar**, Pritam Khan, and Sudhir Kumar, **"Healthcare Data Encryption Technique using Hybrid Cellular Automata in IoT Networks "**, Wireless Personal Communications, Springer, October 2022.

- **Ritesh Kumar**, Pritam Khan, and Sudhir Kumar, **" A Cellular Automata-based Healthcare Data Encryption Technique for IoT Networks ",** 16th IEEE India Council International Conference (INDICON), IEEE, Rajkot, India, 2019.

Key Projects

- **Distributed Inference with Limited Communication (PhD Work)** *(Ongoing)*
  Supervisor: Dr Shashank Vatedka, Department of Electrical Engineering, IIT Hyderabad.
  * Currently, we are working on developing efficient algorithms for a distributed system with limited communication capabilities. The primary objective of these algorithms is to investigate and analyze the trade-off between estimation accuracy and the number of clients, considering communication constraints. These algorithms are specifically designed for distributed networks utilizing federated learning schemes. In our ongoing work, we are conducting an analysis of various existing algorithms that demonstrate efficiency in statistical inference. In parallel, we are also working on a types-based quantization scheme for discrete probability mass functions (PMFs).

- **Mean Estimation Techniques in Federated Learning Systems** *(Joint work with G. Vamsi)*

  * Analyzed and implemented EDEN, a robust Distributed Mean Estimation (DME) technique for federated learning under heterogeneous communication budgets and packet losses
  * Implemented EDEN using the Flower framework, which outperforms state-of-the-art DME techniques across diverse network conditions.
  * Introduced and implemented the concept of bit-flip error handling in the EDEN and DRIVE algorithms within federated learning scenarios.

- **Communication Efficient Algorithms for Distributed Function Computation and Learning Over Multiple Access Channels** *(Joint work with Y. V. Lavanya)*
  * Studied various quantization techniques for data compression in distributed and federated learning.
  * Explored digital modulation schemes for transmission over multiple access channels.
  * Addressed efficient quantization, modulation, decoding, and multiple access methods (e.g., NOMA).
  * Applied techniques to distributed optimization tasks like parallel SGD.

- **Communication-Efficient Distributed Mean Estimation and Federated Learning** *(Joint Work with D. S. Ujjwal)*
  * Developed a novel approach to Distributed Mean Estimation and Federated Learning, emphasizing reduced communication costs.
  * Designed and implemented deterministic and unbiased quantization schemes to achieve lower Normalized Mean Squared Error (NMSE).
  * Enhanced efficiency by minimizing bit transmission, suitable for low-bandwidth distributed systems.
  * Conducted extensive experiments that demonstrated the superior performance of deterministic quantization in Federated Learning tasks.
  * Contributed to privacy-preserving machine learning solutions with practical applications in distributed and edge-based environments.
- **Data Security for IoT Networks (M.Tech Project)** *(Completed in 2020)*
  Thesis advisor: Dr Sudhir kumar , Department of Electrical Engineering, IIT Patna.
  * Implemented data encryption and decryption using the Cellular Automata (CA) concept.
  * Collected healthcare data from MySignal Kit and processed it for the application of CA rules.
  * Successfully implemented cryptographic algorithms using Rule 60 and other additive rules suitable for IoT networks.
- **YatraVihar (startup) (B.Tech Project)** *(Completed in 2017)*
  Mentors: Dr Satvir Singh and Dr Sanjiv Dewara,
  Department of ECE, SBSSTC Ferozepur.
  * Created a prototype for a company that offers an online platform for tourists to hire a guide along with additional facilities.
- **Automatic Stove Gas Control System (B.Tech Project)** *(March 2016)*
  * Accomplished the implementation of an automatic stove gas control system by employing thermal sensors and an 8051 micro-controller.
- **Implemented a Multi-functional Robot System at SBSSTC Ferozepur (B.Tech Project)** *(March 2016)*
  * Hardware implementation of the wireless robot capable of functioning in three modes: light-phobic, light-philic, and obstacle detection.

Technical Skills

- **Programming Languages:** C, LATEX, MATLAB, Python

Positions of Responsibilities

- **Teaching Assistant**

Linear Algebra	Convex Optimization
Information Theory	Source Coding
Channel Coding	Concentration Inequalities.
Digital System (Lab)	Wireless Communication
Topics in Data Storage and Communication	Introduction to Statistical Learning Theory
Kernel Methods	

- **Placement Coordinator** *(2024-25)*

- **Group Leader of start-up Team** *(2016-17)*
  – Guided and mentored the startup team and management. Worked as a motivator and dealt with various types of situations to complete the startup company using both internal and external resources.
- **PRO in Cultural festival** *(March 16)*
  – Worked as a Public Relations Officer (PRO) in **Jashan - 2k16** at SBSSTC Ferozepur.

Relevant Courses

Linear Algebra	Convex Optimization
Information Theory	Source Coding
Channel Coding	Network Information Theory
Digital Communication System	Wireless Communication
Probability and Statistics	Estimation Theory
Random Variables and Stochastic Process	Machine Learning for Signal Processing
Optical Communication	Low Power VLSI
VLSI Technology	

Achievements

- Selected for **JENESYS 2023 India-Japan Student Exchange Program** on Science and Technology.
- Won the best paper award at **National Conference on Communication 2023**.
- Secured 1st position in the national contest: **MV Chauhan Paper Contest (Organized by INDICON) 2019**.

- Secured 1st position in the **Project Exhibition** organized by ISTE SBSSTC Ferozepur.
- Secured 3rd position in the **Mathematics Competition** at the district level in secondary school.
- Secured 3rd position in the **Kavita Path** (poetry) competition at the district level in secondary school.

Extra-Curricular Activities

- Inter-IIT Hockey Player.
- Attended **" Reinforcement Learning Workshop 2025"** at IISc Banglore.
- Attended and volunteered at the **2024 JTG/IEEE ITSoc Summer School** hosted by IIT Hyderabad.
- Participated in the **Artificial Intelligence and Information Security in IoT and Smart Grid Vehicles (AIISIV)** Workshop at IIT Hyderabad in 2024.
- Attended a 3-day workshop on **" Interplay of Machine Learning and the Internet of Things "**, conducted by IIT Patna.
- Participated in **Nebula - 2018** (as a stage play artist) and **Nebula - 2019** (as a stage play coordinator) at **IIT Patna**.
- Attended a 3-day workshop on **"Robotics "** conducted by **IIT Roorkee**.
- Participated in the open mic event at **" Zozimus - 2022 "**, the literary fest of IIT Hyderabad.