

Shubham Jha | Curriculum Vitae

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EDUCATION

- Indian Institute of Science Bengaluru** **Bengaluru**
 ○ *PhD Student, Robert Bosch Centre for Cyber-Physical Systems, CGPA 8.3/10* *2018-present*
 Thesis: Practical Algorithms for Distributed Optimisation, Sampling and Quantization
 Advisor: Dr. Himanshu Tyagi
- Indian Institute of Information Technology Guwahati** **Guwahati**
 ○ *B.Tech, Electronics and Communication Engineering, CPI 8.52/10* *2014–2018*
 Thesis: Decoding Algorithms for Polar codes

COURSES

- Information Theory
- Error-Control Codes
- Random Processes
- Real Analysis
- Stat. Physics methods in Information & Coding
- Topics in AI
- Practical Data Sciences
- Detection & Estimation Theory
- Digital Communication
- Concentration Inequalities
- Probability Theory

RESEARCH PROJECTS

- Communication-constrained distributed optimization**
 ○ *Joint work with: Prathmesh Mayekar (IISc), Dr. Himanshu Tyagi (IISc)* *Feb'21-present*
 We aim to study the fundamental limits of over-the-air (wireless) optimization under communication constraints. Our work for AWGN communication constraint case got accepted for oral presentation at IEEE Globecom, Madrid, Spain, in Dec 2021.
- Distributed Markov chain Monte-Carlo under communication constraints**
 ○ *Joint work with: Dr. Osvaldo Simeone (KCL), Dr. Himanshu Tyagi (IISc)* *July'20-present*
 We consider the problem of distributed Bayesian inference where the observed data is distributed across multiple parties (or processors) and the fundamental question of interest here is to understand how many bits are required as a function of generating a desired number of samples.
- Practical codes for Universal quantization**
 ○ *Joint work with: Dr. Himanshu Tyagi (IISc)* *Jan'19-Sept'20*
 We propose a universally rate optimal and practical quantization scheme using the state-of-art Polar lattices for the classic Wyner-Ziv problem from information theory. Our results are published in IEEE ITW 2020.
- Design of Polar decoders for short-to-medium blocklengths**
 ○ *Joint work with: Dr. Kuntal Deka (IIT Goa), Dr. Shilpa (IIITG)* *Jan'18-Apr'19*

(Part of this work is funded by PMRF) At short-to-medium blocklengths, only a certain fraction of the bit-channels get polarized in Arıkan's Polar codes. We identify the information bits exhibiting full polarization and having high channel reliability and proposed mutual-information-based SCL (MI-SCL) decoder, which uses only half the list size in start-of-art SCL decoder and thus reducing the space and computational complexity.

PUBLICATIONS

- **Jha, S. K.**, Mayekar P. and Tyagi, H., "*Fundamental limits of over-the-air optimization: Are analog schemes optimal?*," Accepted for publication in IEEE Global Conference on Communications (GLOBECOM) 2021, Madrid, Spain.
- **Jha, S. K.**, Mayekar P. and Tyagi, H., "*Fundamental limits of over-the-air optimization: Are analog schemes optimal?*," Submitted to IEEE Transactions in Information Theory (TIT). Click for [arXiv](#).
- **Jha, S. K.** and Tyagi, H., "*Universal Wyner-Ziv for Gaussian Sources using Polar lattices*," Submitted to IEEE Transactions in Communication (TCOM).
- **Jha, S. K.** and Tyagi, H., "*Universal interactive Gaussian quantization with side information*," IEEE Information Theory Workshop (ITW) 2020, Italy. Click for [paper](#).
- **Jha, S. K.**, Deka, K. and Rao, S., "*Mutual-Information Based Successive Cancellation List Decoding of Polar Codes*," 2019 IEEE 89th Vehicular Technology Conference (VTC), Kuala Lumpur, Malaysia, 2019, pp. 1-5. Click for [paper](#).

RESEARCH INTERNSHIP

- **Robert Bosch Center for Cyber-Physical Systems** **Bengaluru**
Summer Research Intern *May'17-Jul'17*
 Algorithmic verification of observability in networked control systems under communication uncertainties like packet losses. That included system modelling, observability criterion, and implementing automata algorithms.

TEACHING EXPERIENCE

- **Channel coding and quantization (Available on CNI, IISc webpage)** **CNI, IISc**
Supplement lectures for Information Theory *Sept'21-Oct'21*
- **Probability and Stochastic Processes (PMRF-ISSS Lecture Series)** **Online**
Lecturer *May'21-present*
- **Information Theory Course** **ECE, IISc**
Teaching Assistant *Oct'20-Jan'21*
- **Information Theory Course** **NPTEL**
Teaching Assistant *Sept'20-Dec'20*

PROFESSIONAL ACTIVITIES

- **Conference reviewer:**
 ○ *IEEE Information Theory Workshop 2020, IEEE Wireless Communication and Networking Conference 2022*
- **Journal reviewer**
 ○ *IEEE Transactions in Information Theory*

ACHIEVEMENTS

- Winner of Prime Minister Research Fellowship 2018 for PhD.
- Was among top 0.6% of 1.4 million students appeared in IIT-JEE 2014.
- Bronze medalist in Regional Mathematics Olympiad (RMO) 2012, 2013.