Anuj Kumar Yadav

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Education

Indian Institute of Technology Patna — **Patna, India**
B.Tech in Electrical Engineering — *2018–22*
CPI: 8.67/10 [*Transcript*]

Guru Nanak Modern School Kanpur — **Kanpur, India**
K-12 (Class XII), AISSCE, C.B.S.E — *2016–17*
Marks: 580/600 [*Result*]

Research Interests

Information Theory ⋃ Cryptography ⋃ Coding Theory ⋃ Security & Privacy

Publications

Remark: *Publications marked with* **(A2Z)** *at the beginning follow alphabetical author order.* (*) represents equal contributions.

• Journals:

1. A. K. Yadav and P. Kumar, "Oblivious Transfer over Compound Binary Erasure Channels", **2022 IEEE Communications Letters (COMML)**. [*Accepted for Publication*]
2. **(A2Z)** A. J. Budkuley, *P. Joshi, *M. Mamindlapally, and *A. K. Yadav, "On Reverse Elastic Channels and the Asymmetry of Commitment Capacity over Channels with Elasticity", **2022 IEEE Journal on Selected Areas in Communications (JSAC Special Issue)**. [*IEEE Xplore*]

• Conferences:

1. A. K. Yadav, M. Mamindlapally, P. Joshi, and A. J. Budkuley, "On Commitment over General Compound Channels", **2022 IEEE International Conference on Communication Systems and Networks (COMSNETS)**, Bengaluru, India. [*IEEE Xplore*]
2. **(A2Z)** A. J. Budkuley, *P. Joshi, *M. Mamindlapally, and *A. K. Yadav, "On the Commitment Capacity of Reverse Elastic Channels", **2021 IEEE Information Theory Workshop (ITW)**, Kanazawa, Japan. [*IEEE Xplore*]
3. A. K. Yadav, M. Mamindlapally, A. J. Budkuley and M. Mishra, "Commitment over Compound Binary Symmetric Channels", **2021 (IEEE) National Conference on Communications (NCC)**, Kanpur, India. [*IEEE Xplore*]
4. M. Mamindlapally, A. K. Yadav, M. Mishra and A. J. Budkuley, "Commitment Capacity under Cost Constraints", **2021 IEEE International Symposium on Information Theory (ISIT)**, Melbourne, Australia. [*IEEE Xplore*]

• Pre-prints (Under Review/Under Preparation):

1. A. K. Yadav, M. A. Mohammadi, Y. Zhang, A. J. Budkuley and S. Jaggi, "New Results on AVCs with Omniscient and Myopic Adversaries", **2022 IEEE International Symposium on Information Theory (ISIT)**. [*Under Review*]
2. **(A2Z)** A. J. Budkuley, *P. Joshi, *M. Mamindlapally, and *A. K. Yadav, "On the (Im)possibility of Commitment Over Gaussian Unfair Noisy Channels", **2022 IEEE International Symposium on Information Theory (ISIT)**. [*Under Review*]
3. M. Mamindlapally, A. K. Yadav, M. Mishra, and A. J. Budkuley, "Commitment capacity Under Cost Constraints" (Extended), to be submitted to **2022 IEEE Transactions in Information Theory**. [*Under Preparation*]
4. A. K. Yadav, M. Mamindlapally, A. J. Budkuley and M. Mishra, "Commitment over Passively Unreliable Channels" (Extended), to be submitted to **2022 IEEE Transactions in Communications**. [*Under Preparation*]

Research Experience

Reed-Muller Codes for Covert Communication — **Sept. 2021 – Nov. 2021**
SUPERVISOR: *Prof. Laura Luzzi, ENSEA - University of Cergy, Pontoise - CNRS.*

- Studied about Reed-Muller codes, their properties, generator matrix construction and their decoding.
- Working on using the Reed-Muller codes for Low probability of detection problem over a binary AWGN channel to prove reliability (low-error probability) and covertness (small KL-divergence) by exploiting their weight distribution property.

Oblivious Transfer over Unreliable Erasure Channels (Bachelor's thesis) — **July 2021 – Present**
SUPERVISOR: *Prof. Preetam Kumar, IIT Patna.*

- Studying the cryptographic primitive - Oblivious Transfer (OT) - from the perspective of Information-theoretic security.
- Obtained the OT Capacity for Compound Binary Erasure Channels (C-BEC) for computationally unbounded adversaries.
- Working on $(1, 2)$-OT protocols over weak unreliable channels such as Arbitrarily Varying Channels in erasure domain.

Reliable Communication over Adversarial Channels **May 2021 – Present**

SUPERVISOR: *Prof. Sidharth Jaggi, University of Bristol - CUHK.*

- Characterized the rate positivity for bit-flip and for general alphabet Non-State Deterministic (NSD) & Omniscient AVCs.
- Obtained upper bound on the rate, based on Elias-Bassalygo bound and sphere-packing bound for bit flip AVCs.
- Designed a cloud-code construction that involves a two-step decoding rule and achieves the upper bound.
- Derived the sufficient condition for NSD & Omniscient AVCs under which only one-step decoding suffices.
- Currently, working on designing achievable code construction for myopic AVCs.

Information-theoretically secure Bit Commitment over Noisy Channels **April 2020 – Present**

SUPERVISOR: *Prof. Amitalok J. Budkuley, IIT Kharagpur.*

- Obtained Commitment Capacity for DMCs under general input cost constraints and characterized the dual expression for cost constrained Commitment Capacity in terms of output distribution.
- Derived Commitment Capacity of weak and strong unreliable noisy channels such as Compound DMCs & Reverse Elastic Channels respectively, and designed computationally-efficient capacity achieving commitment protocols. Also, explored interesting results on asymmetry of Commitment Capacity for strong unreliable channels (UNCs, ECs, RECs).
- Currently, working on the designing efficient commitment schemes and impossibility result over Gaussian UNCs.

Posters & Talks

1. P.Joshi*, M. Mamindlapally*, A. K. Yadav*, M. Mishra, and A. J. Budkuley, "Commitment over Unreliable Channels", **2021 IEEE ISIT Recent Results**, Melbourne, Australia. (*: equal contributions) [*Abstract*] [*Slides*]
2. A. K. Yadav and M. Mamindlapally, "Role of Costs in Commitment over Noisy Channels", at **2021 IEEE North American School of Information Theory (NASIT), UBC Canada.** [*Poster*]
3. A. K. Yadav, "Rate Positivity for Arbitrarily Varying Channels", at **2021 Croucher Summer Course in Information Theory (CSCIT), CUHK, Hong kong.** [*Abstract*] [*Poster*]
4. Conference Presentation on "Commitment over Compound Binary Symmetric Channels" at **2021 (IEEE) National Conference on Communications (NCC)**, Kanpur, India. [*Slides*] [*Video*]
5. Talk on "Commitment Capacity under Cost Constraints" at **Laboratoire ETIS, ENSEA**, CNRS, France. [*Slides*]

Honors & Achievements

IEEE ITSoc D & I Undergraduate Scholarship **June 2021**

- Awarded IEEE Information Theory Society membership by ITSoc and opportunity to virtually attend ISIT 2021 and various summer schools organized by ITSoc, on the basis of undergraduate research in Information Theory. [*Acceptance Email*]

Academic Department Change at IIT Patna **July 2019**

- Changed Department from Chemical Engineering to Electrical Engineering at IIT Patna, after first year. Only offered to students among top 10% of the previous department in terms of Academic Performance. [*Certificate*]

Prime Minister's Scholarship Scheme (PMSS) **2018-Present**

- Receiving PMSS scholarship award of 30,000 INR annually by Ministry of Home Affairs, Government of India for three consecutive years on the basis of Academic Merit in Bachelors at IIT Patna.

Merit in IIT-JEE Advanced Exam **May 2018**

- Ranked among the top 1% of the students in IIT-JEE among 1.4 million students across India and other countries.

Director General Merit Award for Academic Excellence **June 2017**

- Received Cash Award of 25,000 INR by Mr. O.P Singh (IPS) Former DG, CISF for securing 4th Rank in (Zonal/State Region) in AISSCE 2017 examination, organized by C.B.S.E.

Key Projects

UAV aided OFDM Communication Systems **Nov. 2019 – Feb. 2020**

SUPERVISOR: *Prof. Preetam Kumar, IIT Patna*

- Studied the working of OFDM system, and various parameters such as cyclic prefix, oversampling factor, CFO, STO, etc.
- Generated the dataset on MATLAB and performed mathematical analysis.
- Designed, trained and tested a Convolutional Neural Network (CNN) model for equalizing the CFO.

Design of 1 KB DRAM using SPICE **Aug. 2019 – Dec. 2019**

SUPERVISOR: *Prof. Jawar Singh, IIT Patna*

- Studied the operation and layout of a DRAM cell, including the charging & discharging mechanism, pre-charging circuit and the sense amplifier.
- Designed and Simulated a 1 KB DRAM using 1024 1-Transistor, 1-Capacitor memory cells by multiplexing logic gates and the sense amplifier in LTspice. [*Project files*]

Key Courses

Real & Complex analysis, Calculus, Linear Algebra, Probability Theory and Statistics, Signals and systems, Communication Systems, Digital Signal processing, Control Theory, Applied Cryptography and Hashing techniques (MOOC), Bio-medical Signal Processing, Information Theory and Coding‡. (‡: Current semester courses)
[*Complete List*]

Technical Skills

Programming: Python, C, MySQL, Verilog.
Software & Tools: LaTeX, MATLAB, Simulink, LTspice.

Extracurricular Activities

- Contingent Leader of IIT Patna, at 10th Inter-IIT Technical Meet, 2022.
- Secretary, Students' Technical Council, IIT Patna. (July '21 - Present)
- Core Member of Students' Association for Alumni Relations, IIT Patna. (April '19 - April '21)
- Coordinator, Flagship Events, Celesta -The annual Techno-Management fest of IIT Patna. (May '20 - March '21)
- Member of the National Service Scheme (NSS) team at IIT Patna. (July '18- July '19)