Curriculum Vitae

Sourya Basu
Ph.D. Candidate
Electrical & Computer Engineering
University of Illinois at Urbana-Champaign

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Research Interests

Geometric deep learning, natural language processing, and information theory

Education

2020 - present **PhD in Electrical & Computer Engineering**, *University of Illinois at Urbana-Champaign*
Advisor: Prof. Lav R. Varshney **GPA - 3.96**

2018 - 2020 **MS in Electrical & Computer Engineering**, *University of Illinois at Urbana-Champaign*
Advisor: Prof. Lav R. Varshney

2017 **B. Tech. in Electrical Engineering**, *Indian Institute of Technology Kanpur*
Minor in Artificial Intelligence, **CPI - 9.6/10.0**

2013 **Senior School Certificate Examination,** *S.M.Arya Public School, New Delhi*
Scored 89.8% marks in XII AISSCE

2011 **Secondary School Certificate Examination,** *S.M.Arya Public School, New Delhi*
CGPA - 9.8 in X AISSE

Publications & preprints

May 2021 **S. Basu**, G. S. Ramachandran, N. S. Keskar, and L. R. Varshney, **"Mirostat: A Neural Text Decoding Algorithm that Directly Controls Perplexity,"** in Proceedings of the 9th International Conference on Learning Representations (**ICLR**), [Vienna, Austria], 4-8 May 2021. [Paper | Blog | Code]

March 2021 T. Ameen ur Rahman, A. S. Barbehenn, X. Chen, H. Dbouk, J. A. Douglas, Y. Geng, I. George, J. B. Harvill, S. W. Jeon, K. K. Kansal, K. Lee, K. A. Levick, B. Li, Z. Li, Y. Murthy, A. Muthuveeru-Subramaniam, S. Y. Olmez, M. J. Tomei, T. Veeravalli, X. Wang, E. A. Wayman, F. Wu, P. Xu, S. Yan, H. Zhang, Y. Zhang, Y. Zhang, Y. Zhao, **S. Basu**, and L. R. Varshney, " **The Twelvefold Way of Non-Sequential Lossless Compression**," in Proceedings of the IEEE Data Compression Conference (**DCC**), Snowbird, Utah, 23-26 March 2021. [Paper]

June 2020 **S. Basu**, D. Seo, and L. R. Varshney, **"Hypergraph-based Coding Schemes for Two Source Coding Problems under Maximal Distortion,"** in *Proceedings of the 2020 IEEE International Symposium on Information Theory* (**ISIT**), [Los Angeles, California], 21-26 June 2020. [Paper]

March 2020 **S. Basu**, D. Seo, and L. R. Varshney, **"Functional Epsilon Entropy,"** in *Proceedings of the IEEE Data Compression Conference* (**DCC**), [Snowbird, Utah], 24-27 March 2020. [Paper]

July 2019 **S. Basu** and L. R. Varshney, **"Polar Codes for Simultaneous Information and Energy Transmission,"** in *Proceedings of the 20th IEEE International Workshop on Signal Processing Advances in Wireless Communications* (**SPAWC**), [Cannes, France], 2-5 July 2019. [Paper]

December 2018 **S. Basu** and L. R. Varshney, **"Succinct Source Coding of Deep Neural Networks,"** in *Proceedings of NeurIPS Compact Deep Neural Network Representation with Industrial Applications Workshop (CDNNRIA)*, Montreal, Canada. [Paper]

March 2017 **S. Basu** and L. R. Varshney, **"Universal Source Coding of Deep Neural Networks,"** in *Proceedings of the IEEE Data Compression Conference* (**DCC**), [Snowbird, Utah], 4-7 April 2017. [Paper]

Relevant projects

Mesh Attention Networks — Ongoing

In a team of five, mentored by Dr. Taco Cohen, Qualcomm AI Research

Aim: To develop an anisotropic attention mechanism for data signals stored on meshes that is equivariant to local changes in gauge of a manifold. Our architecture respects the geometry of meshes and encompasses the benefits of several previous message passing algorithms such as GCNs, GATs, and GEM-CNNs.

Reinforcement Learning on 2D Manifolds — Ongoing

Mentored by Prof. Lav Varshney, University of Illinois at Urbana-Champaign

Aim: To develop policy learning and evaluation methods for reinforcement learning on 2D manifolds. The key idea is to use gauge equivariance for designing algorithms that would exploit symmetries on manifolds. This would have immense use in robotics like in self-driving cars, drones etc.

Platonic CNNs — Summer 2021

In a team of five, mentored by Dr. Taco Cohen, Qualcomm AI Research

Overview: We implemented a variation of gauge equivariant convolutional networks for data signals stored on cubes from basics. The concepts were taken from the paper Gauge Equivariant Convolutional Networks and the Icosahedral CNN. This work was part of the London Geometry and Machine Learning Summer School 2021. Code to be released soon.

Teaching and service

- **Teaching assistant** ECE 563 Information Theory (Fall 2020)
- **Reviewer** IEEE Transactions on Signal Processing, ITW 2021, ICLR 2021 Neural Compression Workshop, ISIT 2020

Awards and Achievements

- **Dr. Ok Kyun Kim Fellow** at the University of Illinois at Urbana-Champaign. (2021-2022)
- **ECE Distinguished Research Fellow** at the University of Illinois at Urbana-Champaign. (2019-2022)
- **James M. Henderson Fellow** at the University of Illinois at Urbana-Champaign. (2019-2020)
- **Dilip and Sandhya Sarwate Graduate Fellow** at the University of Illinois at Urbana-Champaign. (2018-2019)
- Received **Academic Excellence Award** at IIT Kanpur for distinctive academic performance for the years **2013-14**, **2014-15**, **2015-16**.
- Ranked amongst the **top 10** teams across all the IITs in **Ericsson Innovation Award 2014-2015**.
- Secured **All India Rank 181** in **JEE ADVANCED 2013** out of 0.15 million students.
- Kishore Vaigyanik Protsahan Yojna (**KVPY**) Scholar, awarded to top 600 students in India.
- **Certificate of Merit** for qualifying for **Indian National Chemistry Olympiad (Theory) 2013**.
- **Certificate of Merit** for being placed in National **Top 1%** in **National Standard Examination in Physics-2012-13** among **40,000 candidates**.
- **Certificate of Merit** for being placed in State wise **Top 1%** in **National Standard Examination in Astronomy-2012-13**.

Graduate coursework

- **ECE 534-Random Processes**: Fall 2018 with *Prof. O. Milenkovic*: **A+**
- **ECE 563-Information Theory**: Fall 2018 with *Prof. L. Varshney*: **A+**
- **ECE 561-Detection and Estimation Theory**: Spring 2019 with *Prof. V. Veeravalli*: **A**
- **ECE 543-Statistical Learning Theory**: Spring 2019 with *Prof. B. Hajek*: **A**
- **Math 417-Introduction to Abstract Algebra**: Fall 2019 with *Prof. F. Boca*: **A+**
- **Math 598-Concentration Inequalities and Stein's Method**: Fall 2019 with *Prof. P. Dey*: **A-**
- **ECE 556-Coding Theory**: Spring 2020 with *Prof. O. Milenkovic*: **A+**
- **ECE 544-Pattern Recognition**: Fall 2020 with *Prof. A. Schwing*: **A**
- **CS 598-Statistical Reinforcement Learning**: Fall 2020 with *Prof. N. Jiang*: **A**
- **IE 521-Convex Optimization**: Spring 2021 with *Prof. X. Chen*: **A**

Technical Skills

Python, Pytorch, Pytorch-geometric, Pytorch-lightning, Numpy, Matlab, GitHub

Positions of responsibility & Social initiatives

Secretary, Electronics Club, IITK: Fall 2014 Conducted workshops and mentored freshmen with hands on circuit design for participating in intra-IIT science and technology competitions.

National Service Scheme: Fall 2013 & Spring 2014 Tutored students from class 5^{th} to 8^{th} in the topics of mathematics and science. Conducted a science exhibition for elementary and middle school students.