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, generative models

Education

2024 (expected)	**PhD in Electrical & Computer Engineering**, *University of Illinois at Urbana-Champaign* Advisor: Prof. Lav R. Varshney **GPA - 3.97**
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**

Internships

Summer 2023	**Mitsubishi Electric Research Laboratories, Cambridge, MA** Designed Efficient Group Equivariant Architectures
Summer 2022	**IBM Research, Yorktown Heights, NY** Developed a group equivariant algorithm for finetuning pretrained models Work Published in *AAAI Conference on Artificial Intelligence*

Publications & preprints

Dec 2023	**S. Basu**, P. Katdare, P. Sattigeri, V. Chenthamarakshan, K. Driggs-Campbell, P. Das, and L. R. Varshney Efficient Equivariant Transfer Learning from Pretrained Models *Advances in Neural Information Processing Systems (***NeurIPS***), 2023*
Oct 2023	R. Baltaji, **S. Basu**, L. R. Varshney Efficient Model-Agnostic Multi-Group Equivariant Networks arXiv:2310.09675 [cs.LG]
Feb 2023	**S. Basu**, P. Sattigeri, K. Natesan Ramamurthy, V. Chenthamarakshan, K. R. Varshney, L. R. Varshney, and P. Das Equi-Tuning: Group Equivariant Fine-Tuning of Pretrained Models **AAAI** *Conference on Artificial Intelligence*, vol. 37, no. 6, pp. 6788-6796. 2023
Dec 2022	**S. Basu**, D. Seo, and L. R. Varshney Hypergraph-based Source Codes for Function Computation Under Maximal Distortion *IEEE Journal on Selected Areas in Information Theory*, vol. 3, no. 4, pp. 824-838, Dec. 2022
Dec 2022	**S. Basu** and L. R. Varshney Universal and Succinct Source Coding of Deep Neural Networks *IEEE Journal on Selected Areas in Information Theory*, vol. 3, no. 4, pp. 732-745, Dec. 2022
Aug 2022	**S. Basu**, J. Gallego-Posada, F. Viganò, J. Rowbottom, and T. Cohen Equivariant Mesh Attention Networks *Transactions on Machine Learning Research (***TMLR***)*
May 2022	**S. Basu**, P. Katdare, K. Driggs-Campbell, and L. R. Varshney Gauge Equivariant Deep Q-Learning on Discrete Manifolds **ICLR 2022 Workshop** *on Geometrical and Topological Representation Learning*
June 2021	**S. Basu**, A. Magesh, H. Yadav, and L. R. Varshney Autoequivariant Network Search via Group Decomposition arXiv:2104.04848 [cs.LG]

May 2021 **S. Basu**, G. S. Ramachandran, N. S. Keskar, and L. R. Varshney
Mirostat: A Neural Text Decoding Algorithm that Directly Controls Perplexity
*International Conference on Learning Representations (**ICLR**), 2021*

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
*Proceedings of the IEEE Data Compression Conference (**DCC**), pp. 336-336, 2021*

June 2020 **S. Basu**, D. Seo, and L. R. Varshney
Hypergraph-based Coding Schemes for Two Source Coding Problems under Maximal Distortion
*Proceedings of the IEEE International Symposium on Information Theory (**ISIT**), pp. 2426-2431, 2020*

March 2020 **S. Basu**, D. Seo, and L. R. Varshney
Functional Epsilon Entropy
*Proceedings of the IEEE Data Compression Conference (**DCC**), pp. 332-341, 2020*

July 2019 **S. Basu** and L. R. Varshney
Polar Codes for Simultaneous Information and Energy
Proceedings of the 20th IEEE International Workshop on Signal Processing Advances (SPAWC) 2019

Dec 2018 **S. Basu** and L. R. Varshney
Succinct Source Coding of Deep Neural Networks
NeurIPS Compact Deep Neural Network Representation with Industrial Applications 2018

November 2018 A. Raikar, **S. Basu**, and R. M. Hegde
Single Channel Joint Speech Dereverberation and Denoising using Deep Priors
Proceedings of the IEEE Global Conference on Signal and Information Processing 2018

March 2017 **S. Basu** and L. R. Varshney
Universal Source Coding of Deep Neural Networks
*Proceedings of the IEEE Data Compression Conference (**DCC**) 2017*

June 2016 **S. Basu**, S. Chaturvedi, and R. M. Hegde
Text Compression using Lexicographic Permutation of Binary Strings
Proceedings of the IEEE International Conference on Signal Processing and Communications 2016

March 2016 M. Seth, **S. Basu**, S. Chaturvedi, and R. M. Hegde
Multi Character Frequency based Encoding for Efficient Text Messaging in Indian Languages
Proceedings of the IEEE National Communications Conference 2016

Relevant projects

Equivariant Models for CryoEM — Fall 2022

with Brookhaven National Laboratory
Overview: Developing an equivariant model for application in CryoEM.

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** AAAI 2023, 2024, 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, 2023-2024)
- **ECE Distinguished Research Fellow** at the University of Illinois at Urbana-Champaign. (2019-2023)
- **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. R. 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**
- **ECE 598-Generative AI Models**: Spring 2022 with *Prof. L. R. Varshney*: **A**
- **ECE 598-Molecular Storage and Computing (MSC)**: Spring 2023 with *Prof. O. Milenkovic*: **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.