CURRICULUM VITAE

SOURYA BASU
Ph.D. Candidate
Electrical & Computer Engineering
University of Illinois at Urbana-Champaign

Email: sourya@illinois.edu
Mobile: +1 2177218603
Homepage: basusourya.github.io
GitHub

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

INTERNSHIPS

Summer 2022	**IBM Research, Yorktown Heights**, NY Developed a group equivariant algorithm for finetuning pretrained models

PUBLICATIONS & PREPRINTS

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," in *Proceedings of the 37th* **AAAI** *Conference on Artificial Intelligence*, Washington, DC, 7-14 Feb 2023. [Paper]
AUG 2022	**S. Basu**, J. Gallego-Posada, F. Viganò, J. Rowbottom, and T. Cohen, "Equivariant Mesh Attention Networks," Transactions on Machine Learning Research (**TMLR**), Aug 2022. [Paper | Code]
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**, May 2022. [Paper]
JUNE 2021	**S. Basu**, A. Magesh, H. Yadav, and L. R. Varshney, **"Autoequivariant Network Search via Group Decomposition,"** arXiv:2104.04848 [cs.LG]. [Paper | Code]
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]
NOVEMBER 2018	A. Raikar, **S. Basu**, and R. M. Hegde, **"Single Channel Joint Speech Dereverberation and Denoising using Deep Priors,"** 2018 IEEE *Global Conference on Signal and Information Processing* (**GlobalSIP**). [Paper]
APRIL 2018	**S. Basu** and L. R. Varshney, **"Universal and Succinct Source Coding of Deep Neural Networks"**, arXiv:1804.02800. [Paper]
JUNE 2016	**S. Basu**, S. Chaturvedi, and R. M. Hegde, **"Text Compression Using Lexicographic Permutation of Binary Strings"**, *Eleventh International Conference on Signal Processing and Communications* (**SPCOM**), IEEE, 2016. [Paper	Presentation]
MARCH 2016	M. Seth, **S. Basu**, S. Chaturvedi, and R. M. Hegde, **"Multi Character Frequency based Encoding for Efficient Text Messaging in Indian Languages"**, *Communications (NCC), 2016 Twenty Second National Conference on.* IEEE, 2016. [Paper	Poster]

RELEVANT PROJECTS

Equivariant Models for CryoEM   Fall 2022
with Brookhaven National Laboratory
Overview: Developing an equivariant model for application in CryoEM.

Group Equivariant Finetuning of Pretrained Models   Summer 2022
at IBM Research as a research intern
Overview: We developed an algorithm to produce group equivariant finetuned model from a potentially non-equivariant pretrained model. Applications to image classification, compositional generalization in language, and fairness in natural language generation (NLG) shows improvements over naive finetuning.

Reinforcement Learning on 2D Manifolds   Spring 2022
Mentored by Prof. Lav Varshney, University of Illinois at Urbana-Champaign
Overview: We developed 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. Paper published in ICLR 2022 Workshop on Geometrical and Topological Representation Learning.

Equivariant Mesh Attention Networks   Fall 2021
In a team of four, mentored by Dr. Taco Cohen, Qualcomm AI Research
Overview: We developed an anisotropic attention mechanism for data signals stored on meshes that is equivariant to local changes in gauge as well as global transformations like rotation, translation, and scaling of any 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. Paper published in TMLR'22.

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, 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 5th to 8th in the topics of mathematics and science. Conducted a science exhibition for elementary and middle school students.