

Kushal Bose

✉ kushalbose92@gmail.com | 📄 Google Scholar

Electronics and Communication Sciences
Unit
Indian Statistical Institute
203 B. T. Road, Kolkata: 700108, India
☎ (+91) 9330974473

EDUCATION

Indian Statistical Institute, Kolkata, India (2019 - 2025)
Doctor of Philosophy (Ph.D) in Computer Science.

- Senior Research Fellow: July 2021 - June 2025 (*Expected*)
- Junior Research Fellow: July 2019 - July 2021

Advisor: Prof. Swagatam Das.

Thesis title: Innovations in Graph Neural Network Design: Addressing Oversmoothing, Heterophily, and Information Propagation. (Submitted in July 2025)

Indian Statistical Institute, Kolkata, India (2017 - 2019)
Master of Technology (M. Tech.) in Computer Science.

Heritage Institute of Technology, Kolkata, India (2011 - 2015)
Bachelor of Technology (B. Tech.) in Electronics and Communication Engineering.





RESEARCH INTERESTS

Graph Neural Networks, Non-Euclidean Data Analysis, Hyperbolic Spaces, Geometric Deep Learning,

PUBLICATIONS & PREPRINTS

Paper: 📄 | Code: 🔗 | arXiv: 📄

- [1] Indronil Ojha, **Kushal Bose**, Swagatam Das. "FairSplit: Mitigating Bias in Graph Neural Networks through Sensitivity-based Edge Partitioning". In the *ACM Conference on Information and Knowledge Management*, 2025 (CIKM) (To be presented).
- [2] **Kushal Bose**, Saptarshi Banerjee, and Swagatam Das. "Can Graph Neural Networks Tackle Heterophily? Yes, With a Label-Guided Graph Rewiring Approach!". In *IEEE Transactions on Neural Networks and Learning Systems*, 2025 (TNNLS). 📄
- [3] **Kushal Bose** and Swagatam Das. "Can graph neural networks go deeper without over-smoothing? Yes, with a randomized path exploration!". In *IEEE Transactions on Emerging Topics and Computational Intelligence*, 2023 (TETCI). 📄
- [4] Sujoy Nath, Arkaprabha Basu, **Kushal Bose**, and Swagatam Das. "From Complexity to Clarity: Transforming Chest X-ray Reports with Chained Prompting (Student Abstract)". In *Association for the Advancement of Artificial Intelligence*, 2025 (AAAI). 📄
- [5] Indronil Ojha, **Kushal Bose**, and Swagatam Das. "Affinity-based Homophily: Can we measure homophily of a graph without using node labels?". In *International Conference on Learning Representations*, Tiny Papers (Invited to present), 2024 (ICLR). 📄
- [6] Shubhayan Pan, Saptarshi Chakraborty, Debolina Paul, **Kushal Bose**, Swagatam Das. "Kernelizing Convex Clustering: A Study on Convergence, Finite Sample Bounds, and Performance Insights". Submitted to *Neural Information Processing Systems*, 2025 (NeurIPS).
- [7] **Kushal Bose** and Swagatam Das. "HyPE-GT: where Graph Transformers meet Hyperbolic Positional Encodings" Under review in *Transactions in Machine Learning Research* (TMLR) 📄

- [8] **Kushal Bose** and Swagatam Das. "Asynchronous Message Passing for Addressing Oversquashing in Graph Neural Networks". To be submitted to *ACM International Conference on Web Search and Data Mining (WSDM)*, 2025.
- [9] **Kushal Bose** and Swagatam Das. "Rewiring with Parallel Edges: An Analysis through the Lens of Graph Spectrum". To be submitted to *IEEE Transactions on Signal Processing (TSP)*, 2025.
- [10] **Kushal Bose** and Swagatam Das. "Learning from Heterophilic Graphs: A Spectral Theory Perspective on the Impact of Self-Loops and Parallel Edges". Under review in *IEEE Transactions on Artificial Intelligence (TAI)*, 2025.
- [11] Sagar Ghosh, **Kushal Bose**, and Swagatam Das. "Transformers Are Universally Consistent: A Sequence-to-Sequence Regression Estimation Perspective". Submitted to *Annual AAAI Conference on Artificial Intelligence*, 2025. 
- [12] Indronil Ojha, **Kushal Bose**, and Swagatam Das. "AffNet: Designing Multi-headed Affinity and Adaptive Thresholding for Efficient Link Prediction". Under revision in *IEEE Transactions on Artificial Intelligence*, 2025 (TAI).
- [13] Sagar Ghosh, **Kushal Bose**, and Swagatam Das. "On the universal statistical consistency of expansive hyperbolic deep convolutional neural networks". Under review in *Transactions in Machine Learning Research (TMLR)*. 
- [14] Arghya Pratihar, **Kushal Bose**, and Swagatam Das. "Topology-Driven Clustering: Enhancing Performance with Betti Number Filtration". Under review in *IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI)*. 
- [15] Arkaprabha Basu, **Kushal Bose**, Sankha Subhra Mullick, Anish Chakrabarty, Swagatam Das. "Fortifying fully convolutional generative adversarial networks for image super-resolution using divergence measures". Under revision in *Engineering Applications of Artificial Intelligence*, 2025 (EAAI). 


WORK IN PROGRESS

- [1] **Kushal Bose**. "Commutate Time Graph Transformer". To be submitted to *IEEE Transactions on Pattern Analysis and Machine Intelligence*.
- [2] **Kushal Bose**. "CLS Token and Virtual Node are both sides of the same coin". To be submitted to *Transactions on Machine Learning Research*, 2025 (TMLR).
- [3] **Kushal Bose** and Swagatam Das. "Dirichlet-energy Constrained Graph Rewiring", 2025
- [4] **Kushal Bose** and Swagatam Das. "Designing Scalable Graph Transformers for Large-scale Graphs", 2025

AWARDS

- Junior Research Fellowship (2019 - 2021), and Senior Research Fellowship (2021 - present) awarded by the Indian Statistical Institute.

PROFESSIONAL SERVICES

- Organizing committee member of the Winter School on Deep Learning (2022 - 2025) hosted by the Electronics and Communication Sciences Unit, Indian Statistical Institute, Kolkata.
 <https://sites.google.com/view/wsd12025>

- Acts as a regular reviewer in journals: IEEE Transactions on Neural Networks and Learning Systems (2022 onwards), IEEE Transactions on Cybernetics (2022 onwards), and A* conferences: NeurIPS (Position track) and LoG (2025 onwards), etc.

TECHNICAL SKILLS

Python, C/C++, Pytorch, Pytorch-geometric, DGL, NetworkX.

TALKS & PRESENTATIONS

- Course Lectures for WSDL: Variational Autoencoder (2022), Introduction to Graph Neural Networks (2023, 2024), Knowledge Distillation (2024 - 2025).

REFERENCES

Swagatam Das

Professor, Electronics and Communication Sciences Unit

Indian Statistical Institute, Kolkata

✉ swagatam.das@isical.ac.in