2401 Yellow Birch Way, Apt. 301,
Knoxville, TN 37931
1(785)317-6675
bosea@ornl.gov, avishek.csedu.res@gmail.com
Avishek Bose
abose17
Google Scholar

Avishek Bose

Professional Experience

Postdoctoral Research Associate (Jan 2023 – present)

Learning systems group, Data and AI Systems Section, CSMD, CCSD at Oak Ridge National Laboratory (ORNL), *Oak Ridge, TN, USA*.

- Currently, I am contributing to a project called NAERM which is a sub-project of the DOE-sponsored Eagle-I initiative. My role in this project is to leverage the underlying topological structures of power stations, sub-stations, and critical infrastructure to predict their power outages during hazardous weather events by analyzing explicit and implicit correlations.
- I am leading a project to transform isocontours data from various scientific visualization data sets (weather, fluid dynamics, human skull, etc.) into graph-structured data to apply GNNs to reduce the processing time of depth calculation. My implementation using GNNs performed the calculation 100 times faster than the conventional ways.
- I am currently working on an NIH-sponsored drug discovery project where my task is to predict thousands of drug functionalities at a time even when there are shortages of labeled data using graph neural network (GNN), recurrent neural network (RNN), and Transformers. Another task is to predict similar drug molecules based on their properties and results in a reverse engineering fashion.
- I worked on **Ascend** project where my task was to enrich material knowledge graph by providing hidden information from materials research papers, automatically using pre-trained large language models (LLMs such as GPT3 and BERT) with an attention mechanism. I also made a couple of significant analyses on BERT and GPT models according to their structural differences and usability such as why GPT models are better than BERT models, in which context BERT performs better, principles of fusing of embedding models, etc.
- In another material project, I used GPT and BERT embedding with GNN for predicting solid-state material properties such as bandgap, and energy formation. I achieved a noticeable performance gain over the current state of the approaches for materials property prediction.

Research Assistant (Jun 2018 – Dec 2022)

KDD Lab, Department of Computer Science, Kansas State University, *Manhattan, Kansas, USA*.

- Worked on Cyber Threat Intelligence (CTI) project to extract cyber-threat intelligence, classify their types, and rank threat events from social media texts such as Twitter data stream using PyTorch, scikit-learn, etc. by adopting relevant methods from GNN, NLP, and SNA research domains (**5 peer-reviewed papers accepted**, paper-1 has 94.62% 81.99% accuracy on CTI Relevance and Threat Type respectively, paper-2 achieves a significant precision 93.75% for cyber threat event detection, and paper-3 outperformed baselines by 23.23% on average for CTI relevant user detection from Twitter user network)
- Worked on HPC Analytics project to predict the status of a submitted job and its resource requirements by training Graph Neural Network (GNN) models on computing cluster log data using PyTorch (**2 peer-reviewed papers accepted**, paper-1 achieves R2 of 95% with 99% accuracy and paper-2 achieves a remarkable 88% F1_score)

Research Assistant (June 2017 – May 2018)

ISCAAS Lab, Department of Computer Science, Kansas State University, *Manhattan, Kansas, USA*.

- Worked on a project aiming to develop product' recommendations to customers by analyzing the usability of various clustering algorithms on Big datasets of the hospitality industry (**2 peer-reviewed papers accepted**)

Research Assistant (Jan 2017 – May 2017)

PDCESL Lab, Department of Computer Science and Engineering, University of Nevada, Reno, *Reno, Nevada, USA*.

- Worked on a project to run self-driven cars in a traffic simulator called AirSim by training models, using Deep Reinforcement Learning

Software Developer (PO) (Jul 2016 – Dec 2016)
ICT Division, Dutch Bangla Bank, *15 Dhanmondi, Dhaka, Bangladesh*.
- Worked on the back-end part of a project called Agent Banking and there I used to write PI/SQL scripts to support requests from the Tomcat application server

Research Assistant (May 2016 – June 2016)
VLSI Research Group (VLR), Department of Computer Science and Engineering, University of Dhaka, *Dhaka, Bangladesh*.
- Worked on designing a generic framework for fault-tolerant low-cost quantum circuits

Lecturer (Jan 2016 – Apr 2016)
Department of Computer Science and Engineering, Daffodil International University, *Sobhanbag, Dhaka, Bangladesh*.

Lecturer(Nov 2014 – Dec 2015)
Department of Computer Science and Engineering and ICT, The Millennium University, *Momenbagh, Dhaka, Bangladesh*.

Lecturer (Part-time)(Aug 2013 – Oct 2014)
Department of Computer Science and Engineering, Dhaka International University, *Green Road, Dhaka, Bangladesh*.

Research Assistant (Jan 2012 – Jul 2013)
VLSI Research Group (VLR), Department of Computer Science and Engineering, University of Dhaka, *Dhaka, Bangladesh*.
- Worked on implementing quantum logic circuits using reversible logic

Research Experience and Interests

Deep Learning, Graph Learning, Text Mining, Materials and drug discovery, Computational Chemistry, Social Network Analysis, Security Informatics, Quantum Computing, Recommender Systems, Reversible Logic, etc.

Education

Continuing from Aug 2017
PhD in Computer Science, *Department of Computer Science*, Kansas State University (Defended on Nov 4^{th}, 2022).

Jan 2017 – May 2017
Ph.D. in Computer Science & Engineering, *Department of Computer Science & Engineering*, University of Nevada, Reno (Moved to Kansas State University in July 2017).

Jan 2014 – Dec 2015
MS in Computer Science & Engineering, *Department of Computer Science and Engineering*, University of Dhaka.

Jan 2009 – Aug 2013
BS in Computer Science & Engineering, *Department of Computer Science and Engineering*, University of Dhaka.

Key Publications

Published Papers

1. Yin, J., **Bose, A.**, Cong, G., Lyngaas, I., and Anthony, Q. "Comparative Study of Large Language Model Architectures on HPC" in *(38th IEEE International Parallel & Distributed Processing Symposium (IPDPS)-2024)*
2. **Bose, A.** & Hsu,W. H. (2023, December). "Attention-Augmented Parametric Kernel Graph Neural Network (APKGNN) for Node Classification". In 22^{nd} *International Conference on Machine Learning and Applications (ICMLA-2023) (pp. 1-8). IEEE.*

3. **Bose, A.**, Yang, H., Shivers, M., Orazgeldiyev, A., & Hsu, W. H. (2023, October). "Context-Augmented Key Phrase Extraction from Short Texts for Cyber Threat Intelligence Tasks". In *2023 IEEE International Conference on Intelligence and Security Informatics (ISI) (pp. 1-6). IEEE.*
4. **Bose, A.**, Yang, H., Hsu, W. H., & Andresen, D. (2021, December). "HPCGCN: A Predictive Framework on High-Performance Computing Cluster Log Data Using Graph Convolutional Networks". In *2021 IEEE International Conference on Big Data (Big Data) (pp. 4113-4118). IEEE.*
5. **Bose, A.**, Sundari, S. G., Behzadan, V., & Hsu, W. H. (2021, November). "Tracing Relevant Twitter Accounts Active in Cyber Threat Intelligence Domain by Exploiting Content and Structure of Twitter Network". In *2021 IEEE International Conference on Intelligence and Security Informatics (ISI) (pp. 1-6). IEEE.*
6. Adedolapo, O., Huichen, Y., **Avishek, B.**, William, H., Dan, A., & Mohammed, T. (2020, December). "Feature Selection for Learning to Predict Outcomes of Compute Cluster Jobs with Application to Decision Support". In *2020 International Conference on Computational Science and Computational Intelligence (CSCI) (pp. 1231-1236). IEEE.*
7. Nafi, N. M., **Bose, A.**, Khanal, S., Caragea, D., & Hsu, W. H. (2020, April). "Abstractive Text Summarization of Disaster-Related Document". In *ISCRAM 2020 Conference Proceedings–17th International Conference on Information Systems for Crisis Response and Management.*
8. **Bose, A.**, Munir, A., & Shabani, N. (2020, January). "A Quantitative Analysis of Big Data Clustering Algorithms for Market Segmentation in Hospitality Industry". In *2020 IEEE International Conference on Consumer Electronics (ICCE) (pp. 1-6). IEEE.*
9. **Bose, A.**, Behzadan, V., Aguirre, C., & Hsu, W. H. (2019, August). "A novel approach for detection and ranking of trendy and emerging cyber threat events in Twitter streams". In *2019 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM) (pp. 871-878). IEEE.*
10. Islam, S., **Bose, A.**, Jones, C. A., Hossain, M., & Vahl, C. I. (2020). "Developing an Automated Technique to Calibrate the AASHTOWare Pavement ME Design Software". *Transportation Research Record: Journal of the Transportation Research Board, 2674(9).*
11. Islam, S., Hossain, M., Jones, C. A., **Bose, A.**, Barrett, R., & Velasquez, N. (2019). "Implementation of AASHTOWare Pavement ME Design Software for Asphalt Pavements in Kansas". *Transportation Research Record: Journal of the Transportation Research Board, 2673(19-05765).*
12. Behzadan, V., Aguirre, C., **Bose, A.**, & Hsu, W. (2018, December). "Corpus and deep learning classifier for collection of cyber threat indicators in Twitter stream". In *2018 IEEE International Conference on Big Data (Big Data) (pp. 5002-5007). IEEE.*
13. **Bose, A.**, & Babu, H. M. H. (2015, December)."Optimized Designs of Reversible Fault Tolerant BCD adder and Fault Tolerant Reversible Carry Skip BCD Adder." In *2015 18th International Conference on Computer and Information Technology (ICCIT) (pp. 202-207). IEEE.*
14. **Bose, A.**, Babu, H. M. H., & Gupta, S. (2015, December)."Design of Compact Reversible Online Testable Ripple Carry Adder." In *2015 IEEE International WIE Conference on Electrical and Computer Engineering (WIECON-ECE) (pp. 556-560). IEEE.*
15. **Bose, A.**, & Sarker, A. (2014, May)."A novel approach for constructing reversible fault tolerant n-bit binary comparator." In *2014 International Conference on Informatics, Electronics & Vision (ICIEV) (pp. 1-6). IEEE*.
16. Sarker, A., **Bose, A.**, & Gupta, S. (2014, December). "Design of a compact fault tolerant adder/subtractor circuits using parity preserving reversible gates." In *2014 17th International Conference on Computer and Information Technology (ICCIT) (pp. 1-7). IEEE.*.
17. Sarker, A., Amin, M. S., **Bose, A.**, & Islam, N. (2014, May). "An optimized design of binary comparator circuit in quantum computing" In *2014 International Conference on Informatics, Electronics & Vision (ICIEV) (pp. 1-5). IEEE.*.
18. Shabani, N., Munir, A. and **Bose, A.**.(2018, January) "Analysis of big data maturity stage in hospitality industry." *23rd Annual Graduate Education and Graduate Student Research Conference in Hospitality and Tourism.*

Under Review

1. **Bose, A.**, Cong, G., and Patton, R. "Being optimal for predicting drug effects from high-degree asymmetric drug data sets: A comprehensive analysis on multitask prediction" *(Drafted to submit to 2023 IEEE 24th International Conference on Information Reuse and Integration for Data Science (IRI))*
2. **Bose, A.**, Lee, S., and Chinthavali, S."Exploring the Correlation Between Critical Infrastructure Networks and Power Outage Spread During Extreme Weather Events" *(Drafted to submit to a special issue of ACS Medicinal Chemistry Letters known as Exploring the Use of AI/ML Technologies in Medicinal Chemistry and Drug Discovery)*

Grants and Awards

Travel grant from ERGP and Department of Computer Science at Kansas State University, Seattle, WA, *For presenting a conference paper*.

Travel grant from the Department of Computer Science at Kansas State University, Vancouver, BC, CA, *For presenting a conference paper*.

Fellowship from the ministry of ICT, Peoples Republic of Bangladesh , *For outstanding research work in MS*.

District Talent Pool Scholarship, Dinajpur, Bangladesh, *For outstanding result in HSC exam*.

High School Scholarship, *For outstanding result from class six to class Ten*.

Academic Contribution and Professional Activity

Reviewer	IEEE Transactions on Neural Networks and Learning Systems (TNNLS) (Editor Name: Yongduan Song)
Reviewer	Electronics and Telecommunications Research Institute (ETRI) (Editor Names: Jinwoong Kim, Sungwon Yi)
Reviewer	IEEE 66th International Midwest Symposium on Circuits and Systems (MWSCAS)
President	Computer Science Graduate Student Association, Department of Computer Science, Kansas State University (Sep 2020 - Sep 2021)

Leadership Skill

Former Treasurer	Bangladeshi Students Association at Kansas State University (Feb 2019 - Feb 2020)
Participant	Successfully Completed Leadership Development Program from Staley School of Leadership Studies at Kansas State University
Personnel Manager	Knowledge Discovery in Databases Lab, Department of Computer Science, Kansas State University (Jan 2019 - Present)

Memberships

Member	Institute of Electrical and Electronics Engineers (IEEE)
Member	Association for Computing Machinery (ACM)

Presentations

CanSec-2018, Regional Cyber-Security Conference, *Oral presentation of ongoing* Threat Intelligence *project*.

Graduate School Research Forum, Kansas State University, *Oral presentation of Cyber-threat event detection*.

3MT Thesis Presentation, Kansas State University, *Presentation on the usage of User Modeling in High-Performance Computing (HPC) resource prediction*.

Programming Skill and Tool Utilization

Frameworks and Tools	PyTorch, PyTorch Geometric, Networkx, scikit-learn, Tensorflow, Keras, Apache Hadoop, Django, GeoPandas, Uppaal, Alloy, UML, Logika, PySpark
Programming Languages	Python, Java, C, C++, R
Web Languages	Php, Javascript, XML, HTML
Query Languages and Databases	MySQL, PostgreSQL, MongoDB, OracleDB, PL/SQL
Mobile Apps Development	Android SDK
Systems, Softwares, and others	Docker, AWS, Proteus, Latex, AVR-Studio, Eclips, Prolog, Microsoft Visual Studio, Linux OS, Latex, Github, Microwind, DSCH