TANWI MALLICK

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RESEARCH INTERESTS

Spatiotemporal graph neural networks; scalable data-efficient deep learning; uncertainty quantification; large-scale machine learning on high-performance computing systems; natural language processing; acceleration of machine learning models using emerging artificial intelligence hardware accelerators (such as SambaNova and Cerebras)

WORK EXPERIENCE

Argonne National Laboratory, Lemont, Illinois, USA February 2022 – Present
Assistant computer science specialist

- Working on long-term spatiotemporal forecasting, uncertainty quantification on graph neural network, spatiotemporal embedding and clustering, surrogate modeling for the transportation network, and analyzing the impact of climate change on critical infrastructure using natural language processing.

Argonne National Laboratory, Lemont, Illinois, USA October 2018 – February 2022
Postdoctoral Appointee

- Worked on large-scale short-term highway traffic forecasting, community and infrastructure assessment for COVID-19, traffic forecasting in wide area networks, accelerating a graph-convolution-based deep learning framework with SambaNova and Cerebras.

General Electric (GE) Oil and Gas, Bangalore, India June 2018 – October 2018
Senior Data Scientist

- Worked on production oil forecasting in reservoirs and failure prediction of turbines using deep learning techniques

National Digital Library Project, IIT Kharagpur, India June 2017 – April 2018
Research Consultant

- Worked on building graphical abstract from the figures and their labels in scientific research papers using convolutional neural network

Durgapur Institute of Technology and Management, India July 2010 – December 2011
Assistant Professor

- Taught Image processing, Object oriented programming, and Design and analysis of algorithms

EDUCATION

Indian Institute of Technology, Kharagpur, India *February 2018*
Doctor of Philosophy
Department of Computer Science & Engineering
Thesis: A Framework for Modeling, Analysis and Transcription of Bharatanatyam Dance Performances

National Institute of Technology, Durgapur, India *June 2010*

Master of Technology
Department of Computer Science & Engineering

Jalpaiguri Government Engineering College, India *June 2008*
Bachelor of Technology
Department of Computer Science & Engineering

AWARDS AND ACHIEVEMENTS

- Travel award from 14^{th} Women in Machine Learning (WiML) Workshop colocated with NeurIPS, Vancouver, Canada, December 2019.
- Travel award from DST, Government of India, for VISAPP 2015, and from Rajaghari Fund of IIT Kharagpur for 2nd Heidelberg Laureate Forum.
- Selected to participate in the 2nd Heidelberg Laureate Forum as one of the 100 most qualified Young Researchers in Computer Science to meet a number of Turing Awardees. September, 2014.
- The paper "Characterization of Noise in Kinetic Depth Images: A Review" was one of the 25 most downloaded papers for April – May 2014, IEEE Sensor Journal.
- One of the 7 finalists for the Samsung Innovation Award 2014. In total 50 groups had participated for the award. News Article
- Tata Consultancy Services research fellowship. October 2012 to June 2017 during my doctoral study.

PUBLICATIONS IN PEER-REVIEWED VENUE

Google Scholar: https://scholar.google.com/citations?user=-SYCofkAAAAJ

Citations: 327; h-index: 7; i10-index: 5 (as of January 11, 2023).

1. Yixuan Sun, **Tanwi Mallick**, Prasanna Balaprakash, and Jane Macfarlane. A data-centric weak supervised learning for highway traffic incident detection. Accident Analysis & Prevention, 176, p.106779, August 2022.
2. **Tanwi Mallick**, Partha Pratim Das, and Arun Kumar Majumdar. Posture and sequence recognition for Bharatanatyam dance performances using machine learning approaches. Journal of Visual Communication and Image Representation, 87, p.103548, 2022.
3. **Tanwi Mallick**, Prasanna Balaprakash, Erik Rask, and Jane Macfarlane. Graph-Partitioning-Based Diffusion Convolutional Recurrent Neural Network for Large-Scale Traffic Forecasting, Transportation Research Record, Vol. 2674, Issue 9, pp. 473-488, 2020,
4. **Tanwi Mallick**, Prasanna Balaprakash, Erik Rask, and Jane Macfarlane. Transfer Learning with Graph Neural Networks for Short-Term Highway Traffic Forecasting. 25^{th} International Conference on Pattern Recognition (ICPR 2020), 10367–10374.
5. **Tanwi Mallick**, Mariam Kiran, Bashir Mohammed, Prasanna Balaprakash. Dynamic Graph Neural Network for Traffic Forecasting in Wide Area Networks. In the special session Machine Learning on Big Data (MLBD 2020), IEEE Big Data 2020.
6. **Tanwi Mallick**, Partha Pratim Das, and Arun Kumar Majumdar. Characterization, Detection, and Synchronization of Audio-Video Events. In Bharatanatyam Adavus. Heritage Preservation. Springer, Singapore, pp. 241–268, 2018.

7. Achyuta Aich, **Tanwi Mallick**, Himadri B.G.S. Bhuyan, Partha Pratim Das, and Arun Kumar Majumdar. NrityaGuru: A Dance Tutoring System for Bharatanatyam Using Kinect. In Computer Vision, Pattern Recognition, Image Processing and Graphics (NCVPRIPG 2017), vol 841. Springer, Singapore, p 481-493, 2017.

8. Anindhya Sankhla, Vinanti Kalangutkar, Himadri B.G.S. Bhuyan, **Tanwi Mallick**, Vivek Nautiyal, Partha Pratim Das, and Arun Kumar Majumdar. Automated Translation of Human Postures from Kinect Data to Labanotation. In Computer Vision, Pattern Recognition, Image Processing and Graphics (NCVPRIPG 2017), vol. 841. Springer, Singapore, pp. 494–505, 2017.

9. **Tanwi Mallick**, Aakash Anuj, Partha Pratim Das and Arun Kumar Majumdar. Using Musical Beats to Segment Videos of Bharatanatyam Adavus. In Proc. International Conference on Computer Vision and Image Processing (CVIP 2016), pp. 581-591, 2016.

10. **Tanwi Mallick**, Palash Goyel, Partha Pratim Das and Arun Kumar Majumdar. Facial Emotion Recognition from Kinect Data An Appraisal of Kinect Face Tracking Library. In Proc. 11th Joint Conference on Computer Vision, Imaging and Computer Graphics Theory and Applications (VISIGRAPP 2016), Vol. 4: VISAPP, pp. 525-532, 2016.

11. **Tanwi Mallick**, Ankit Khedia, Partha Pratim Das and Arun Kumar Majumdar. Fast Gait Recognition from Kinect Skeletons. In Proc. 11th Joint Conference onComputer Vision, Imaging and Computer Graphics Theory and Applications (VISIGRAPP 2016), Vol. 3: VISAPP, pp. 340-347, 2016.

12. **Tanwi Mallick**, Aakash Anuj, Partha Pratim Das and Arun Kumar Majumdar. Segmentation of Videos of Adavus in Bharatanatyam Dance by Musical Beats. In Frontiers of Research Speech and Music (FRSM 2015), pp. 175-180, 2015.

13. **Tanwi Mallick**, Rishabh Agrawal, Partha Pratim Das and Arun Kumar Majumdar. Omnidirectional Reconstruction of Human Figures from Depth Data Using Mirrors. In Computer Vision Theory and Applications (VISAPP 2015), Proc. 10th International Conference (2015), pp. 559-566, 2015.

14. Aakash Anuj, **Tanwi Mallick**, Partha Pratim Das and Arun Kumar Majumdar. Robust Control of Applications by Hand-Gestures. In Proc. 5th National Conference on Computer Vision, Pattern Recognition, Image Processing and Graphics (NCVPRIPG 2015), pp. 1-4, 2015.

15. **Tanwi Mallick**, Partha Pratim Das and Arun Kumar Majumdar. Characterizations of Noise in Kinect Depth Images: A Review. IEEE Sensor Journal, Vol. 14, Issue 6, pp. 1731–1740, 2014.

16. **Tanwi Mallick**, Partha Pratim Das and Arun Kumar Majumdar. Study of Interference Noise in Multi-Kinect Set-up. In Proc. 9th International Conference on Computer Vision Theory and Applications (VISAPP 2014), pp. 173-178, 2014.

17. **Tanwi Mallick**, Partha Pratim Das and Arun Kumar Majumdar. Estimation of the Orientation and Distance of a Mirror from Kinect Depth Data. In Proc. 4th National Conference on Computer Vision, Pattern Recognition, Image Processing and Graphics (NCVPRIPG 2013), pp. 1-4, 2013.

18. **Tanwi Mallick**, Gopa Bhaumik, Koyel Sinha Chowdhury, and Gautam Sanyal. Study & Analysis of. surveillance Using Human Facial Expressions. In Proc. International Conference on Systemic Cybernetics and Informatics (ICSCI 2010), pp. 434–437, 2010.

19. Gopa Bhaumik, **Tanwi Mallick**, Koyel Sinha Chowdhury, and Gautam Sanyal. Analysis and Detection of Human Faces by Using Minimum Distance Classifier for Surveillance. In Proc. International Conference on Recent Trends in Information, Telecommunication and Computing (ITC 2010), pp. 265–67, 2010.

EXTENDED ABSTRACTS AND WHITE PAPERS

1. Tanwi Mallick, John Hutchison, and Josh Bergerson, Community and Infrastructure Adaptation to Climate Change (CIACC): From Scientific Literature to Actionable Insights using Advanced Natural Language Processing, MORS Emerging Techniques Forum, September 2022.
2. Tanwi Mallick, Prasanna Balaprakash, Duane Verner, and Leslie-Anne Levy. Analyzing the impact of COVID-19 on critical infrastructure using natural language processing, DOE white paper, January 2022.

PUBLICATIONS – OTHER

1. Weiheng Zhong, Tanwi Mallick, Hadi Meidani, Jane Macfarlane, Prasanna Balaprakash, Explainable Graph Pyramid Autoformer for Long-Term Traffic Forecasting.
2. **Tanwi Mallick**, Partha Pratim Das, and Arun Kumar Majumdar. Beat Detection and Automatic Annotation of the Music of Bharatanatyam Dance Using Speech Recognition Techniques. arXiv preprint arXiv:2004.08269, 2020.

MANUSCRIPTS IN REVIEW/PREPARATION

1. Tanwi Mallick, Jane Macfarlane, and Prasanna Balaprakash, Deep-Ensemble-Based Uncertainty Quantification for Traffic Forecasting with Spatiotemporal Graph Neural Networks, submitted to IEEE transactions on intelligent transportation systems, August 2022.
2. Tanwi Mallick, Prasanna Balaprakash, Duane R. Verner, LA Levy, Joshua Bergerson, and John Hutchison. Analyzing the impact of climate change on critical infrastructure from scientific literature: A weakly supervised NLP approach.

RESEARCH COVERAGE

- Bumper to bumper, Can AI and supercomputers solve California's traffic? Science Node, 25 January 2021.
- Can a national lab forecast traffic jams to prevent them in future? Federal News Network, 4 December 2020.
- Feature Stories - Building a better traffic forecasting model, Argonne website, 12 November 2020.
- Feature Stories - On the road to efficiency, Argonne website, 3 June 2019.

FUNDED PROPOSALS

- PI; Accelerating graph-convolution-based deep learning framework for large-scale highway traffic forecasting with SambaNova, LDRD-Expedition, Argonne National Laboratory. Year: 2021; Budget: $30K.
- Senior personnel; High Performance Computing and Big Data Solutions for Mobility Design and Planning (DOE EERE/VTO); Year: 2020–2023; ANL Budget: $1M. Effort level: 40%
- Co-PI; Community and Infrastructure Adaptation to Climate Change: An AI-Driven Research Tool, ANL LDRD. Budget: $300K per year, Effort level: 40%

UNFUNDED PROPOSALS

- Randomized Algorithms for Continually-Learning Higher-Order Graph Neural Networks, Prasanna Balaprakash, Emilie Purvine, Ilya Safro, Stefan Dernbach, Mahantesh Halappanavar, Tanwi Mallick, Krishnan Raghavan, and Edoardo Serra, DOE Advanced Scientific Computing Research, June 2022, period of funding: 2022-2025, my role: CO-PI, total budget: $2,400,000

- An AI-enabled model for forecasting near-term crime risk using real-time traffic data, Hadi Meidani, Tanwi Mallick, Prasanna Balaprakash, and Joshua Bergerson, DPI-Argonne Research Partnerships Seed Grants, June 2022, period of funding: 2 years, my role: CO-PI, total budget: $250,000
- Neural Network Modeling of Grain Microstructure on Plasmonic Performance, Tanwi Mallick, Prasanna Balaprakash, Ganesh Sivaraman, and Eliu A Huerta, High-Performance computing for energy innovation, July 2022, Pre-proposal.
- Spatiotemporal Forecasting using Graph-Structured Recurrent Neural Network, LDRD-Seed, Argonne National Laboratory. my role: PI, Year: 2020; Budget: $25K.

SUPERVISION

- Weiheng Zhong, University of Illinois Urbana-Champaign, Explainable Graph Pyramid Autoformer for Long-Term Traffic Forecasting, Summer 2022.
- Yixuan Sun, Purdue University, Datacentric supervised learning workflow for highway traffic incident detection, Summer 2021.
- Yixuan Sun, Purdue University, Traffic incident detection using weak supervision, Summer 2020.

PROFESSIONAL SERVICE

- Organizer, LANS Seminar Series, Argonne National Laboratory, January 2021 – present.
- Organizer, AI & HPC Seminar Series, Argonne National Laboratory, May 2020 – January 2021.
- Chair, IEEE Women in Engineering Affinity Group Kharagpur Section (2015–2016).
- Treasurer and Member of Management Team, IEEE Women in Engineering Affinity Group Kharagpur Section, 2014–2015.
- Student volunteer at ACM SIGGRAPH 2015.

Reviewer for journals: IEEE Transaction on Intelligent Transportation System, Geo-spatial Information Science, Transportation Research Part C, Applied Soft Computing Journal, International Journal of High-Performance Computing Applications, The Institution of Engineers (India): Series B, Computer Animation and Virtual Worlds.

Reviewer for conferences: International Conference on Parallel Processing (ICPP) 2021, International Conference on Computational Intelligence and Networks (CINE) 2020, Supercomputing (SC) 2019, IEEE Students Technology Symposium 2014.

PRESENTATIONS

- Contributed talk - Jointly presented our work on programmatic labeling and weak supervised learning approaches for extracting climate change impacts and geography-specific adaptation strategies from a large corpus of scientific literature on the future of data-centric AI by Snorkel, 2^{nd} August 2022.
- Talk - Accelerating graph convolution based deep learning framework for large scale highway traffic forecasting with sambanova, Usecase presentation in SambaNova training workshop, June 16, 2021.
- Talk - Spatiotemporal learning for climate modeling using graph neural network, Climate and Energy Action Initiative Town Hall on Advancing Predictive Climate Science, June 8, 2021.

- Talk - Graph-Partitioning-Based Diffusion Convolution Recurrent Neural Network for Large-Scale Traffic Forecasting, AI & HPC Seminar, Argonne National Laboratory, July 17, 2020.
- Talk - Graph-Partitioning-Based Diffusion Convolution Recurrent Neural Network for Large-Scale Traffic Forecasting, Postdoc society e-seminar, Argonne National Laboratory, June 23, 2020.
- Talk - Graph-Partitioning-Based Diffusion Convolution Recurrent Neural Network for Large-Scale Traffic Forecasting, CELS Computing Coffee Hours, Argonne National Laboratory, April 29, 2020.
- Talk - Graph-Partitioning-Based Diffusion Convolution Recurrent Neural Network for Large-Scale Traffic Forecasting, Transportation Research Board (TRB 2020), January 15, 2020.
- Poster presentation - Scalable Diffusion Convolution Recurrent Neural Network for Large-Scale Traffic Forecasting, Women in Machine Learning, NeurIPS, December 9, 2019.
- Poster presentation – Learning to Forecast Entire California Traffic within 3 Hours, Postdoc symposium, Argonne National Laboratory, November 6, 2019.
- Talk - Diffusion Convolution Recurrent Neural Network for Traffic Forecasting, Argonne Physical Sciences and Engineering (PSE) AI in Science and Engineering Townhall Meetings, July 18, 2019.

TUTORIALS/ WORKSHOPS

Tutorial on Neural Networks in Tensorflow in Intro to AI-driven Science on Supercomputers: A Student Training Series, October 22.

Deep Learning Methods (talk/hands-on) at an Argonne training program on extreme-scale computing (ATPESC) on August 12, 2022.

- Transfer learning in the hyperparameter search session and hands-on in the Deephyper workshop, July 15, 2022
- Object Detection Using Machine Learning, Argonne Leadership Computing Facility (ALCF), AI4Science tutorial, Argonne National Laboratory, August 23, 2019.
- Diffusion Convolution Recurrent Neural Network for traffic forecasting, Argonne Training Program on Extreme-Scale Computing (ATPESC), August 9, 2019.

TEACHING ASSISTANT

- Programming in C++ in NPTEL MOOCs [January – March 2017] and [July – September 2016], Indian Institute of Technology Kharagpur
- Object Oriented Analysis and Design (OOAD) in NPTEL MOOCs [July – September 2016], Indian Institute of Technology Kharagpur
- Advance Digital Image Processing and Computer Vision [Spring Semester 2014 and 2015, Indian Institute of Technology Kharagpur]
- Compiler Design [Autumn Semester, 2013 and 2014, Indian Institute of Technology Kharagpur]
- Software Engineering [Spring Semester, 2013 and 2014, Indian Institute of Technology Kharagpur]
- Image Processing [Autumn Semester, 2012, Indian Institute of Technology Kharagpur]

OPEN-SOURCE SOFTWARE

1. Tanwi Mallick, and Prasanna Balaprakash. GP-DCRNN: Large scale traffic forecasting using graph-partition-based diffusion convolution recurrent neural network, Developed in Tensorflow and tested on ALCF supercomputer Cooley GPU,

   https://github.com/tanwimallick/graph_partition_based_DCRNN

2. Tanwi Mallick, and Prasanna Balaprakash. TL-DCRNN: Transfer Learning with Graph Neural Networks for Short-Term Highway Traffic Forecasting, Developed in Tensorflow and tested on ALCF supercomputer Cooley GPU,

   https://github.com/tanwimallick/TL-DCRNN

3. Tanwi Mallick, and Prasanna Balaprakash. D-DCRNN: Dynamic Diffusion Convolution Recurrent Neural Network for spatio-temporal Forecasting, Developed in Tensorflow and tested on ALCF supercomputer Cooley GPU,

   https://github.com/tanwimallick/D_DCRNN