

# SAYEED SHAFAYET CHOWDHURY

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## EDUCATION

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**Purdue University**, West Lafayette, IN, USA

2019- 2024

**PhD** in Electrical and Computer Engineering, Research Area – Efficient Machine Learning Algorithms, **CGPA: 4.00/4.00**

Advisor - Prof. Kaushik Roy

**Bangladesh University of Engineering & Technology (BUET)**, Dhaka, Bangladesh

March 2016

**B.Sc.** in Electrical and Electronic Engineering, CGPA: 3.98/4.00, Rank: 2/205

## RESEARCH AND WORK EXPERIENCES

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**Postdoctoral Research Associate, Machine Learning, Purdue University**

April 2025 - Present

- Improved rhinosinusitis surgery outcome prediction accuracy by 7% using novel ensemble ML models with human-in-the-loop.
- Mitigated the class imbalance problem of rhinosinusitis surgery outcome prediction leveraging generative AI, and enhanced the classification performance by 4%.
- Developing multimodal pipeline with CT images from medical data, resulting in ~5% surgery prediction accuracy enhancement.

**Research Scientist, Machine Learning, Meta**

Sep 2024-March 2025

Develop Large Scale Machine Learning based Ads Ranking Models

- Implemented a novel architecture modeling the user behavior using event based features to enhance the ranking performance of ads ranking foundation models by 0.4%.
- Improved the predictive performance of line cook Ads models by scaling up to 5-10X, resulting in up to 1% accuracy enhancement.

**Graduate Research Assistant, Purdue University**

2019 – 2024

Scene understanding from videos

- Proposed an optimal transport formulation for unsupervised learning from videos, resulting in 22% enhancement of accuracy.
- Developed an algorithm for temporal localization of key steps in surgical videos in collaboration with IU health, with 10% accuracy improvement.

Segmentation from Echocardiographic Images

- Implemented a UNet based segmentation algorithm from echocardiographic images on the CAMUS dataset.
- Incorporated Resnet like skip layers to enhance the segmentation performance by 3% to obtain SOTA.

Ultra low latency Spiking Neural Networks (SNN)

- Proposed a novel temporal pruning method for low-power image recognition, reinforcement learning on Atari games and event-based optical flow estimation.
- Achieved 5X lower latency (just 1 timestep) and up to 100X higher energy-efficiency compared to prior state-of-the-art.

Discrete Cosine Transform (DCT)-based encoding for energy-efficient SNNs

- Proposed a novel DCT-based frequency domain encoding method for SNNs to process sequential inputs.
- Achieved up to 10X lower latency and up to 2X higher energy-efficiency compared to prior state-of-the-art.

ECG classification using Artificial Intelligence

- Proposed a novel XGboost based classification algorithm for ECG classification on the Physionet Challenge data.
- Implemented novel features and feature selection process to obtain up to 90% accuracy.

Understanding visual syntax with Vision Transformers (ViTs)

- Reported a novel problem with ViTs where they fail to capture image syntax.
- Proposed a masked auto-encoder based training using ViTs to capture syntactic anomalies in an explainable manner.

Understanding the effect of leak in SNNs

- Performed a frequency-domain analysis to understand the effect of the leak parameter in SNNs.
- Obtained SNNs with ~5\% higher noise robustness and ~2X lower energy consumption by optimizing leak and threshold.

Foveation-based image recognition with ViTs

- Proposed a novel attention-based bio-inspired foveation with ViTs for background agnostic image recognition.
- Achieved 2-3X lower compute and higher robustness compared to ViTs.

**Advanced ML Algorithm Intern**, AI Solutions Team, Analog Devices Inc.

*September 2023- December 2023*

- Developed an algorithm for speech enhancement using bone conduction microphone (BCM) data.
- Proposed and implemented a speech enhancement approach using fusion of air conduction (AC) and BCM signals.
- Evaluated the proposed method on an in-house dataset and developed a demo for the pipeline.

**Research Associate**, Digital Signal Processing Research Laboratory, BUET

*Jan 2015 – April 2018*

- Developed a novel adaptive filtering based heart rate measurement algorithm from photoplethysmography (PPG) for real-time outdoor applications in severe motion artifact cases which achieved state-of-the-art accuracy (<1% error in BPM heart rate estimation).
- Implemented a novel pole-matching using unsupervised machine learning for region-of-recording identification from multimedia signals.

## TEACHING EXPERIENCE

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**Visiting Assistant Professor**, Purdue University

*August 2025 – Present*

- *Designed and taught* the upper undergrad level **AI for IoT** course as the instructor of record.
- Guest lectured for the Artificial Intelligence course.
- Supervising an undergraduate student for the capstone project on transfer learning for biomedical applications of AI.

Lecturer, Ahsanullah University of Science and Technology, Dhaka

*2018*

- Taught C++ and Matlab programming courses in large classrooms
- Performed as an instructor of record for the VLSI course and laboratory, contributed to the curriculum and lab manual development.

Lecturer, Bangladesh University of Engineering & Technology (BUET), Dhaka

*2016-2017*

- Lectured Undergrad Theory courses -
  - Signals and Systems – EEE 301
  - Electrical DC and AC circuits - EEE 101 and 105
  - Measurement and Instrumentation - EEE 407
  - Digital Signal Processing - EEE 307
- Taught **12 lab sections** (including programming courses) and demonstrated examples in class to encourage student participation

Lecturer, BRAC University, Bangladesh, Dhaka

*2016*

- Taught the Digital Signal Processing course (both theory and laboratory section)
- Led the power system protection laboratory for multiple sections

## PROJECT MENTORSHIP EXPERIENCE

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- Supervising an undergraduate student at Purdue CS department for the capstone project on transfer learning for biomedical applications of AI.
- Mentored 2 undergrad students at Purdue ECE as part of their SURF (Summer undergraduate research) project on spiking neural networks for language modeling.
- Mentored 2 grad students at Purdue ECE NRL lab, helping them with research projects, leading to peer-reviewed publications.

- Supervised a team of students of Bangladesh University of Engineering & Technology for the 4<sup>th</sup> edition of IEEE Signal Processing Cup, 2017: real-time music beat prediction challenge
- Mentored a team of students of Bangladesh University of Engineering & Technology for the 1<sup>st</sup> edition of for IEEE Video and Image Processing Cup: to detect traffic signs for self-driving cars
- Mentored a team of students of Ahsanullah University of Science and Technology, Bangladesh for fifth edition of the Signal Processing Cup: forensic camera model identification challenge.

## GRAD COURSEWORK

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Machine Learning I and II, Deep Learning, Reinforcement Learning, Optimization, Probability and Random Signals, Digital Image Processing, Digital Video Processing, Linear Algebra, Algorithms and Data Structures, CMOS VLSI design, IC/MEMS Fabrication

## AWARDS AND GRANTS

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- Travel for Collaborative Research (TRACER) Grant, 2023, awarded from **Purdue** in collaboration with **Georgia Tech**.
- Travel grant for European Conference on Computer Vision (ECCV), 2022, awarded from **Meta**.
- *1<sup>st</sup> prize* at Research idea contest, School of ECE, Purdue University, 2022.
- *8<sup>th</sup> prize in IEEE Signal Processing Cup 2020*, Barcelona, Spain for proposing an unsupervised method to detect abnormalities in the behavior of the ground and aerial systems based on embedded sensor data in real-time.
- Dean's Fellowship, University of Maryland, College Park, USA, 2019.
- Department of EECS Fellowship, University of California, Berkeley, 2017.
- Best Paper Award in IEEE Region 10 Humanitarian Technology Conference (R10-HTC), 2017 for implementation of wheelchair with advanced control features.
- *3<sup>rd</sup> prize in IEEE Video and Image Processing Cup, 2017*, Beijing, China (1500\$ prize money with 1200\$ travel grant), for implementing a computer vision algorithm to identify traffic signs in severe conditions from both real and artificial videos.
- *1<sup>st</sup> prize in IEEE Signal Processing Cup 2016*, Shanghai, China (5000\$ prize money with 1200\$ travel grant), for proposing a machine learning based algorithm which performs location forensics from media recordings.
- Best Paper Award in the International Conference on Electrical and Computer Engineering (ICECE), 2016.
- *2<sup>nd</sup> prize in IEEE Signal Processing Cup 2015*, Brisbane, Australia (2500\$ prize money with 1700\$ travel grant), for development of real-time heart beat tracking system from wrist-watch signals focusing on mobile applications.
- Dean's List Award and University Merit Scholarship (at all terms of undergraduate study).

## SKILLS AND AFFILIATIONS

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Computer : Linux, Machine learning (Pytorch, Tensorflow, Keras), MATLAB, Python, C, C++, Java, Verilog, Assembly, HTML, PHP, MS Office, Adobe Illustrator, Photoshop, AutoCad, Cadence, Zeemax, Solidworks

Language : Bengali, English, Hindi and Urdu (Fluent), Arabic (Reading and writing)

Affiliations: Student member- Institute of Electrical and Electronics Engineers, Committee Member - Purdue Bangladesh Student Association, Purdue Graduate Student Government, Member- HKN beta chapter, Purdue, Purdue ECE Graduate Student Association and Purdue Chess Club

## PUBLICATIONS

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- **S. S. Chowdhury**, D. Sharma, A. Kosta, and K. Roy, "From Biology to Bytes: A Neuromorphic Computing Odyssey", Nature Communications Engineering, 2025.
- S. Chandra, **S. S. Chowdhury**, and K. Roy, "ViPeR: Vision-based Surgical Phase Recognition", IEEE Access, 2025.
- **S. S. Chowdhury**, S. Chandra, and K. Roy, "OPEL: Optimal Transport Guided Procedure Learning", Advances in Neural Information Processing Systems, **NeurIPS**, 2024.
- **S. S. Chowdhury**, S. Chandra, and K. Roy, "Towards Syntactical Understanding of Images", IEEE Access, 2024.
- A. Mehonic\*, D. Lelmini\*, K. Roy\*, **S. S. Chowdhury\*** et al., "Roadmap of Materials Challenges for Neuromorphic Computing", APL Materials, 2024. (\*equal contribution)
- **S. S. Chowdhury**, A. Kosta, D. Sharma, M. Apolinario, and K. Roy, "Unearthing the Potential of Spiking Neural Networks", Design, Automation & Test in Europe Conference & Exhibition (DATE), 2024.
- Y. Long, **S. S. Chowdhury**, and K. Roy, "Segmented Recurrent Transformer: An Efficient Sequence-to-Sequence Model", Findings of Empirical Methods in Natural Language Processing (EMNLP), 2023.

- B. Wickramasinghe\*, **S. S. Chowdhury\***, A. K. Kosta, W. Ponghiran, and Kaushik Roy, “Unlocking the Potential of Spiking Neural Networks: Understanding the What, Why, and Where”, IEEE Transaction on Cognitive and Developmental Systems (TCDS), 2023. (\*equal contribution)
- **S. S. Chowdhury**, N. Rathi, and K. Roy, “Towards Ultra Low Latency Spiking Neural Networks for Vision and Sequential Tasks Using Temporal Pruning”, European Conference on Computer Vision (ECCV), 2022.
- **S. S. Chowdhury\***, C. Lee\*, and K. Roy, “Towards Understanding the Effect of Leak in Spiking Neural Networks”, Neurocomputing, 2021. (\*equal contribution)
- **S. S. Chowdhury\***, I. Garg\*, and K. Roy, “DCT-SNN: Using DCT to Distribute Spatial Information over Time for Learning Low-Latency Spiking Neural Networks”, International Conference on Computer Vision (ICCV), 2021. (\*equal contribution)
- **S. S. Chowdhury**, I. Garg, and K. Roy, “Spatio-Temporal Pruning and Quantization for Low-latency Spiking Neural Networks”, International Joint Conference on Neural Network (IJCNN), 2021.
- **S. S. Chowdhury et al.**, “Anomaly Detection in Unsupervised Surveillance Setting Using Ensemble of Multimodal Data with Adversarial Defense”, *IEEE International Conference on Machine Learning and Applications (ICMLA)*, 2020.
- **S. S. Chowdhury et al.**, “Numerical Analysis of Sensitivity Enhancement of Surface Plasmon Resonance Biosensors Using a Mirrored Bilayer Structure”, *Photonics and Nanostructures- Fundamentals and Applications*, 2020.
- **S. S. Chowdhury**, M. S. Hasan, and R. Sharmin, “Robust Heart Rate Estimation from PPG Signals with Intense Motion Artifacts using Cascade of Adaptive Filter and Recurrent Neural Network”, IEEE TENCON, Kerala, India, 2019.
- I. Hussaini, A. I. Humayun, S. Alam, S. I. Foysal, A. Al Masud, A. Mahmud, R. I. Chowdhury, N. Ibtehaz, S. U. Zaman, R. Hyder, **S. S. Chowdhury**, and M. A. Haque, “Predictive Real-Time Beat Tracking from Music for Embedded Application”, IEEE Conference on Multimedia Information Processing and Retrieval (MIPR), FL, USA, 2018.
- **S. S. Chowdhury**, R. Hyder, C. Shahnaz, and S. A. Fattah, “Robust single finger movement detection scheme for real time wheelchair control by physically challenged people”, IEEE R-10 HTC, Dhaka, Bangladesh, 2017.
- S. A. Fattah, N. M. Rahman, A. Maksud, S. I. Foysal, R. I. Chowdhury, **S. S. Chowdhury**, and Celia Shahanaz, “Stethophone: Low-cost digital stethoscope for remote personalized healthcare”, IEEE Global Humanitarian Technology Conference, California, USA, 2017.
- A. Maksud, R. I. Chowdhury, T. T. Chowdhury, S. A. Fattah, C. Shahnaz, and **S. S. Chowdhury**, “Low-cost EEG based electric wheelchair with advanced control features”, IEEE Region 10 Conference, TENCON, Malaysia, 2017.
- T. B. Shameem, M. Islam, **S. S. Chowdhury**, C. Shahnaz, and S. A. Fattah, “Voice Based Eye Vision Tester for Underprivileged Community”, IEEE International WIE Conference on Electrical and Computer Engineering (WIECON-ECE), Dehradun, India, 2017.
- C. Shahnaz, A. Maksud, S. A. Fattah, and **S. S. Chowdhury**, “Low-cost smart electric wheelchair with destination mapping and intelligent control features”, IEEE International Symposium on Technology and Society (ISTAS), Australia, 2017.
- C. Shahnaz, Md. J. N. Sampad, D. Adhikary, S. M. Uchayash, M. Mahdia, **S. S. Chowdhury**, and S. A. Fattah, “Smart-hat: Safe and smooth walking assistant for elderly people”, IEEE International Symposium on Technology and Society (ISTAS), Australia, 2017.
- **S. S. Chowdhury et al.**, “Real Time Robust Heart Rate Estimation from Wrist-type PPG Signals Using Multiple Reference Adaptive Noise Cancellation”, *IEEE Journal of Biomedical and Health Informatics*. vol. 22, 2016.
- R. Hyder, **S. S. Chowdhury**, and S. A. Fattah, “Real-Time Non-intrusive Eye-gaze Tracking Based Wheelchair Control For The Physically Challenged”, IEEE EMBS Conference on Biomedical Engineering and Sciences (IECBES), Malaysia, 2016.

## PROFESSIONAL ACTIVITIES

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- Reviewer:
  - Journals: Neurocomputing, Neural Networks, IEEE Access, IEEE Journal of Biomedical and Health Informatics, Frontiers in Neuroscience, IEEE Open Journal of Signal Processing, Decision Making and Analysis, Frontiers in Applied Mathematics and Statistics, IEEE Transactions on Cognitive and Developmental Systems, Frontiers in Computational Neuroscience
  - Conferences: ICLR, NeurIPS, AISTATS, WACV, AAAI, Workshop and Challenge on Unlearning and Model Editing, IEEE International Symposium on Circuits and Systems (ISCAS)

## PRESENTATIONS

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- Presented at premier Machine Learning conferences including NeurIPS 2024, ECCV, 2022, ICCV, 2021 and IJCNN, 2021.
- Presented at IEEE International Conference on Machine Learning and Applications (ICMLA), in 2020.
- Presented at International Conference on Acoustics, Speech, and Signal Processing, ICASSP, (the annual flagship conference of IEEE Signal Processing Society), in Australia, 2015 and China, 2016.
- Communicated our research at various international conference avenues such as IEEE Region-10 Humanitarian Technology Conference, International Conference on Electrical and Computer Engineering, IEEE Region 10 Conference, TENCON.

## REFERENCES

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Professor Kaushik Roy,

Edward G. Tiedemann Jr. Distinguished Professor of Electrical and Computer Engineering,

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