

# MD SHAMIM HUSSAIN

☎ 518-687-4223 ✉ [hussam4@rpi.edu](mailto:hussam4@rpi.edu)  
🎓 <https://scholar.google.de/citations?user=hc97XqQAAAAJ>  
🐙 <https://github.com/shamim-hussain>  
🌐 <https://www.linkedin.com/in/md-shamim-hussain-344611b3>

## Summary

IBM AI Horizons Scholar and Ph.D. candidate in Computer Science at Rensselaer Polytechnic Institute.

## Education

<b>Doctor of Philosophy (Computer Science)</b> <i>Rensselaer Polytechnic Institute, Troy, New York</i>	<b>2019 – Present</b>
<b>Master of Science (Computer Science)</b> <i>Rensselaer Polytechnic Institute, Troy, New York</i>	<b>2019 – 2021</b>
<b>Master of Science in Electrical and Electronic Engineering</b> <i>Bangladesh University of Engineering and Technology, Dhaka</i>	<b>2017 – 2019</b>
<b>Bachelor of Science in Electrical and Electronic Engineering</b> <i>Bangladesh University of Engineering and Technology, Dhaka</i>	<b>2012 – 2017</b>

## Experience

<b>Rensselaer-IBM AI Research Collaboration</b> <i>AI Horizons Scholar</i>	<b>Aug 2020– Present</b> <i>Rensselaer Polytechnic Institute, Troy, NY</i>
<ul style="list-style-type: none"><li>Working on the project – “Attention and Graphs”</li></ul>	
<b>International Business Machines (IBM)</b> <i>Resident Scholar (Internship)</i>	<b>May 2023– Aug 2023</b> <i>IBM Thomas J Watson Research Center, Yorktown Heights, NY</i>
<ul style="list-style-type: none"><li>Conducted research on accurate quantum chemical prediction with graph transformers</li></ul>	
<b>International Business Machines (IBM)</b> <i>Resident Scholar (Internship)</i>	<b>May 2022– Aug 2022</b> <i>IBM Thomas J Watson Research Center, Yorktown Heights, NY</i>
<ul style="list-style-type: none"><li>Conducted research on efficient subsampled self-attention for transformers</li></ul>	
<b>Rensselaer Polytechnic Institute</b> <i>Research Assistant</i>	<b>Jan 2020– Jul 2020</b> <i>Troy, NY</i>
<ul style="list-style-type: none"><li>Conducted research on novel graph neural network architectures</li></ul>	
<b>Rensselaer Polytechnic Institute</b> <i>Teaching Assistant</i>	<b>Aug 2019– Dec 2019</b> <i>Course: Troy, NY</i>
<ul style="list-style-type: none"><li>Worked as the Head TA for the “Computer Organization” course</li></ul>	
<b>Bangladesh University of Engineering and Technology</b> <i>Research Engineer</i>	<b>Aug 2017– July 2019</b> <i>Dhaka, Bangladesh</i>
<ul style="list-style-type: none"><li>Developed a CNN based breast lesion classification system using transfer and multi-task learning at DSP Research Lab</li></ul>	

## Skills

### Programming Languages

- Proficient in Python, C, C++ and Matlab
- Working knowledge of JavaScript, Java, Go and Haskell

### Machine Learning Libraries

- Proficient in both PyTorch and Tensorflow
- Proficient in Huggingface, OpenCV, Scikit-learn, Pandas, Numba, PyArrow

## Web Development

- Working knowledge of HTML, CSS and client-side JavaScript
- Working knowledge of FastAPI, Flask and Node.js

## Other Skills

- Distributed Training on the AiMOS supercomputer, Slurm, CUDA, MPI
- Experience with Docker, Git, Linux, Bash, GNU Coreutils, and other CLI tools

## Relevant Coursework

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### Computer Science

Machine Learning and Optimization, Data Mining, Computational Vision, Information and Coding Theory, Projects in AI/ML, Parallel Programming, Probabilistic Graphical Models, Reinforcement Learning

### Mathematics

Computational Optimization, Probability and Statistics, Linear Algebra, Complex Analysis, Numerical Analysis, Vector Calculus

### Signal Processing

Advanced Digital Signal Processing, Digital Image Processing, Digital Speech Processing

## Publications

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- **“Triplet Interaction Improves Graph Transformers: Accurate Molecular Graph Learning with Triplet Graph Transformers”** in Proceedings of the Forty-first International Conference on Machine Learning, 2024. [Proceedings of ICML’24]
- **“The Information Pathways Hypothesis: Transformers are Dynamic Self-Ensembles”** in Proceedings of the 29th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (pp. 810-821). DOI: 10.1145/3580305.3599520 [Arxiv:2306.01705]
- **“Global Self-attention as a Replacement for Graph Convolution”** in Proceedings of the 28th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (pp. 655-665). DOI: 10.1145/3534678.3539296 [Arxiv:2108.03348]
- **“SwishNet: A Fast Convolutional Neural Network for Speech, Music and Noise Classification and Segmentation”** (Preprint) [Arxiv:1812.00149]
- **“A Fast Double-Talk Detection Algorithm Based on Signal Envelopes for Implementation of Acoustic Echo Cancellation in Embedded Systems”** in The 4th International Conference on Advances in Electrical Engineering (ICAEE), 2017 (pp. 199-204). IEEE.(2017, September) DOI: 10.1109/ICAEE.2017.8255353
- **“Identification of Autoregressive Systems in the Presence of Additive Noise Using the Matrix Pencil Method”** in 2019 1st International Conference on Advances in Science, Engineering and Robotics Technology (ICASERT). IEEE, 2019. DOI: 10.1109/ICASERT.2019.8934608
- **“Breast Lesion Classification from Bi-Modal Ultrasound Images by Deep CNN Using Transfer and Multi-Task Learning”** (Preprint). DOI: 10.13140/RG.2.2.18288.61444

## Peer Review Services

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- Served as a reviewer for **IEEE Transactions on Neural Networks and Learning Systems** in 2023.
- Served as a reviewer for **IEEE Transactions on Big Data** in 2023.

## Relevant Projects

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- **Triplet Graph Transformer** | <https://github.com/shamim-hussain/tgt>
- **Edge Augmented Graph Transformer** | [https://github.com/shamim-hussain/egt\\_pytorch](https://github.com/shamim-hussain/egt_pytorch)
- **Efficient Audio Classification on the MUSAN Corpus** | [https://github.com/shamim-hussain/musan\\_investigation\\_cnn\\_rnn](https://github.com/shamim-hussain/musan_investigation_cnn_rnn)
- **Investigation on 4x Super-resolution by Deep Convolutional Neural Networks** | [https://github.com/shamim-hussain/4x\\_superresolution\\_cnn](https://github.com/shamim-hussain/4x_superresolution_cnn)
- **Experiments on Generative Models** | [https://github.com/shamim-hussain/generative\\_neural\\_networks](https://github.com/shamim-hussain/generative_neural_networks)
- **A Parallel Implementation of The Apriori Algorithm on AiMOS Supercomputer Using CUDA and MPI** | <https://github.com/shamim-hussain/parallel-apriori-with-cuda-and-mpi>
- **An Implementation of Restricted Boltzmann Machine with Pytorch** | <https://github.com/shamim-hussain/rbm-pytorch>
- **Speech Dereverberation using Block Adaptive Inverse Filtering and Spectral Subtraction** | [https://github.com/shamim-hussain/speech\\_dereverberation\\_using\\_lp\\_residual](https://github.com/shamim-hussain/speech_dereverberation_using_lp_residual)
- **Coarse Grained Classification of the Audioset Dataset** | [https://github.com/shamim-hussain/audioset\\_coarse\\_grained\\_classification](https://github.com/shamim-hussain/audioset_coarse_grained_classification)
- **Asynchronous ADMM for Consensus Optimization** | [https://github.com/shamim-hussain/async\\_admm\\_consensus](https://github.com/shamim-hussain/async_admm_consensus)
- **ARMA and AR Systems Identification in Noise by Gradient Descent in the Frequency Domain** | [https://github.com/shamim-hussain/model\\_parameter\\_estimation\\_sgd](https://github.com/shamim-hussain/model_parameter_estimation_sgd)
- **Design of a Recursive Algorithm for Finding All Real Roots of Higher Order Polynomial Equations** | [https://github.com/shamim-hussain/newton\\_raphson\\_real\\_roots](https://github.com/shamim-hussain/newton_raphson_real_roots)

## Achievements

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- 2022, 23: Summer Residency at IBM T.J. Watson Research Center
- 2023: Ph.D. Candidate
- 2021: Master of Science in Computer Science with a perfect CGPA (4.00/4.00)
- 2020: IBM AI Horizons Scholarship
- 2016: 1st Runner-up in Cadence Tensilica Xtenxa Embedded DSP Design Contest
- 2013: University Merit
- 2012-13: Dean's List
- 2009-11: Perfect (100%) Attendance in College
- 2008-10: Bangladesh National Math Olympiad – Champion (once) and Runner-up (once)
- 2007-10: Divisional Math Olympiad – Champion (3 times) and Runner-up (once)
- 2006-17: Bangladesh Educational Board Scholarships (In Junior, Secondary and Higher Secondary levels)

## Volunteer Works

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- 2022, 23: Student volunteer in the ACM SIGKDD conference
- 2022, 23: Volunteer at RPI Bangladeshi Students' Association (BDSA) festivities
- 2018: Organizer of the seminar on “Beat Breast Cancer by Early Detection, Diagnosis and Treatment” at BUET
- 2013: Managed a group on “Programming problems - solutions and discussions”