# Mohammad Tariqul Islam

PhD Candidate,
Department of Electrical and Computer Engineering, Princeton University
mhdtariqul@gmail.com mtislam@princeton.edu
Website: http://tariqul-islam.github.io
Google Scholar: http://bit.ly/TariqsScholar
Github: https://github.com/tariqul-islam

## Research Interest

Machine Learning, Image Processing, Signal Processing, Biomedical Engineering, Imaging

## Education

2018 – —— **PhD Candidate. Electrical and Computer Engineering, Princeton University.**
Courses: Machine Learning and Pattern Recognition, Biomedical Imaging, Advanced Topics in Computer Science (Theoretical Foundations of Deep Learning), Sequential Decision Analysis and Modeling, Deep Learning Networks, Convex and Conic Optimization, Large Scale Optimization for Data Science, Nonlinear Optics.

2016 – 2018 **M.Sc. Electrical and Electronic Engineering, Bangladesh University of Engineering and Technology.**
Courses: (Major:) Digital Speech Processing, Digital Image Processing, Genomic Signal Processing, Biomedical Signal Processing, (Minor:) Quantum Phenomena in Nanostructure, Selected Topic in Electrical and Electronic Engineering (Grid Connected Solar System Analysis).

2011 – 2016 **B.Sc. Electrical and Electronic Engineering, Bangladesh University of Engineering and Technology.**
Courses: Probability and Statistics, Continuous and Linear Systems, Digital Signal Processing, Solid State Devices, Control System I, Measurement and Instrumentation, (Major:) Digital Signal Processing II (Statistical Signal Processing), Random Signals and Processes, Microwave Engineering, (Minor:) VLSI II, Optoelectronics.

## Research Experience

2019 – **Imaging Physics Lab**,
Supervised by, Jason W. Fleischer, Professor, Dept. of ECE, Princeton
- **Research Project**: Biomedical Data Analysis using Unsupervised Non-linear Dimensionality Reduction Algorithms, particularly Uniform Manifold Approximation and Projection (UMAP). Applications include outlier detection in large chest x-ray datasets and COVID-19 phenotyping.

2015 – 2018 **Computer Vision Group**,
Supervised by, S.M. Mahbubur Rahman, Professor, Dept. of EEE, BUET
- **Research Project**: Image Denoising using Convolutional Neural Network (Focused on mixed Gaussian-impulse noise), Determination of affective dimensions using Neural Networks.

## Research Experience (continued)

2016 – 2018 **Computer Vision and Machine Learning**,
Supervised by, Khalid Ashraf, CEO, Semion
- **Research Project**: Chest X-ray Analysis: classification of diseases from chest x-rays using convolutional neural networks.

2014 – 2015 **Signal Processing Group**,
Supervised by, Shaikh Anowarul Fattah and Celia Shahnaz, Professor, Dept. of EEE, BUET
- **Research Project**: Heart Rate Measurement from Photoplethysmographic Signals: The research involved time series analysis using periodogram, and adaptive signal processing.

## Research Publications

### In Preparation

[1] **Islam**, **M. T.** & Fleischer, J. W. (2023a). *Explaining UMAP: Attraction-Repulsion Shape Gudied Dinensionality Reduction*.

[2] **Islam**, **M. T.** & Fleischer, J. W. (2023b). *Improving Out-of-sample Embedding in UMAP*.

[3] **Islam**, **M. T.** & Fleischer, J. W. (2023c). *Neighbor Embedding Reveals Anomalies in Large X-ray Datasets*.

### Articles

[1] Alam, M. M., **Islam**, **M. T.**, & Rahman, S. M. (2021). Unified Learning Approach for Egocentric Hand Gesture Recognition and Fingertip Detection. *Pattern Recognition*, 108200. , https://bit.ly/alam2021unified

[2] Saha, D., Rahman, S. M., **Islam**, **M. T.**, Ahmad, M. O., & Swamy, M. (2021). Prediction of Instantaneous Likeability of Advertisements using Deep Learning. *Cognitive Computation and Systems*. , https://bit.ly/saha2021prediction

[3] **Islam**, **M. T.** & Fleischer, J. W. (2020). Distinguishing L and H phenotypes of COVID-19 using a single x-ray image. *medRxiv*. , https://bit.ly/islam2020dist

[4] Alam, M. M. & **Islam**, **M. T.** (2019). Machine Learning Approach of Automatic Identification and Counting of Blood Cells. *Healthcare technology letters*, *6*(4), 103–108. , https://bit.ly/alam2019cellid

[5] Basnet, R., **Islam**, **M. T.**, Howlader, T., Rahman, S. M., & Hatzinakos, D. (2019). Estimation of Affective Dimensions using CNN-based Features of Audiovisual Data. *Pattern Recognition Letters*, *128*, 290–297. , https://bit.ly/basnet2019estimation

[6] **Islam**, **M. T.**, Ahmed, S. T., Shahnaz, C., & Fattah, S. A. (2019). SPECMAR: Fast Heart Rate Estimation from PPG Signal using a Modified Spectral Subtraction Scheme with Composite Motion Artifacts Reference Generation. *Medical & Biological Engineering & Computing*, *57*(3), 689–702. , https://bit.ly/islam2018specmar

[7] **Islam**, **M. T.**, Aowal, M. A., Minhaz, A. T., & Ashraf, K. (2018). Abnormality Detection and Localization in Chest X-Rays using Deep Convolutional Neural Networks. *arXiv preprint arXiv:1705.09850*. , http://bit.ly/islam2017abnormality

[8] **Islam**, **M. T.**, Rahman, S. M., Ahmad, M. O., & Swamy, M. (2018). Mixed Gaussian-Impulse Noise Reduction from Images Using Convolutional Neural Network. *Signal Processing: Image Communication*, *68*, 26–41. , https://bit.ly/islam2018mixed

[9] **Islam**, **M. T.**, Ahmed, S. T., Zabir, I., Shahnaz, C., & Fattah, S. A. (2017). Cascade and Parallel Combination (CPC) of Adaptive Filters for Estimating Heart Rate During Intensive Physical Exercise from Photoplethysmographic Signal. *Healthcare Technology Letters*. , https://bit.ly/islam2017cpc

[10] **Islam**, **M. T.**, Zabir, I., Ahamed, S. T., Yasar, M. T., Shahnaz, C., & Fattah, S. A. (2017). A Time-frequency Domain Approach of Heart Rate Estimation from Photoplethysmographic (PPG) Signal. *Biomedical Signal Processing and Control*, *36*, 146–154. , https://bit.ly/islam2017timefreq

## Proceedings

[1] Das, S., Sikder, B., Khan, M. H. R., & **Islam**, **M. T.** (2018). Microstrip-Line Fed Gap-Coupled Antennas for Different Patch Geometries. In *2018 10th International Conference on Electrical and Computer Engineering (ICECE)* (pp. 473–476). IEEE. , https://bit.ly/das2018microstrip

[2] Hossain, M. S., Abir, M. T., Khan, M. H. R., & **Islam**, **M. T.** (2018). Multiheaded Starfish Shaped Multiband Microstrip Patch Antenna for Satellite Communication. In *2018 10th International Conference on Electrical and Computer Engineering (ICECE)* (pp. 449–452). IEEE. , https://bit.ly/hossain2018multiheaded

[3] **Islam**, **M. T.**, Saha, D., Rahman, S. M., Ahmad, M. O., & Swamy, M. (2018). A Variational Step for Reduction of Mixed Gaussian-Impulse Noise from Images. In *The International Conference on Electrical and Computer Engineering* (pp. 97–100). Dhaka, Bangladesh. , https://bit.ly/islam2018variational

[4] Najeeb, S., Sharmile, N., Khan, M. S., Sahin, I., **Islam**, **M. T.**, & Bhuiyan, M. I. H. (2018). Classification of Retinal Diseases from OCT scans using Convolutional Neural Networks. In *2018 10th International Conference on Electrical and Computer Engineering (ICECE)* (pp. 465–468). IEEE. , https://bit.ly/najeeb2018classification

[5] Basnet, R., **Islam**, **M. T.**, Howlader, T., Rahman, S., & Hatzinakos, D. (2017). Statistical Selection of CNN-Based Audiovisual Features for Instantaneous Estimation of Human Emotional States. In *The International Conference on New Trends in Computing Sciences* (pp. 50–54). Amman, Jordan. , https://bit.ly/basnet2017stastical

[6] Fattah, S. A., Rahman, M., Mustakin, N., **Islam**, **M. T.**, Khan, A. I., & Shahnaz, C. (2017). Wrist-Card: PPG Sensor based Wrist Wearable Unit for Low-Cost Personalized Cardio Healthcare System. In *IEEE Global Humanitarian Technology Conference* (pp. 1–7). San Jose, CA. , https://bit.ly/fattah2017wrist

[7] Hossain, M. M., Dipu, N. F., Islam, M. S., **Islam**, **M. T.**, Fattah, S. A., & Shahnaz, C. (2017). Design of a Low Cost Anti-Theft Sensor for Motorcycle Security Device. In *IEEE Region 10 Humanitarian Technology Conference* (pp. 778–783). Dhaka, Bangladesh. , https://bit.ly/hossain2017motor

[8] Nahian, M. A., Iftekhar, A., **Islam**, **M. T.**, Rahman, S., & Hatzinakos, D. (2017). CNN-Based Prediction of Frame-Level Shot Importance for Video Summarization. In *The International Conference on New Trends in Computing Sciences* (pp. 24–29). Amman, Jordan. , https://bit.ly/nahian2017CNN

[9] Ahamed, S. T. & **Islam**, **M. T.** (2016). An Efficient Method for Heart Rate Monitoring Using Wrist-type Photoplethysmographic Signals during Intensive Physical Exercise. In *Int. Conf. on Informatics, Electronics and Vision* (pp. 863–868). IEEE. Dhaka,Bangladesh. , https://bit.ly/ahmed2016ppg

## Workshops

[1] **Islam**, **M. T.** & Fleischer, J. W. (2022). *Manifold-aligned Neighbor Embedding*. 2022 ICLR Workshop on Geometrical and Topological Representation Learning. , https://bit.ly/islam2022manifold

### Posters and Presentations/Congress

[1] **Islam**, **M. T.**, Aarav, S., Wadood, S. A., & Fleischer, J. W. (2023). *Super-resolution using Gradient Descent*. Computational Optical Sensing and Imaging.

[2] Fleischer, J. W. & **Islam**, **M. T.** (2020). *Identifying and Phenotyping COVID-19 Patients using Machine Learning on Chest X-rays*. European Respiratory J., 56 (suppl 64), Eur. Respiratory Soc. , https://bit.ly/fleischer2020identifying

## In News

2020 **AI tool gives doctors a new look at the lungs in treating COVID-19**, ECE, Princeton. https://ece.princeton.edu/news/ai-tool-gives-doctors-new-look-lungs-treating-covid-19

**AI Can Pinpoint COVID-19 From Chest X-Rays**, https://www.medscape.com/viewarticle/937160

## Reviewer Experience

**IEEE Transactions on Medical Imaging**, IEEE

**Medical Image Analysis**, Elsevier

**Biomedical Signal Processing and Control**, Elsevier

**Topology, Algebra, and Geometry in Machine Learning, 2022**, Workshop at ICML 2022

**2023 Topological, Algebraic, and Geometric Pattern Recognition with Applications Workshop**, at CVPR 2023

**IEEE Access**, IEEE

**Smart Health**, Elsevier

**Circuits, Systems and Signal Processing**, Springer

**International Journal of Intelligent Robotics and Applications**, Springer

## Honors and Achievements

**The William G. Bowen Merit Fellowship**, for the 2018-19 academic year at Princeton University

**Dean's List Scholarship**, In all levels of undergraduate studies at BUET

**University Merit Scholarship**, In all terms of undergraduate studies at BUET

**Best Educational Impact, IEEE International Future Energy Challenge 2015**, by IEEE Power and Energy Society

**5th, IEEE Signal Processing Cup 2015**, 5th among ∼50 Teams, ICASSP-2015

**Champion, International Robotics Challenge 2013-14**, National Round, Dhaka, Bangladesh

**Champion, Esonance 2015**, MATLAB Challenge, Islamic University of Technology, Bangladesh

## Synergistic Activities

2018 **Founding Member and Secretary**, IEEE Signal Processing Society Bangladesh Chapter

**Secretary**, IEEE EMBS Bangladesh Chapter

2017 **Organizing Committee Member**, 2017 2nd IEEE International Conference on Telecommunications and Photonics (ICTP), Dhaka, Bangladesh

**Co-Supervisor and Judge**, EEE Day 2017 Robo War, BUET, Dhaka, Bangladesh

**Speaker, Training on Artificial Intelligence for Beginners**, at Satyen Bose Science Club, BUET, Dhaka, Bangladesh

2016 **Technical Committee Member**, 2016 9th International Conference on Electrical and Computer Engineering (ICECE), Dhaka, Bangladesh

**Organizer and Question Setter**, EEE Day 2016 MATLAB Contest, BUET, Dhaka, Bangladesh

2015 **Organizer of Workshop**, Robot Tutor-1, IEEE BUET Student Branch, Dhaka, Bangladesh

**Webmaster**, The Executive Committee of 2015, IEEE BUET Student Branch

## Membership and Affiliation

2015 – Present Institute of Electrical and Electronics Engineers (IEEE)

IEEE Signal Processing Society