

Md Billal Hossain

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HIGHLIGHTS

- 5 years of active research experience on **advanced signal processing, machine learning, deep learning, optimization, and statistical analysis.**
- **115+ citations since 2019**, 15+ publications in top biomedical and signal processing journals/conferences, 2+ years of experience as reviewer in top biomedical and signal processing journals and conferences.

EDUCATION

Doctor of Philosophy (Ph.D.) – Biomedical Engineering, **University of Connecticut.** CGPA: **4.00** **May 2023 (Exp)**

Master of Science (M.Sc.) – Electrical Engineering, **University of Connecticut.** CGPA: **3.92** **Dec 2022**

Bachelor of Science (B.Sc.) – Electrical & Electronic Engineering, **Bangladesh Univ of Engineering & Technology** **Mar 2016**

Relevant Courses: Convex Optimization, Introduction to Optimization, Neural Network in Classification and Optimization, Machine Learning, Estimation Theory and Navigation Algorithm, Applied Probability and Stochastic Process, Introduction to Applied Statistics, Digital Signal Processing, Digital Speech Processing, Introduction to System Theory, Digital Communication, Control Systems, VLSI Design I, Linear Algebra, Probability and Statistics, Microprocessor.

SKILL SUMMARY

- **Languages:** Python, R, C++, C, MATLAB **Framework:** Pytorch, Scikit-learn, TensorFlow, Matplotlib, Seaborn, scipy **Tools:** GIT, SQL, LaTeX, Powerpoint, Excel, Jupyter Notebook, RStudio, **Soft Skills:** Leadership, Event Management, Writing, Public Speaking, Time Management

PROFESSIONAL EXPERIENCE

Graduate Research Assistant- Dept. of Biomedical Engineering, University of Connecticut **Jan 2019 - Present**

- Deigned experimental protocol, obtained IRB approval, collected and analyzed the data, and synthesized the results and prepared manuscripts on the results.

Graduate Teaching Assistant- Dept. of Electrical Engineering, University of Texas at Arlington **Aug 2018 – Dec 2018**

- Conducted after class Engaging sessions with students from continuous and discrete signals and systems course, prepared class material and performed evaluation and provided feedback.

Lecturer - Dept. of Electrical and Electronic Engineering, Daffodil International University **May 2016 – July 2018**

- Conducted courses such as C programming language, Digital Signal Processing, Communication Engineering, Control System, Signals and Systems, Random Signals and Processes.

NOTABLE PROJECTS AND PUBLICATIONS

- **Scottcare's FDA Validation Project:** Worked as a contractual researcher for obtaining FDA's approval for the Arrio device developed by Scottcare, a popular company developing cardiovascular patient monitoring solutions. This project required adjudication of ECG data, debugging and modifying C, C++, and C Sharp programs developed for the real-time cardiac arrhythmia detection, performing validation on standard dataset, writing report following AAMI standard for the FDA.
- **Automatic Detection and Removal of Motion Artifacts (MA) from Electrodermal Activity:** Obtained 95% detection accuracy of MA detection using **gradient boosting classifier** in conjunction with advanced signal processing and statistical features. Developed a **deep convolutional autoencoder** for reconstructing clean EDA signal from MA-corrupted data with a RMSE significantly lower than previous methods. Tech: Python, Pytorch, Scikit-learn, Matlab
- **Location Forensics Using Electrical Network Frequency (ENF):** Determined Location of recording of an audio signal using power signature inherent in the audio clips. **The model achieved 95% detection accuracy and won the championship IEEE signal processing cup 2016, ICASSP 2016, Shanghai, China.** Tech: Matlab, libSVM
- **Cognitive Performance Analysis Using Bio signal:** Using **Support Vector machine (SVM)** and statistical and spectral features of heart rate variability (HRV), obtained 80% accuracy in predicting cognitive performance impairment under hyperbaric gas condition. Tech: Python, Scikit-learn, Matlab.
- **Accurate Signal Modeling Using Autoregressive Moving Average (ARMA) Model:** Artificial Neural Network and Deep Neural Network obtained ARMA model model order with higher accuracy compared to statistical methods. Tech: Python, Pytorch, Matlab
- **Atrial Fibrillation (AF) Detection Using Electrocardiogram (ECG):** Developed highly accurate (96%) automatic algorithm to detect AF in critically ill ICU patient with sepsis. **Developed 99.85% accurate algorithm for automatic QRS complex and P-wave detection.** Tech: Matlab

HONORS and AWARDS

Doctoral Student Travel Award, Graduate School, UConn, 2022

Predoctoral Fellowship, Dept. of BME, UConn, 2020, 2021, 2022

IEEE Signal Processing Cup (Champion), Signal Processing Society, IEEE, 2016

Journal Articles

- **Md-Billal Hossain**, Hugo F. Posada-Quintero, Youngsun Kong, Riley McNaboe, Ki H. Chon, Automatic motion artifact detection in electrodermal activity data using machine learning, *Biomedical Signal Processing and Control*, Volume 74, 2022, 103483, ISSN 1746-8094, <https://doi.org/10.1016/j.bspc.2022.103483>.
- **Md Billal Hossain**, Hugo F. Posada-Quintero, John J. Freiberger, Ki H. Chon, "Cognitive Performance Assessment using Heart Rate Variability during Gas-Narcosis.", under preparation.
- **Md Billal Hossain**, Syed Khairul Bashar, Jesus Lazaro, Natasa Reljin, Yeonsik Noh, Ki Chon, "A Robust ECG Denoising Technique Using the Variable Frequency Complex Demodulation", *Computer Methods and Programs in Biomedicine*, DOI: 10.1016/j.cmpb.2020.105856.
- **Md Billal Hossain**, Hugo F. Posada-Quintero, Ki H. Chon, "A Deep Convolutional Autoencoder for Automatic Motion Artifact Removal in Electrodermal Activity. Submitted to IEEE TBME.
- **Md Billal Hossain**, Hugo F. Posada-Quintero, Youngsun Kong, Ki H. Chon, "Comparison of Electrodermal Activity from Multiple Body Locations Based on Standard EDA Indices' Quality and Robustness against Motion Artifact", *Sensors* **2022**, 22(9), 3177; <https://doi.org/10.3390/s22093177>
- **Md Billal Hossain**, Syed Khairul Bashar, Allan J. Walkey, David D. McManus, Ki H. Chon, "An Accurate QRS Complex and P Wave Detection in ECG Signals Using Complete Ensemble Empirical Mode Decomposition with Adaptive Noise Approach." *IEEE Access*. DOI: 10.1109/ACCESS.2019.2939943.
- **Md Billal Hossain**, Jihye Moon, Ki Chon, "Estimation of ARMA Model Order via Artificial Neural Network for Modeling Physiological Systems", *IEEE Access*, DOI: 10.1109/ACCESS.2020.3029756
- Jesus Lazaro, Natasa Reljin, **Md Billal Hossain**, Yeon Sik Noh, Pablu Leguna, Ki H. Chon, "Wearable Armband Device for Daily Life Electrocardiogram Monitoring." *IEEE Transactions on Biomedical Engineering* PP(99):1-1, DOI: 10.1109/TBME.2020.2987759
- Syed Khairul Bashar, **Md Billal Hossain**, Eric Ding, Allan J. Walkey, David D. McManus and Ki H. Chon "Atrial Fibrillation Detection during Sepsis: Study on MIMIC III ICU Data." *IEEE Journal of Biomedical and Health Informatics*, DOI: 10.1109/JBHI.2020.2995139
- Natasa Reljin, Jesus Lazaro, **Md Billal Hossain**, Yeon Sik Noh, Chae Ho Cho, Ki H. Chon, "Using the Redundant Convolutional Encoder-Decoder to Denoise QRS Complexes in ECG Signals Recorded with an Armband Wearable Device" *Sensors*, DOI: 10.3390/s20164611
- Allan J Walkey, Syed K. Bashar, **Md Billal Hossain**, Eric Ding, Daniella Albuquerque, Michael Winter, Ki H. Chon, David D. McManus, "Development and validation of an automated algorithm to detect atrial fibrillation within stored intensive care unit continuous electrocardiographic data: An observational study", *JMIR Cardio*, DOI: 10.2196/18840
- Syed K. Bashar, **Md Billal Hossain**, Jesus Lazaro, Eric Y. Ding, Yeonsik Noh, Chae Ho Cho, David D. McManus, imothy P.Fitzgibbons, Ki H. Chon, "Feasibility of Atrial Fibrillation Detection from a Novel Wearable Armband Device", *Cardiovascular Digital Health Journal*, DOI: <https://doi.org/10.1016/j.cvdhj.2021.05.004>
- Jihye Moon, **Md Billal Hossain**, Ki Chon, "AR and ARMA Order Selection for Time-Series Modeling with ImageNet Classification", *Signal Processing*, DOI: 10.1016/j.sigpro.2021.108026.

Conference Proceeding

- **Md Billal Hossain**, Hugo F. Posada-Quintero, Ki Chon, "A Deep Convolutional Autoencoder for Automatic Motion Artifact Removal in Electrodermal Activity Signals: Preliminary Results", 2021 44th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC).
- **Md Billal Hossain**, Hugo F. Posada-Quintero, Youngsun Kong, Riley McNaboe, Ki Chon, "A Preliminary Study on Automatic Motion Artifacts Detection in Electrodermal Activity Data Using Machine*", 2021 43rd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC).
- Riley McNaboe*, **Md Billal Hossain**, Youngsun Kong, Ki Chon, Hugo F.Posada-Quintero, "Validation of Spectral Indices of Electrodermal Activity with a Wearable Device", 43rd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC).
- **Md Billal Hossain**, Jesus Lazaro, Yeo Sik Noh, Ki Chon, "Denoising Wearable Armband ECG Data Using the Variable Frequency Complex Demodulation Technique", 2020 42nd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC). DOI: 10.1109/EMBC44109.2020.9175665
- S.S. Chowdhury, **MB Hossain**, S.M.A. Uddin, "Inversion of symmetric matrices using unsymmetrical fault analysis." *International Conference on Electrical, Computer and Communication Engineering (ECCE) 2017*.DOI: 10.1109/ECACE.2017.7912984