Fabiha Bushra

Dhaka, Bangladesh
Google Scholar | Website | Github
Email: fabiha.bushra278@gmail.com

Research Interests: AI Robotics, Deep Reinforcement Learning, Human-Robot Interaction, Computer Vision, Natural Language Processing

EDUCATION

Bachelor of Science in Electrical and Electronic Engineering *Dhaka, Bangladesh*
University of Dhaka *2022*

- **Cumulative CGPA:** 3.50/4.00

PUBLICATIONS

- **Bushra, F.**, Chowdhury, M. E. H., Sarmun, R., Kabir, S., Said, M., Zoghoul, S. B., Mushtak, A., Al-Hashimi, I., Alqahtani, A., Hasan, A., 2024. Deep learning in computed tomography pulmonary angiography imaging: a dual-pronged approach for pulmonary embolism detection. *Expert Systems With Applications, 245,* p.123029.

- [Under Review] Baray, S. B., Chowdhury M. E. H., Sarmun, R., Prithula, J., **Bushra, F.**, Islam, M. S., Khandakar, A., Khan M. M., Sayem F. R., Sumon, M. S. I., Mushtak, A., Alqahtani, A., Hasan, A., 2023. Atherosclerosis Diagnosis from Magnetic Resonance Images: An Empirical Approach to Automate Carotid Vessel Wall Segmentation and Feature-Based Prediction. *Biomedical Signal Processing & Control.*

- [Under Review] Saha, P., Majid, M. E., Nashbat, M., Hasan-Zia, M., Kashem, S. B. A., Khandakar, A., Ashraf, A., Kunju, A. K. A., **Bushra, F.**, Sarmun, R., Hossen, M. M., Chowdhury M. E. H., 2023. UAVNet: A Novel Network for Waste Localization and Classification using Images from Unmanned Aerial Vehicles. *Journal of Material Cycles and Waste Management.*

RESEARCH EXPERIENCE

Multimodal Semantic Segmentation with Hybrid CNN-Transformer Encoder *2023*
Continuing Research, In collaboration with Dr. Muhammad E. H. Chowdhury, Funded by Qatar University

- In this study, the **U-net** architecture was utilized as baseline for segmenting multimodal brain tumor MRI images. Our research direction focuses on the integration of transformer with CNN in the encoder design.

- The transformer was utilized to encode tokenized image patches from CNN feature maps to capture **long-range contextual information**, while the decoder was designed to integrate upsampled features with CNN feature maps for leveraging low-level details.

- To enhance the model learn from different hierarchical levels, a feature fusion technique was implemented to integrate outputs from the decoder stages.

Classifier-guided Detection using Deep Learning *2023*
In collaboration with Dr. Muhammad E. H. Chowdhury, Funded by Qatar University

- For the classifier, a deep learning-based approach was proposed that leveraged **local context** alongside global information by utilizing an **attention mechanism** for Pulmonary Embolism diagnosis. This framework emulated the attention of a human expert.

- The attention-based classifier demonstrated major improvements over baseline models **improving AUROC by 8.1%**.

- For the detection framework, *EfficientDet*, *Faster R-CNN*, and *YOLO* models were employed to localize PE. The mAP was further **improved by a 4.7%** increase through the implementation of model ensembling.

- Utilizing the classifier's probabilistic inference, the detection outcomes were refined based on adaptive confidence thresholds. This approach optimized precision by mitigating the false positives associated with the detection framework's high sensitivity. **Published in ESWA. DOI:** [10.1016/j.eswa.2023.123029]

Detection of Supermarket Products for a Batch-Billing Infrastructure *2022*
Senior Thesis

- A Computer Vision-based billing system was proposed to reduce congestion at the supermarket's cash register. A two-tiered approach, combining deep learning-based **object detection** with deterministic **pattern recognition**, was implemented.

- Standard pre-packaged goods were immediately detected and billed at fixed prices, while weight-based products underwent a two-phase processing: initial detection by *YOLO* followed by hybrid ArUco marker decoding step for dynamic price calculation.

- The detection models, trained on our custom-made dataset sourced through web scraping, were optimized with synthetic image augmentation, genetic algorithm-based hyperparameter evolution, and ensembling methods. PyQt5 was used to create a GUI-based interface for the billing system.
   Github Repository: github.com/fabihabushra/Computer_vision_based_check_out_system

Datasoft Manufacturing & Assembly Inc. Limited - DMA *2021*
IoT Engineer, Research and Development Department

- **Telemedicine Project:** Developed the prototype of an **IoT-enabled** Blood Pressure Monitor that interfaces with a telemedicine platform, allowing for remote patient health monitoring by physicians during the COVID-19 pandemic.

- **Pisciculture Project:** Worked on developing an **IoT infrastructure** to continuously monitor and report aquaculture pond parameters, facilitating real-time data-driven decisions for pond management and worker notification.

Fabrication Laboratory, University of Dhaka (FAB LAB DU) *2018-19*
Undergraduate Research Assistant

- **Pet Robot:** Collaborated with a senior student. My contribution was on designing the manipulator end effector and developing the **robot locomotion** system.

- **Bipedal Robot:** Collaborated with a senior student. My contribution was in developing the CAD model and simulation of a bipedal robot.

INDEPENDENT PROJECTS

Object Pick-and-Place Robot *2019*
Pre-programmed Robot

- A pick-and-place robot was developed capable of detecting the color of the cube passing over a conveyor belt using a color sensor. The manipulator was finely tuned for **sensorimotor coordination**, allowing for object sorting by color.

AVR-Microcontroller Based Obstacle Avoiding and Line Follower Robot *2017-18*
Pre-programmed Robot

- Developed an AVR-Microcontroller based robot capable of following a black line on white ground (or inverted colors) and avoiding obstacles in its path.

- The primary circuit board and IR sensor module of the robot were simulated and custom-designed using Proteus and the CAD model of the robot was developed on SOLIDWORKS.

Teleoperated Robot *2018*
Pre-programmed Robot

- A remote-controlled robot was developed for the Robo Soccer contest, incorporating a WiFi module for wireless communication. The robot's control mechanism was developed with a dual-axis locomotion system, integrating **sensorimotor synchronization** for real-time maneuvering.

Maze Solver Robot *2018*
Pre-programmed Robot

- Implemented the recursive backtracking algorithm on a line-following robot to solve mazes. The algorithm enabled the robot to navigate mazes while incorporating **sensorimotor feedback** for decision-making processes.

Research Grants

High Impact Grant (HIG)# QUHI-CENG-22/23-548   *2023*
Qatar University

○ The grant supports my research on the development of deep learning-based algorithms for the segmentation of brain tumors in medical images with the objective of enhanced treatment planning.

High Impact Grant (HIG)# QUHI-CENG-23/24-216   *2023*
Qatar University

○ The grant was conferred for my research on the development of innovative AI algorithms aimed at enhancing the diagnosis of Pulmonary Embolism through medical image analysis.

Relevant Academic Coursework

Intelligent System	Linear Algebra	Statistics and Probability
Differential and Integral Calculus	Vector Analysis	Computer Programming
Control System	Signals and Systems	Numerical Technique Lab

Online Coursework

Coursera	Institution
Unsupervised Learning, Recommenders, Reinforcement Learning	Stanford University & DeepLearning.AI
DeepLearning.AI TensorFlow Developer Specialization	DeepLearning.AI
Introduction to TensorFlow for Artificial Intelligence, Machine Learning, and Deep Learning	DeepLearning.AI
Convolutional Neural Networks in TensorFlow	DeepLearning.AI
Natural Language Processing in TensorFlow	DeepLearning.AI
Sequences, Time Series and Prediction	DeepLearning.AI

Mentorship & Volunteering Experience

IEEE Student Branch University of Dhaka (IEEE SB DU)   *2018-19*
Executive Member

○ Co-led the "Workshop and Hands-on Training on Microcontrollers", Apr 2018.

○ As an executive member, I was actively involved in organizing workshops, seminars, and talks hosted by IEEE SB DU in more than 10 events throughout my tenure.

Fabrication Laboratory, University of Dhaka (FAB LAB DU)   *2018-19*
Undergraduate Research Assistant

○ Served in the organizing committee of Fab Fest 2018, Nov 2018.

○ Formulated and conducted a foundational training workshop on SOLIDWORKS and fabrication tools, Sep 2018.

Skills

Programming Languages   Python, C/C++, MATLAB, LaTeX, Assembly Language
Libraries & Frameworks   PyTorch, TensorFlow, Keras, scikit-learn, OpenCV, NumPy, pandas, Matplotlib
Software & Tools   Git, SOLIDWORKS, Proteus, Arduino, AVR Microcontrollers
Webs & Databases   HTML/CSS, MySQL, Django

HONORS & AWARDS

2019

- Finalist, LFR Challenge, Techsurgence, Bangladesh University of Professionals (BUP)

- Participant, Industrial Automation Challenge, ROBO CARNIVAL, Bangladesh University of Engineering and Technology (BUET)

2018

- **Champion**, Robo F1 Contest, Technovation, North South University (NSU)

- **Champion**, Robotics Contest, National Science Carnival, Dhaka Residential Model College (DRMC)

- 2nd Runner Up, Death Race Contest, ROBO FIESTA, Bangladesh University of Engineering and Technology (BUET)

- Finalist, SeeGuider Contest, ROBOLUTION, Military Institute of Science and Technology (MIST)

- Participant, LFR Challenge, Mecceleration, Islamic University of Technology (IUT)

2017

- **Champion**, Robo-Race Contest, DUSS Science Festival, University of Dhaka (DU)

- Finalist, THE FURY ROAD Contest, Robofest, University of Dhaka (DU)

- Finalist, LFR Challenge, Mecceleration, Islamic University of Technology (IUT)

- Participant, PathFinder Contest, ROBO CARNIVAL, Bangladesh University of Engineering and Technology (BUET)

- Participant, Robomania V4.0, ESONANCE, Islamic University of Technology (IUT)

- Participant, Robo soccer Contest, Bit Arena V.2, North South University (NSU)

- Participant, Speed Battle Contest, DUET-TECHFEST, Dhaka University of Engineering & Technology (DUET)

- Participant, Poster Presentation, ROBOLUTION, Military Institute of Science and Technology (MIST)

- Participant, Bangladesh Electronics Olympiad, University of Dhaka (DU)

All my certificates can be found attached here in my portfolio.