# Fabiha Bushra

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**Research Interests:** AI Robotics, Deep Reinforcement Learning, Computer Vision

## Education

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

- **Cumulative CGPA:** 3.50/4.00
- **Major:** Computer

## Research Experience

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

- For the classification framework, a deep learning-based approach was proposed that leverages **local context** by utilizing an **attention mechanism** for improved diagnosis of Pulmonary Embolism (PE). This framework emulates the attention of a human expert by considering both global appearances and local lesion regions before forming a conclusive decision.
- Demonstrated major improvements over baseline models by incorporating the attention method on the classification framework; **improving AUROC by 8.1%** on a publicly available CTA dataset of PE.
- 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.
- To mitigate the false positives associated with the detection framework's high sensitivity, a post-processing step was employed utilizing the classifier's probabilistic inference to direct the detection outcomes. This approach adeptly optimized the precision-recall trade-off, fine-tuning detection performance based on adaptive confidence thresholds.
- The research is submitted for publication in a reputable journal.

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

- A computer vision based billing infrastructure based on the **YOLO** architecture was implemented with the goal of reducing retail billing time in supermarkets.
- The system utilizes the **PyTorch** Framework and **OpenCV** library to detect supermarket products. Multiple products can be detected and billed simultaneously in real time. The Yolov5 models were trained on our **own dataset** of 3056 images of 26 distinct products using a **transfer learning** approach. The performance of the model was further improved by **augmenting with synthetic images**, **hyperparameter evolution** and **ensembling technique**. An **ArUco Marker** based system was also incorporated in order to bill items with weight-based pricing. The **PyQt5** framework was used to create a GUI-based interface for user convenience.
  **Github Repository:** github.com/fabihabushra/Computer_vision_based_check_out_system

**Datasoft Manufacturing & Assembly Inc. Limited - DMA** *April 2021- Dec 2021*
Engineer Part-time, Research and Development Department

- **Telemedicine Project:** Developed the prototype of an IoT-based Blood Pressure Monitor and integrated it to the telemedicine platform for real-time monitoring. The project was developed in response to the COVID-19 pandemic to enable doctors to virtually monitor patient's health-data using distance technology.
- **Pisciculture Project:** Worked on developing an IoT-based infrastructure to monitor and analyze the water parameters of pond for ensuring optimum health of the fishes.

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

- **Pet Robot:** Developed the CAD model for robot locomotion and manipulation using **SOLIDWORKS** for a senior student's project. The manipulator end effector was designed in conjunction with the base chassis to enable the pet robot fetch a ball.
- **Bipedal Robot:** Developed the CAD model of a bipedal robot for a senior student's project.
- Instructed freshmen students for basic training of operation of fabrication tools

## Projects

**AVR-Microcontroller Based Obstacle Avoiding and Line Follower Robot** *2018*
Personal Project

- An **AVR-Microcontroller (Atmega32A)** based robot that can follow a line on a surface and avoid obstacles in its path. The primary circuit board and IR sensor module of the robot was custom designed using **Proteus** and the CAD model was developed on **SOLIDWORKS** which was further built by laser cutting. It was programmed using **C**.

**Object Pick-and-Place Robot** *2018*
Personal Project

- A robot that can detect the color of the cube passing through a conveyor belt using the **TCS3200** sensor. The manipulator was calibrated to pick and place the cubes in the corresponding colored zones. The system was programmed using the **Arduino IDE** platform.

**Teleoperated Robot** *2018*
Personal Project

- **Robo Soccer:** A remote-controlled robot was developed for the Robo Soccer Contest. The remote was custom-made using a WiFi module **(NRF24L01)** and two dual-axis joysticks **(KY-023)**. The teleoperation system was programmed in **Arduino**.

**Maze Solver Robot** *2018*
Personal Project

- The **recursive backtracking algorithm** was deployed on a line follower robot considering the order of left-forward-right directions to solve a line maze.

## Relevant Coursework

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| Intelligent System | Linear Algebra | Statistics and Probability |
| Differential and Integral Calculus | Control System | Signals and Systems |

## Certifications

| **Coursera Platform** | **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** *Session: 2018-2019*
Graphic Designer, Executive Member

- As an executive member, the key responsibilities included formulating workshop training, seminars and talks.
- As a graphic designer, created contents for the educational events with an attempt to inspire students for active participation and growing their interests.

## Relevant Skills

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|---|---|
| **Programming Languages** | Python, C, C++, MATLAB, Arduino, MySQL |
| **Software & Tools** | PyTorch, Tensorflow, SOLIDWORKS, Proteus (Circuit Simulation and Prototyping, PCB Design) |
| **Development Boards** | NodeMCU - ESP32,ESP8266; AVR MCU - ATmega328, ATmega328P, ATmega2560 |

## Honors & Awards

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|---|---|---|
| 2022 | Participant, ADS Class, 2022 FORMULA STUDENT ARTIFICIAL INTELLIGENCE (FS-AI), IMechE | *Northamptonshire, UK* |
| 2019 | Finalist, LFR Challenge, Techsurgence 2019, Bangladesh University of Professionals | *Dhaka, Bangladesh* |
| 2019 | Participant, Industrial Automation Challenge, ROBO CARNIVAL 2019, ECE Building, BUET | *Dhaka, Bangladesh* |
| 2018 | Participant, LFR Challenge, Mecceleration 2018, Islamic University of Technology | *Gazipur, Bangladesh* |
| 2018 | 2nd Runner Up, Death Race Contest, ROBO FIESTA, ECE Building, BUET | *Dhaka, Bangladesh* |
| 2018 | Finalist, SeeGuider Contest, ROBOLUTION-2018, MIST | *Dhaka, Bangladesh* |
| 2018 | Champion, Robo F1 Contest, Technovation 2018, North South University | *Dhaka, Bangladesh* |
| 2018 | Champion, Robotics Contest, 11th National Science Carnival-2018, DRMC | *Dhaka, Bangladesh* |
| 2018 | Finalist, ROBORACE Contest, Engenius'18, Ahsanullah University of Science and Technology | *Dhaka, Bangladesh* |
| 2017 | Participant, PathFinder Contest, ROBO CARNIVAL 2017, ECE Building, BUET | *Dhaka, Bangladesh* |
| 2017 | Finalist, LFR Challenge, Mecceleration 2017, Islamic University of Technology | *Gazipur, Bangladesh* |
| 2017 | Participant , Robomania V4.0, ESONANCE 2017, Islamic University of Technology | *Gazipur, Bangladesh* |
| 2017 | Finalist, THE FURY ROAD Contest, Robofest 2017, University of Dhaka | *Dhaka, Bangladesh* |
| 2017 | Participant, Robo soccer/Robo wrestling Contest, Bit Arena V.2 2017, North South University | *Dhaka, Bangladesh* |
| 2017 | Champion, Robo-Race Contest, DUSS Science Festival 2017, TSC, University of Dhaka | *Dhaka, Bangladesh* |
| 2017 | Participant, Speed Battle Contest, DUET-TECHFEST-2K17, DUET | *Dhaka, Bangladesh* |
| 2017 | Participant, Poster Presentation, ROBOLUTION - 2017, MIST | *Dhaka, Bangladesh* |
| 2017 | Participant, 2nd Bangladesh Electronics Olympiad 2017, University of Dhaka | *Dhaka, Bangladesh* |