

Fabiha Bushra

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

EDUCATION

Bachelor of Science in Electrical and Electronic Engineering
University of Dhaka

Dhaka, Bangladesh

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

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

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

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

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