MD FOKHRUL ISLAM

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Education

University of Dhaka *Dhaka, Bangladesh*
Bachelor of Science in Robotics and Mechatronics Engineering *Jan, 2017 - Nov, 2021*
CGPA: 3.45 out of 4.0 | **Last three semesters: 3.74/4.0**

Master of Science in Robotics and Mechatronics Engineering *Feb, 2022 - July, 2023*
CGPA: 3.79 out of 4.0

Publications

1. Swakshar Deb*, **Md Fokhrul Islam***, Shafin Rahman, Sejuti Rahman, "Graph Convolutional Networks for Assessment of Physical Rehabilitation Exercises," in *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. 30, pp. 410-419, 2022. (* denotes equal contribution) [paper], [code]. Also appeared in the Proceedings of WiCV Workshop of IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2022, New Orleans, LA, USA. [poster].
2. Sejuti Rahman, Sujan Sarker, A. K. M. Nadimul Haque, Monisha Mushtary Uttsha, **Md Fokhrul Islam**, Swakshar Deb, "AI-Driven Stroke Rehabilitation Systems and Assessment: A Systematic Review," in *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. 31, pp. 192-207, 2023. [paper].
3. Mohammad Tareq, **Md Fokhrul Islam**, Swakshar Deb, Sejuti Rahman, Abdullah Al Mahmud, "Data-Augmentation for Bangla-English Code-Mixed Sentiment Analysis: Enhancing Cross Linguistic Contextual Understanding," in *IEEE Access*, vol. 11, pp. 51657-51671, 2023. [paper], [code].
4. Md Tahmeed Abdullah, Sejuti Rahman, Shafin Rahman, **Md Fokhrul Islam**, "VAE-GAN3D: Leveraging Image-Based Semantics for 3D Zero-Shot Recognition," Accepted at *Image and Vision Computing* Journal, Volume 147, 105049, 2024. [paper].
5. **Md Fokhrul Islam**, Sejuti Rahman, Shafin Rahman, "ReKon3D: Relation-Knowledge Aware Multi-Modal Embedding and Contrastive GAN for Zero-Shot 3D Recognition" (Under review; NEUCOM-D-24-07366). [preprint].

Technical Skills

Languages: Python, C/C++, Matlab (e.g., Simulink)

Frameworks: PyTorch, Tensorflow, Keras, Scikit-learn, Opencv, HuggingFace, etc.

Others: ROS, Linux, Git, AWS, Docker, LaTeX, Arduino/ESP, Raspberry pi, etc

Ongoing Research Project

- **An Instrumental approach for monitoring physical exercise in a visual scenario: A step-forward to home-based exercise monitoring of stroke patient** *Sept, 2023 - Ongoing*
  Resources: [data collection and annotation guideline], [code and setup], [proposal], [demo exercises]
  - ◇ Collected large-scale datasets from both patients and healthy subjects across different categories (e.g., muscle power, disease types), and collaborate with doctors to design exercise selections and experimental protocols using more medically accepted approaches. Analyzed the collected data for validation, format and store it for future release to researchers.

Research Experience

- **An Intelligent Agent for Evaluating and Guiding the Post-Stroke Rehabilitation Exercises (Undergraduate thesis)** *March, 2020 - Dec, 2021*
  Resources: [undergrad thesis book], [paper], [review paper], [code], [poster], [demo]
  - ◇ Presented a novel spatio-temporal graph convolution framework designed for rehab. exercises.
  - ◇ Introduced a guidance system featuring self-attention mechanisms to efficiently direct patients' attention toward the most informative joints during rehabilitation exercises.
- **IHABOT: Intelligent Hospital Assistance Robot to Fight Contagion by Reducing Doctor-Patient Interaction** *June, 2022 - Oct , 2022*
  Resources: [report], [demo], [media coverage (in Bengali)]
  - ◇ Designed and engineered an autonomous hospital assistance robot with advanced autonomous navigation, mapping capabilities, and proficiency in real-world navigation.
  - ◇ Integrated a diverse array of sensors to acquire and analyze patients' physiological data, as well as evaluate their physical exercises.
- **Relation and Knowledge Aware Zero Shot Learning in 3D Object Recognition (Master's thesis)** *May, 2022 - July, 2023*
  Resources: [masters thesis book], [preprint]
  - ◇ Developed a novel framework for class embedding learning that integrates knowledge base text and 2D visual information using GCN and co-attention mechanisms. Introduced an novel Generalized Zero-Shot Learning (GZSL) framework incorporating embedding and feature generation models, enhanced by a contrastive module for instance-level supervision.
  - ◇ Significantly improved performance, achieving an average 19.22% increase in the average harmonic mean and a 21.4% enhancement in unseen accuracy on ModelNet10 and ScanobjectNN datasets.
- **Artificial Intelligence in Business Decision Making: A Study on Code-Mixed and Translit-erated Bangla Customer Reviews** *Feb, 2022 - May, 2022*
  Resources: [paper], [report], [code]
  - ◇ Proposed a novel data augmentation technique for enhancing cross-lingual contextual understanding, obviating the need for a parallel corpus.
  - ◇ Collected and annotated a gold standard dataset, achieving substantial performance improvements over established word embedding methods on the same dataset.
- **Learning to Trade with Deep Q Learning** *Oct, 2019 - Jan, 2020*
  Resources: [report], [code]
  - ◇ Developed a Reinforcement Learning model for stock trading using Deep DQN algorithm.
  - ◇ Improved model performance by integrating trend analysis and sentiment information with NLP.

Work Experience

Advanced Chemical Industries (ACI) Limited *Tejgaon Industrial Area, Dhaka, Bangladesh*
Machine Learning Engineer *Jan, 2024 - Present*

Key Projects:

- Developed and deployed a multi-modal system for crop disease prediction using deep learning, currently serving thousands of ACI Agribusiness field workers [Snapshot of prediction]
- Implemented an OCR framework (trOCR + YOLOv8) to analyze doctors' prescriptions for medicine sales tracking through ACI's FPM app [Demo]
- Leading development of an AI-based surveillance system for detecting suspicious activities in retail shops using action recognition models

Academic Projects

- **Swarm Robots Aggregation (Triangular Pattern Formation)** [report], [demo] *(2022)*
  - ◇ **Summary:** Six swarm robots were deployed to autonomously arrange themselves into a triangular formation, utilizing a variety of attraction-repulsion objective functions. These algorithms were designed to guide the swarm in processing information and precisely coordinating their movements to achieve the desired geometric configuration.
- **Camera Calibration using AprilTag** [report] *(2022)*
  - ◇ **Summary:** Implemented Zhang's camera calibration technique using AprilTag markers to estimate intrinsic camera parameters and determine 3D-to-2D point projections in Matlab.
- **Self Solving Eight Puzzle** [demo] *(2019)*
  - ◇ **Summary:** Designed an AI-based eight puzzle solver using A* search with a mismatched tiles heuristic. Built a physical puzzle model with PVC, automated tile movement using CNC and electromagnets.
- **Hand Gesture Controlled Robot** [presentation] *(2018)*
  - ◇ **Summary:** Designed a robot controlled by hand gestures using an MPU6050 sensor and Bluetooth. Integrated sensor in hand glove for gesture recognition, enabling real-time robot control via wireless communication.
- **Fire Extinguisher Robot** *(2019)*
  - ◇ **Summary:** As part of a lab project, a Fire Extinguisher Robot was built that senses potential fire hazards by detecting gas leakage, high temperature or flames and rushes to the spot to extinguish the fire by spraying water.
- **Classifying Autism on Eye-Tracking Data Using Saliency Maps and Deep learning** *(2019)*
  - ◇ **Summary:** Developed a deep learning model using visual saliency maps to improve autism spectrum disorder classification accuracy through enhanced fixation data analysis.

Teaching & Mentoring

- **Competition Mentor** | Bangladesh National Teams 2021-2024
  - – Led teams to multiple medals in International Robot Olympiad (2021-2023)
  - – Mentored Silver Medal-winning team in International AI Olympiad (2024)
- **Academic Tutor** | Physics, Mathematics & Statistics (High School Level) 2020-2022

Online Certifications

- Attended OxML Summer School 2022 - Health Track [syllabus] [certificate] *Jul, 2022 - Aug, 2022*
  Organizer: AI for Global Goals, CIFAR & University of Oxford's Deep Medicine Program
  Topics covered: statistical / probabilistic Machine Learning (ML), representation learning, graph neural networks and geometrical deep learning, computer vision, knowledge graph as well as other topics related to ML in healthcare.
- Other Online Certificates: (1) Computational Neuroscience (2) Machine Learning (3) Deep Learning Specialization (4) AI for Medical Diagnosis *2019 - 2023*

Scholarships & Awards

- Top 10 in Robi Datathon 3.0 (biggest AI/ML competition in Bangladesh) *2024*
- National Science & Technology (NST) Fellowship for **Excellent Master's Thesis** *2022 - 2023*
- IFIC Bank Trust Fund **Research Grant (Highest & Consecutive 3 times)** *2021, 2022, 2023*
- **Winner in the Research Project Category**, Seminar on "Robotics in Bangladesh: Academia and Industry Initiatives" (for Undergrad's thesis work) *2022*
- **1st Runner-up Poster Presentation** in Dhaka University Research and Publication Fair (for IHABOT project) *2022*
- Bank Asia Higher Education Scholarship *2017 - 2021*
- Islamic Bank (IBBL) Scholarship for Undergrad Studies *2017 - 2021*