

# MD FOKHRUL ISLAM

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## RESEARCH INTEREST

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**AI in healthcare, Biomedical image processing, Graph machine learning, Multimodal commonsense reasoning, Data efficient and uncertainty learning, Generative AI**

## EDUCATION

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### University of Dhaka

Dhaka, Bangladesh

Bachelor of Science in Robotics and Mechatronics Engineering

Jan, 2017 - Nov, 2021

Dissertation: *An Intelligent Agent for Evaluating and Guiding the Post-Stroke Rehabilitation Exercises*

Master of Science in Robotics and Mechatronics Engineering

Feb, 2022 - July, 2023

Thesis: *Relation and Knowledge Aware Zero Shot Learning in 3D Object Recognition*

Advisor: [Dr. Sejuti Rahman](#)

**Some core courses:** Fundamentals of Computing & Programming, Object Oriented Programming, Artificial Intelligence, Pattern Recognition, Digital Image Processing, Digital Signal Processing, Computer Vision, Robot Learning

## PUBLICATIONS

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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). [[paper abstract](#)].

## TECHNICAL SKILLS

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**Languages:** Python, Matlab, C/C++, SQL

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

**Others:** Linux, Git, AWS,  $\text{\LaTeX}$

## WORK EXPERIENCE


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
### ACI Limited

Tejgaon Industrial Area, Dhaka, Bangladesh

Machine Learning Engineer

Jan, 2024 - Present

Projects: *Crop Disease Detection* ([Demo Apps Snap](#) ): Designing a multi-modal system to predict crop diseases or mineral deficiencies using images of crops and situational parameters (e.g., weather, crop age), providing expert guidance on how to prevent them.

*PrescriptionOCR* ([Demo Processes](#) ): Designing a deep learning-based OCR framework (based on trOCR and YOLOv8) to detect doctors' handwriting and understand the medicine recommended for patients, and using this information to analyze the market for medicine sales for our company. More than 5,000 sales representatives are now using this service.

### University of Dhaka

Dhaka, Bangladesh

Research Assistant - *Advisor:* [Dr. Sejuti Rahman](#)

Aug, 2023 - Jan, 2024

Contribution: Collected multi-modal (RGB, Depth and body keypoint) and multi-camera (KinectV2 and Astra Mini sensor) data of stroke patients of Bangladesh and annotated those data by expert physicians. Developing a multi-modal ensemble model to utilize different sensor's data, and designing a **LLM based feedback systems** to guide patients based on their performed exercise.

## RESEARCH EXPERIENCE

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- **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: [\[report\]](#), [\[demo\]](#)

- ◊ 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: [\[masters thesis book\]](#).

- ◊ 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 Transliterated 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.

## ACADEMIC PROJECTS

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- **Swarm Robots Aggregation (Triangular Pattern Formation)**

*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**

*2022*

- ◊ **Summary:** The work is based on the paper “A flexible new technique for camera calibration” by Zhengyou Zhang. We implemented this using Matlab 2021b. This work can estimate the parameters of a lens and image sensor of a video camera to determine a 3D point’s projection onto the image plane using AprilTag placed in real world.

- **Classifying Autism on Eye-Tracking Data Using Saliency Maps and Deep learning**

*2020*

- ◊ **Summary:** We designed a visual saliency based deep learning model for automatic and quantitative ASD/TD classification. Instead of directly extracting features from the fixation data, our method employs several saliency maps in order to capture better information.

## ONLINE CERTIFICATIONS





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- 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](#) 

*2020 - 2023*

## SCHOLARSHIPS & AWARDS

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- 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*

- **1<sup>st</sup> 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*