SWAKSHAR DEB

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RESEARCH INTEREST

My research interests include graph signal processing, graph neural networks, and computer vision for the purpose of developing highly efficient robotic vision systems.

EDUCATION

Masters of Science in Robotics and Mechatronics Engineering *Feb, 2022 – October, 2023*
University of Dhaka *Dhaka, Bangladesh*
Research Area: Graph Wavelet Neural Networks
Advisor: Dr. Sejuti Rahman, Associate Professor & Chairperson, Department of RME, DU
CGPA: 3.82 out of 4.0(Expected), Current Rank 2^{nd} **place**

Bachelor of Science in Robotics and Mechatronics Engineering *Feb, 2017 – Dec, 2021*
University of Dhaka *Dhaka, Bangladesh*
Dissertation: Rehabilitation Exercises Assessment with Graph Neural Networks
Advisor: Dr. Sejuti Rahman, Associate Professor & Chairperson, Department of RME, DU
CGPA: 3.72 out of 4.0, Ranked 5^{th} **place**

PUBLICATIONS & MANUSCRIPTS

1 **Swakshar Deb**, Md Fokhrul Islam, Shafin Rahman, Sejuti Rahman. Graph Convolutional Networks for Assessment of Physical Rehabilitation Exercises. Accepted in *IEEE Transactions on Neural Systems and Rehabilitation Engineering (TNSRE), 2021.* [Paper], [Code], [Video]. 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 **Swakshar Deb**, Shafin Rahman, Sejuti Rahman. GA-GWNN: Generalized Adaptive Graph Wavelet Neural Network. Submitted to *Pattern Recognition Letter (PRL), 2023.*

3 Tahsin Tariq Banna, **Swakshar Deb**, Sejuti Rahman and Shafin Rahman. GEMM: A Graph Embedded Model for Memorability Prediction, Accepted in *International Joint Conference on Neural Networks (IJCNN), 2023,* Queensland, Australia. [Paper], [Code], [Video]

4 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. Accepted in *IEEE Access, 2023.* [Paper], [Code]

5 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. Accepted in *IEEE Transactions on Neural Systems and Rehabilitation Engineering (TNSRE), 2022* [Paper].

RESEARCH EXPERIENCE

Research Assistant *Jan, 2020 – Present*
Graph Machine Learning
Advisor: Dr. Sejuti Rahman, Associate Professor & Chairperson, Department of RME, DU

ONGOING RESEARCH PROJECTS

- **Ma (Mother) Mental Health: Artificial intelligence-Enabled Detection of Perinatal Depression** *Jun, 2023 – Present*
  Keywords: Maternal Depression, Machine Learning, Visual Saliency

Funding: *IDRC Canada*, *AI-SAROSH*
Resources: [Accepted proposal]

- **Image Memorability Prediction** *Jan, 2023 – Present*
  Keywords: Graph Neural Network, Image Segmentation, Visual Saliency
  Funding: *Ministry of Science and Technology, Government of Bangladesh*
  Resources: [Accepted proposal]

OTHER RESEARCH PROJECTS

- **Empowering Graph Wavelet Convolution for Node Classification: A Novel Approach with Local Lifting Scheme** *May, 2022 – July, 2023*
  Resources: [M.Sc thesis], [Paper], [Code].
  - Proposed a highly scaleable, efficient, and novel algorithm to produce desirable class of wavelet filters for the adaptive graph wavelet neural network.
  - Our algorithm evaluated on both homophilic and heterophilic datasets exhibit $\sim 15\%$ improvement over the baseline graph wavelet-based approach - opening up a new frontier for future research.

- **Intelligent Hospital Assistance Robot to Fight Contagion by Reducing Doctor-Patient Interaction** *Feb, 2022 – Jun, 2022*
  Funding: *Centennial Research Grant, University of Dhaka*
  Resources: [Report], [Code], [Video]
  - Developed an autonomous hospital assistance robot, equipped with autonomous features, mapping capabilities, and real-world navigation abilities
  - Integrated diverse sensors to gather and analyze physiological data from patients, including movement of exercise, temperature, blood pressure, oxygen saturation, and pulse rate.

- **Artificial Intelligence in Business Decision Making: A Study on Code-Mixed and Transliterated Bangla Customer Reviews** *Jan, 2022 – May, 2022*
  Funding: *Centre for Advanced Research in Strategic Human Resource Management, University of Dhaka*
  Resources: [Paper], [Code]
  - Proposed a novel class of data augmentation technique to enhance cross-lingual contextual understanding without requiring any parallel corpus.
  - Collected and annotated a gold standard dataset for Bangla-English code-mixed sentiment analysis.

UNDERGRADE RESEARCH PROJECTS

- **An Intelligent Agent for Evaluating and Guiding sthe Post-Stroke Rehabilitation Exercises** *Jan, 2020 – Dec, 2020*
  Funding: *Information and Communication Technology Division, Ministry of Posts, Telecommunications, and Information Technology of the Government of Bangladesh*
  Resources: [B.Sc dissertation], [Paper], [Survey paper], [Code], [Poster], [Video]
  - Proposed a novel spatio-temporal graph convolution based framework over the skeleton graph specifically designed for rehabilitation exercises.
  - Introduced a guidance system with a self-attention mechanism that focuses on the most informative joints to effectively guide the patients.

- **Investment Decision Marking with Reinforcement Learning** *Oct, 2019 – Jan, 2020*
  Funding: *Centre for Advanced Research in Strategic Human Resource Management, University of Dhaka*
  Resources: [Report], [Code]
  - Used past ten consecutive stock price differences, trend prediction with LSTM, newspaper sentiment, and diverse accounting features as states and buy, sell, or hold as the action space.
  - Trained the agent with state-of-the-art deep Q learning algorithms such as Double Deep Q Learning, Q Learning with Prioritized Experience Replay.

SCHOLARSHIPS & AWARDS

- **2023 Dhaka University Student Scholarship** (Awarded for the academic performance)
- **2023 IFIC Bank Scholarship** (Awarded for excellent research potential in the M.Sc. thesis)
- **2022** 1^{st} **runner up** for poster presentation in **Dhaka University Science Fair**
- **2022** 1^{st} **place** for poster presentation in **Robotics in Bangladesh: Academia and Industry Initiative**
- **2021 IFIC Bank Scholarship** (Awarded for the excellent undergraduate project dissertation)
- **Board Merit Scholarship: Government of Bangladesh** (Year: 2007, 2013)

TECHNICAL SKILLS

Languages: Python, C/C++, Latex, Matlab, Markdown, Shell
Frameworks: Pytorch, Tensorflow, Keras, Arduino
Libraries: OpenCV, NLTK, Pandas, NumPy, Matplotlib, Scikit-Learn, Seaborn
Operating System: Windows, Linux

REFERENCE

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