

# SWAKSHAR DEB

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(+880) 1797574820 | [swakshar.sd@gmail.com](mailto:swakshar.sd@gmail.com) |  [personal website](#) |  [google scholar](#) |  [github](#)

## RESEARCH INTEREST

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

## EDUCATION

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**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<sup>nd</sup> 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<sup>th</sup> place**

## PUBLICATIONS & MANUSCRIPTS

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- 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

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**Research Assistant** *Jan, 2020 – Present*

*Graph Machine Learning*

Advisor: [Dr. Sejuti Rahman](#), Associate Professor & Chairperson, Department of RME, DU

## ONGOING RESEARCH PROJECTS

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

Funding: [AI-SAROSH](#), [IDRC Canada](#)

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

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- **Empowering Graph Wavelet Convolution for Node Classification: A Novel Approach with Local Lifting Scheme**

*May, 2022 – July, 2023*

Resources: [\[MSc thesis\]](#), [\[Paper\]](#), [\[Code\]](#).

- 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.

## UNDERGRADUATE RESEARCH PROJECTS

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- **An Intelligent Agent for Evaluating and Guiding the 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: [\[BSc dissertation\]](#), [\[Paper\]](#), [\[Survey paper\]](#), [\[Code\]](#), [\[Poster\]](#), [\[Video\]](#)

- 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

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- **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<sup>st</sup> runner up** for poster presentation in **Dhaka University Science Fair**
- **2022 1<sup>st</sup> 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

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**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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[Dr. Sejuti Rahman](#)

Associate professor & Chairperson, Department of RME, DU

**Mobile:** (+880)1836800864

**Email:** [sejuti.rahman@du.ac.bd](mailto:sejuti.rahman@du.ac.bd)

**Google Scholar:** [Dr. Sejuti Rahman](#)