Mohammed Rakib

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LinkedIn Github Google Scholar

Education

Doctor of Philosophy in Computer Science **August 2023 – Present**
Oklahoma State University (OSU) - Stillwater, OK, USA ***GPA: 3.79***

Bachelor of Science in Computer Science and Engineering **September 2017 – September 2021**
North South University (NSU) - Dhaka, Bangladesh ***GPA: 3.96***

Research Interest

• Computer Vision • Multimodal Learning • NLP • Model Compression Techniques

Academic Experience

Graduate Research Assistant **August 2023 – Present**
Complex Systems Lab, OSU *Stillwater, OK, USA*

- Conducting research to refine soil moisture estimation techniques using crop imagery for a USDA-funded project.
- Exploring advancements in soil moisture prediction by adapting existing time-series models and modifying deep learning architectures to improve accuracy.
- Developing a multimodal forecasting approach by merging tabular meteorological data with soil imagery to elevate prediction reliability.

Graduate Teaching Assistant **August 2023 – Present**
Computer Science Department, OSU *Stillwater, OK, USA*

- Assisted in developing and grading course materials and managed the Canvas platform for efficient distribution and organization.
- Provided one-on-one mentorship during office hours, developed and maintained course websites, and participated in departmental meetings to discuss curriculum development.
- Engaged in professional development activities to enhance teaching effectiveness. Courses taught include:
  - Design & Implementation of Operating Systems 1 (Fall 2023)
  - Computer Science II - Intro to Object Oriented Programming (Spring 2024)

Research Assistant **September 2021 – September 2022**
Apurba-NSU R&D Lab *Dhaka, Bangladesh*

- Collaborate with fellow RAs to train, fine-tune, and deploy various deep learning models for image classification, OCR, ASR, sentence similarity, masked language modeling, QA, and NER.
- Conduct research in model compression techniques (pruning, quantization, and knowledge distillation), analyze findings, and present weekly reports.

Professional Experience

Data Scientist & Machine Learning Engineer **September 2022 – July 2023**
NeovoTech Ltd. *Dhaka, Bangladesh*

- Create crawlers to scrape news articles from various websites and store them in an AWS S3 bucket.
- Create, maintain, and deploy text translation and text summarization pipelines.

Machine Learning Intern **June 2022 – August 2022**
NeovoTech Ltd. *Dhaka, Bangladesh*

- Collaborated with colleagues to prepare a web crawler that crawls Swedish news text.
- Contributed to improving the Neural Machine Translation (NMT) pipeline from Swedish to English text.

Technical Skills

Programming Languages: Python, Java, C, C++, Shell Scripting, Arduino, HTML, SQL, x86 Assembly
AI & Data Science: PyTorch, TensorFlow, Keras, OpenCV, Scikit-learn, Hugging Face, Pandas, Matplotlib
Web Development: Django, FastAPI, Flask, Nginx, HTML, CSS, JavaScript
Version Control: Git, Bitbucket
Databases: MySQL, MongoDB, NoSQL, Redis
DevOps & Containerization: Docker, Kubernetes
Cloud Computing: Amazon EC2, AWS Services
Big Data Technologies: Hadoop, Apache Spark

Projects

Multi-modal Soil Moisture Estimation: A Distinctive Approach **August 2023 – January 2024**

Research Member

- Introduced a new multimodal framework called Meteorological & Image Soil-Moisture Estimator (MIS-ME) that integrates image features from soil patches with their corresponding meteorological data to improve soil moisture predictions.
- Achieved at least 4% improvement in the MAPE scores for the soil moisture regression task compared to conventional image regression architectures like ResNet or MobileNet.

LILABOTI: Leveraging Isolated Letter Accumulations by Ordering Teacher Insights for Bangla Handwriting Recognition **June 2021 – March 2022**

Research Member

- Introduced a new knowledge distillation method to eradicate the student model's bias toward major classes, where the student CRNN model is trained on an imbalanced handwritten word-level dataset by leveraging the insights from a teacher model trained on a balanced printed character-level dataset.
- Utilizing an inter-dataset evaluation protocol, achieved up to a 4% increase in the F1-Macro score for the minor classes and up to a 3.5% increase in overall word recognition rate when compared to the base CRNN model and conventional knowledge distillation approach.

Water Level Forecasting Using Spatiotemporal Attention-Based Long Short-Term Memory Network **June 2021 – September 2021**

Research Member

- Demonstrated that Spatial-Temporal Attention LSTM (STALSTM) outperforms other types of neural networks in real-time water-level forecasting of complex river systems.

IoT Based Air Pollution Monitoring & Prediction System **January 2020 – April 2020**

Project Leader

- Led a group of 3 to create an air pollution monitoring and prediction system that detects current pollution levels as well as predicts future pollution levels from the environment with high accuracy.
- Implemented ARIMA model to forecast pollution levels of pollutants.

An Open Source Contractual Language Understanding Application Using Machine Learning **January 2021 – August 2021**

Project Co-leader

- Co-led a group of 4 to build an end-to-end legal contract review system where when a user inputs a contract, a deep learning model in the backend outputs a labeled contract with the types of clauses highlighted, allowing the user to make educated decisions.
- In charge of training, fine-tuning, and evaluating various transformer models along with deploying the best-performing one in a resource-constrained environment.

Cyclic Overlapping Lottery Ticket (COLT) – Undergraduate Thesis **November 2020 – October 2021**

Research Member

- Collaborated with fellow members to develop a cyclic or iterative pruning algorithm based on overlapping weights of two one-half splits of a dataset to identify a sparse subnetwork that reaches accuracies similar to the original unpruned network.
- Demonstrated that COLTs can be generated in fewer iterations than Iterative Magnitude Pruning (IMP) of Lottery Ticket Hypothesis (LTH).
- Demonstrated that COLT found by partitioning a dataset into two parts can be transferred even on a third dataset, indicating that the proposed method generalizes well.

My Reading Room **May 2020 – August 2020**

Individual Project

- Developed a learning management system where a user can create classrooms, upload documents, and monitor the document reading time of enrolled users using the Django web framework.
- Integrated face detection and face recognition system using OpenCV to monitor the document reading time of users.

Age Estimation on AgeDB **May 2021 – August 2021**

Individual Project

- Finetuned a pre-trained deep learning network to achieve an MAE score of 9.07 years on the AgeDB age estimation dataset, which outperforms the SOTA MAE score of 13.1 years.
- Demonstrated that CORAL loss performs better than cross-entropy loss for the AgeDB dataset.
- Achieved superior performance on the AgeDB dataset by finetuning a ResNet-152 model on 20 times fewer samples than the SOTA DEX deep learning model.

Publications (Most Recent First)

- **Rakib, M.**, Hossain, M.I., Mohammed, N., and Rahman, F., 2023, February. **Bangla-Wave: Improving Bangla Automatic Speech Recognition Utilizing N-gram Language Models**. *In Proceedings of the 2023 12th International Conference on Software and Computer Applications* (pp. 297-301).
- Hossain, M.I., **Rakib, M.**, Elahi, M.M., Mohammed, N., and Rahman, S., 2022. **COLT: Cyclic Overlapping Lottery Tickets for Faster Pruning of Convolutional Neural Networks**. arXiv preprint arXiv:2212.12770.
- Hossain, M.I., **Rakib, M.**, Mollah, S., Rahman, F., and Mohammed, N., 2022, August. **Lila-boti: Leveraging isolated letter accumulations by ordering teacher insights for bangla handwriting recognition**. *In 2022 26th International Conference on Pattern Recognition (ICPR)* (pp. 1770-1776). IEEE.
- Nawar, A., **Rakib, M.**, Hai, S.A., and Haq, S., 2022, June. **An Open Source Contractual Language Understanding Application Using Machine Learning**. *In Proceedings of the First Workshop on Language Technology and Resources for a Fair, Inclusive, and Safe Society within the 13th Language Resources and Evaluation Conference* (pp. 42-50).
- **Rakib, M.**, Haq, S., Hossain, M.I., and Rahman, T., 2022, February. **IoT based air pollution monitoring & prediction system**. *In 2022 International Conference on Innovations in Science, Engineering and Technology (ICISET)* (pp. 184-189). IEEE.
- Noor, F., Haq, S., **Rakib, M.**, Ahmed, T., Jamal, Z., Siam, Z.S., Hasan, R.T., Adnan, M.S.G., Dewan, A., and Rahman, R.M., 2022. **Water level forecasting using spatiotemporal attention-based long short-term memory network**. *Water*, 14(4), p.612.

Awards and Honors

- Summa Cum Laude Distinction at NSU for achieving a GPA of 3.96.
- Academic Excellence Award at NSU, 2017 – 75% scholarship for Bachelor's degree.
- 2nd Runner Up - Bengali ASR Competition, DL Sprint - BUET CSE Fest 2022.
- 5th Place - Project Showcasing, MIST ICT Innovation Fest 2021.

Voluntary Activities

- Assisted in fundraising for SCARS, a non-profit, to support the underprivileged, enhancing community support & donations.
- Instructed Pytorch-based Deep Learning workshops, promoting skill development in neural networks.

References

Dr. Arunkumar Bagavathi
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Assistant Professor
Department of Computer Science
Oklahoma State University (OSU), OK, USA

Dr. Nabeel Mohammed
Email: *nabeel.mohammed@northsouth.edu*
Associate Professor
Department of Electrical & Computer Engineering (ECE)
North South University (NSU), Bangladesh