# Md Awsafur **Rahman**

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## Education

**Bangladesh University of Engineering and Technology (BUET)** ⬈                       *Dhaka, Bangladesh*
B.Sc in Electrical and Electronic Engineering (EEE)                                   *Apr. 2018 - May 2023*

- Advisor: Professor Dr. Shaikh Anowarul Fattah

## Research Experience

**Research Assistant, IRAB (Institute of Robotics & Automation BUET)**                 *BUET*
Supervisor: Professor Dr. Shaikh Anowarul Fattah                                       *July 2023 - Present*

- Enhance Robustness of Diffusion-based Models (e.g. Inpainting) via Self-Supervised Transformers (Preparing for ECCV'24)

**Undergraduate Thesis**                                                              *BUET*
Supervisor: Professor Dr. Shaikh Anowarul Fattah                                       *Feb. 2022 - May 2023*

- Designed a semi-supervised transformer enhancing semantic segmentation and depth estimation tasks through symbiosis and a dual compensating augmentation, ensuring object integrity, diversity, and controlled generation [WACV'24]
- Proposed local-global window transformers to mitigate trade-off between detailed & consistent depth map [IEEE JSEN'23]
- Introduced a dataset comprising $\sim 2.5$ Million real vs. fake images ($25$ generators) and a novel multi-class strategy to detect both seen and unseen generators amid social-media impairments (compress and downsample) [ICIP'23]

**Research Collaboration at University of Texas at Dallas**                            *Texas, USA (Remote)*
Supervisor: Professor Dr. Mohammad Saquib                                              *Nov. 2022 - May 2023*

- Developed a semi-supervised ensemble technique to identify the algorithms responsible for generating synthetic speeches amidst perturbations, using mel-spectrogram features. [In Review at ICASSP'24]

**Research Collaboration at Princeton University**                                     *New Jersey, USA (Remote)*
Supervisor: Professor Dr. Sun-Yuan Kung                                                *Apr. 2020 - Aug. 2020*

- Proposed horizontal network expansion to reduce cost while maintaining good performance in COVID-19 lesion segmentation from CT scans; all codes, diagrams, and experiments implemented [IEEE TAI]

**Undergraduate Research Assistant, Robotics Lab**                                     *BUET*
Supervisor: Lecturer Tanvir Mahmud & Professor Dr. Shaikh Anowarul Fattah              *Dec. 2019 - Feb. 2022*

- Introduced network for melanoma diagnosis using concurrent multi-image comparison with patient-level context [BSPC]
- Proposed an efficient AF detection scheme to integrate raw ECG and discrete wavelet transformed features [EMBC'22]
- Introduced stacking ensemble strategy, and implemented all codes, diagrams, experiments [Elsevier CBM]

## Publications (Google Scholar)

M. A. Rahman and S. A. Fattah, "Semi-Supervised Semantic Depth Estimation using Symbiotic Transformer and NearFarMix Augmentation," *WACV 2024*, pp. 250-259. Link: CVF Open Access

M. A. Rahman and S. A. Fattah, "DwinFormer: Dual Window Transformers for End-to-End Monocular Depth Estimation," *IEEE Sensors Journal 2023*, vol. 23, no. 18, pp. 21443-21451. DOI: 10.1109/JSEN.2023.3299782

M. A. Rahman, B. Paul, N. H. Sarker, Z. I. A. Hakim, and S. A. Fattah, "ArtiFact: A Large-Scale Dataset with Artificial and Factual Images for Generalizable and Robust Synthetic Image Detection," *ICIP 2023*. DOI: 10.1109/ICIP49359.2023.10222083

M. A. Rahman, B. Paul, N. H. Sarker, Z. I. A. Hakim, S. A. Fattah, and M. Saquib, "Syn-Att: Synthetic Speech Attribution via Semi-Supervised Unknown Multi-Class Ensemble of CNNs," *Under Review at ICASSP 2024*. DOI: 10.48550/arXiv.2309.08146

M. A. Rahman, B. Paul, T. Mahmud, and S. A. Fattah, "CIFF-Net: Contextual Image Feature Fusion for Melanoma Diagnosis," *Elsevier BSPC 2024*, vol. 88, issn. 1746-8094, pp. 105673. DOI: 10.1016/j.bspc.2023.105673

M. A. Rahman, S. Ahmed, and S. A. Fattah, "A Deep Learning Scheme for Detecting Atrial Fibrillation Based on Fusion of Raw and Discrete Wavelet Transformed ECG Features," *IEEE EMBC 2022*, pp. 1024-1027. DOI: 10.1109/EMBC48229.2022.9870829

T. Mahmud, M. A. Rahman, S. A. Fattah, and S. Y. Kung, "CovSegNet: A multi encoder-decoder architecture for improved lesion segmentation," *IEEE Transactions on Artificial Intelligence 2021*, vol. 2, no. 3, pp. 283-297. DOI: 10.1109/TAI.2021.3064913

T. Mahmud, M. A. Rahman, and S. A. Fattah, "CovXNet: A multi-dilation convolutional neural network for COVID-19 and pneumonia detection," *Elsevier CBM 2020*, vol. 122, p. 103869. DOI: 10.1016/j.compbiomed.2020.103869

## Professional Experience

**Google**                                                                            *Washington, USA (Remote)*
Contractor (Supervisor: Martin Görner, Product Manager for Keras & TensorFlow)         *Dec. 2023 - Present*

- Develop interactive codes and tutorials to solve problems in ML competitions on Kaggle using Keras, focusing on Computer Vision (CV) and Natural Language Processing (NLP) tasks

### Weights & Biases (MLOps) ⧉

DEVELOPER EXPERT (SUPERVISOR: MORGAN MCGUIRE, DIRECTOR OF GROWTH ML)

*California, USA (Remote)*

*Aug. 2021 - Sept. 2023*

- Testing WandB in ML projects, troubleshooting issues, optimization and creating tutorials for effective tracking workflow
- Integrated WandB pipeline into YOLOv5 and tested it for Underwater Object Detection (Code | Blog)

### Collaboration

NVIDIA (SENIOR DATA SCIENTIST DR. CHRIS DEOTTE)

*Santa Clara, USA (Remote)*

*May. 2021 - Jul. 2021*

- Won Best Student Team Award and ranked $4^{th}$ in SIIM-FISABIO-RSNA COVID-19 Detection Competition (Ref | Code | Video)
- Introduced a Semi-supervised Multi-Stage Transfer Learning scheme to detect abnormalities from limited data
- Developed a fast BBox-Filter method to remove abnormal bounding boxes using statistical distribution

### Kaggle: Competitive Deep-Learning ⧉

1X GRANDMASTER & 3X MASTER

*San Francisco, USA (Remote)*

*Nov. 2019 - Present*

- Competed with professionals from leading companies like NVIDIA, Amazon, HuggingFace, H20.ai, and more
- Awarded Grandmaster title, ranking $7^{th}$ (best $5^{th}$) among 313,000+ contenders and $1^{st}$ in Bangladesh at the Code section
- Won 38 Gold, 10 Silver medals in the Code section, and 1 Gold, 3 Silver medals in the Competition section

## Teaching Experience

### MLDL-I: Machine Learning & Deep Learning I (Course + Lab) (Code & Slides)

CO-CREATOR & CO-INSTRUCTOR

*IRAB, BUET*

*July. 2023 - Sept. 2023*

- ML: Backpropagation, Gradient Descent, Linear/Logistic Regression, SVM, Tree-based model, KNN, K-Means Clustering
- DL: DNN, CNN, Architectures (ResNet, EfficientNet, etc), Image Classify/Segment, Cross-Validation, Augmentaiton

## Selected Projects

OPEN SOURCE PROJECT AUTHOR / CONTRIBUTOR

- **Keras/TensorFlow**: Added - $GroupedQueryAttention$, Conversion to multibackend (JAX/PyTorch), $DeBertaV3$ classifier for MCQ task, $pad_images$, $to\_ordinal$, multi-backend $GCViT$. Ongoing - $MelSpectogram$ (Code | PRs)
- **gcvit-tf** : Implemented the GCViT paper from scratch in TensorFlow, explained the paper in a live notebook, converted model weights from PyTorch, and created a live demo (Code | Annotated Notebook | HF Demo)
- **TransUnet-tf** : Implemented TransUnet paper from scratch and segmented MRI scans for cancer (Code | Notebook)
- **LLM-Science-Exam** : Implemented a multi-backend (TF, PyTorch, JAX) model to answer scientific questions using Keras-NLP classifiers for GPU & TPUv3, and created a live notebook for use-case (Code | Notebook)
- **audio-cls-models** : Implemented the Conformer and ContextNet papers from scratch, converted them from $Speech2Text$ task for $AudioRecognition$ task, and used it for Fake Speech Detection (Code | Notebook)
- **LLM-Detect-AI-Generated-Text** : Demonstrated synthetic text detection with multi-backend $DebertaV3$ (Code | Notebook)
- **HuggingFace**: Detected and resolved a discretized depth issue in the NYU-Depth-V2 dataset (PR)
- **YOLOv5**: Identified and resolved bug related to best model checkpointing (PR)

## Honors & Awards

PROJECTS & GRANTS

| | | |
|---|---|---|
| 2023 | **Winner**, Google OSS Peer Bonus Award: October 2023 - gcvit-tf & TransUNet-tf (Ref | Code1 | Code2) | *Google* |
| 2023 | **Awarded**, IEEE SPS Travel Grant for IEEE ICIP 2023 Conference (Ref) | *ICIP 2023* |
| 2022 | **Winner**, Kaggle ML Research Spotlight - GCViT: Global Context Vision Transformer (Ref | Code | Notebook) | *Kaggle* |
| 2022 | **Winner**, Google OSS Expert Prize: June 2022 - Fake Speech Detection (Ref | Code | Notebook) | *Google* |
| 2022 | **Winner**, Google OSS Expert Prize: May 2022 - GI Tract Image Segmentation (Ref | Code | Notebook) | *Google* |
| 2022 | **Winner**, Google OSS Expert Prize: January 2022 - Extraterrestrial Deep Space Signal Detection (Ref | Code) | *Google* |

COMPETITIONS

| | | |
|---|---|---|
| 2022 | **1st Place (on leaderboard)**, IEEE VIP Cup 2022 - Synthetic Image Detection (Ref | Code | Video) | *ICIP 2022* |
| 2022 | **1st Place**, IEEE SP Cup 2022 - Synthetic Speech Attribution (Ref | Code | Video) | *ICASSP 2022* |
| 2021 | **1st Place (jontly)**, KaggleDays x ZbyHP Championship, Shanghai - Predict the yoga pose correctly (Ref) | *HP* |
| 2021 | **1st Place**, Deep Chimpact - Depth Estimation for Wildlife Conservation (Ref | Code) | *DrivenData* |
| 2021 | **1st Place (on test1)**, IEEE VIP CUP 2021 - Privacy-Preserving In-Bed Human Pose Estimation (Ref | Code) | *ICIP 2021* |
| 2021 | **Best Student Team, 4th Place**, SIIM-FISABIO-RSNA COVID-19 Detection and Localization (Ref | Code | Video) | *Kaggle* |
| 2020 | **1st Place**, DhakaAI - Vehicle Detection in Densely Populated Dhaka City (Ref | Video) | *Green Uni* |
| 2020 | **2nd Place**, IEEE VIP Cup 2020 - Real-time vehicle detection and tracking at using fisheye camera (Ref | Video) | *ICIP 2020* |
| 2020 | **Silver Medal**, NFL 1st Place and Future - Detect helmet impacts in videos of NFL plays (Ref) | *Kaggle* |

## Extracurricular Activities

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|---|---|---|
| 2021 - 23 | **Reviewer**, Conference: ISBI 2024 | Journal: IEEE JTEHM, Elsevier BSPC | |
| 2021 - 23 | **Chairperson ('23), Secretary ('21-'22)**, IEEE EMBS Student Branch, BUET Chapter | *Dhaka* |
| 2019 - 23 | **Class Representative (CR)**, Dept. of EEE, Batch'17, BUET | *Dhaka* |