

# Sakib Mohammad

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US Lawful Permanent Resident

## RESEARCH BACKGROUND

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**Research Interest & Area:** Applied ML/DL, AI in Biomedical Sciences, Computer Vision, Generative AI, Explainable AI.

## EDUCATION

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**Southern Illinois University Carbondale**, Carbondale, IL May 2025 (expected)  
Doctor of Philosophy in Electrical and Computer Engineering GPA: 4.00/4.00  
Thesis: *Deep Learning Powered Identification and Classification of Early Differentiated Germ Layers from Pluripotent Stem Cells with Interpretability*  
Supervisor: Dr. Farhan H. Chowdhury

**Southern Illinois University Carbondale**, Carbondale, IL July 2021  
Master of Science in Electrical and Computer Engineering GPA: 3.96/4.00  
Thesis: *A Novel Multiplier Using Modified Shift and Add Algorithm*  
Supervisor: Dr. Themistoklis Haniotakis

## EXPERIENCE

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*Research Assistant*, **Mechanogenomics Lab, SIUC, Carbondale, IL** August 2021 - Present

- Trained MLP and generative AI models (VAE, CVAE) to predict rheological properties ( $G'$  and  $G''$ ) of 3D-printed polyacrylamide (PAA) hydrogels ( $R^2 = 0.89$ ) and generate material compositions validated by statistical tests & deployed on HF Space.
- Used transfer learning with CNN models (ResNet18, GoogLeNet, VGG11) on HeLa (F1 score 0.92) and B16F1 (F1 score 0.80) phase-contrast images to classify substrate stiffness, with Grad-CAM and LIME for decision-making insights.
- Applied CNN models (InceptionV3, DenseNet121, Xception, U-Net, Attention U-Net) to achieve 97% accuracy and 69% mIoU for phase-contrast and 90% accuracy and 61% mIoU for nucleus images in classifying and segmenting early mesoderm cells, with Grad-CAM for interpretability.
- Developed a supervised AI model combining InceptionV3 and Support Vector Machine (SVM), and unsupervised k-means and hierarchical clustering methods to identify and classify pancreatic tumor repopulating cells (TRCs) into three sub-types with 90% accuracy.
- Utilized a Random Forest Regressor machine learning model to predict thermo-mechanical properties of hollow glass micro-balloon filled composite materials with an  $R^2$  of 0.9.
- Built XGBoost and CNN models (ResNet50, U-Net with ResNet34 encoder) for traction force prediction (MAPE = 4.96%) and substrate stiffness classification (Accuracy = 98%).
- Used MATLAB and ImageJ for image processing and traction force microscopy (TFM) to find forces and prestresses of single cells.
- Cultured and maintained cell lines including murine embryonic stem cells (OGTR1, OGR1, W4), and human and murine cancer cell lines (HeLa, MIA PaCa-2, B16F1), and performed various assays in a BSL-2 lab.
- Employed a Leica wide-field epifluorescence microscope to acquire and process images for further experimentation.

*Research Assistant*, **VLSI and RF Circuit Design Lab, SIUC, Carbondale, IL** April 2020 - July 2021

- Developed a binary multiplier using a modified shift-and-add algorithm with a barrel shifter and carry-save adders, implemented in Cadence Virtuoso (GPDK 45nm library), achieving scalable multiplication.

*Teaching Assistant*, **Department of ECE and EET, SIUC** August 2019 - July 2024

- Delivered laboratory lectures and assisted students in setting up and debugging electrical circuits.
- Graded assignments, labs, and exams.
- Prepared lab manuals.
- **Courses Assigned:** EET 238 Digital Systems Fundamentals, EET 245 Introductory Circuit Analysis and Applications, EET 245L Introductory Circuit Analysis and Applications Lab, EET 304A AC/DC Circuit Theory and Application, EET 304B Network Theory and Application, EET 403A Electronic Circuit Analysis, EET 403B Electronics Application and Design, ECE 235 Electrical Circuits I, ECE 235L Electrical Circuit I Lab, ECE 327 Digital Circuit Design with HDL, ECE 327L Digital Circuit Design with HDL Lab.

*Lecturer*, **Department of EEE, Bangabandhu Sheikh Mujibur Rahman Science and Technology University, Bangladesh**  
November 2018 - July 2019

- Prepared and delivered lectures, labs, and supervised over 50 students.
- Managed exam questions, graded assignments, labs, and exams.
- **Courses Taught:** EEE 102 Electrical Circuit I Lab, EEE 321 Power Electronics, EEE 322 Power Electronics Lab.

*Adjunct Lecturer*, **Department of EEE, Green University of Bangladesh, Bangladesh** May 2018 - September 2018

- Prepared and conducted lectures, lab sessions; graded assignments and exams.
- **Courses Taught:** EEE 101 Electrical Circuits I, EEE 406 Discrete Signal Processing Lab, EEE 340 Engineering Drawing and Electrical Service Design Lab.

## PUBLICATIONS

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### Journal Papers

- **Mohammad, S.**, Akand, R., Cook, K.M., Nilufar, S., & Chowdhury, F. (2024). Leveraging deep learning and generative AI for predicting rheological properties and material compositions of 3D printed polyacrylamide hydrogels. *Gels*, 10(10), 660. <https://doi.org/10.3390/gels10100660>.
- **Mohammad, S.**, Roy, A., Karatzas, A., Sarver, S.L., Anagnostopoulos, I., & Chowdhury, F. (2024). Deep learning powered identification of differentiated early mesoderm cells from pluripotent stem cells. *Cells*, 13(6), 534. <https://doi.org/10.3390/cells13060534>.
- **Mohammad, S.**, Amar, K., & Chowdhury, F. (2023). Hybrid AI models allow label-free identification and classification of pancreatic tumor repopulating cell population. *Biochemical and Biophysical Research Communications*, 677, 126-131. <https://doi.org/10.1016/j.bbrc.2023.08.015>.
- Tousif, M. N., **Mohammad, S.**, Ferdous, A. A., & Hoque, M. A. (2018). Investigation of different materials as buffer layer in CZTS solar cells using SCAPS. *Journal of Clean Energy Technologies*, 6(4), 293-296. <https://doi.org/10.18178/jocet.2018.6.4.477>.

### Conference Papers

- Tousif, M. N., Ushan, M. N. R., Akhter, R., Mahmud, S., Rashid, S., & **Mohammad, S.** (2024). Performance analysis of heart disease detection using different machine learning approaches. In *2024 6th International Conference on Electrical Engineering and Information & Communication Technology (ICEEICT)*. IEEE. <https://doi.org/10.1109/ICEEICT62016.2024.10534366>.
- Tousif, M. N., Ushan, M. N. R., Joha, A. A., & **Mohammad, S.** (2017). A comprehensive study of CZTS solar cell simulation with ZnS buffer layer. In *2017 IEEE Region 10 Humanitarian Technology Conference (R10-HTC)* (pp. 193-197). IEEE. <https://doi.org/10.1109/R10-HTC.2017.8288936>.
- **Mohammad, S.**, Tousif, M. N., Ferdous, A. A., Hoque, M. A., & Rahman, M. W. (2017). Numerical analysis of CZTS solar cell with In2S3 buffer layer: A study of a CZTS-based thin-film solar cell, concerning the effects of several parameters on its electrical performance. In *2017 IEEE International Conference on Smart Grid and Smart Cities (ICSGSC)* (pp. 55-60). IEEE. <https://doi.org/10.1109/ICSGSC.2017.8038549>.

### Poster Presentations

- **Mohammad, S.**, Roy, A., Akand, R., & Chowdhury, F. (2024, April). Impact of various transfer learning methods on small biological dataset training. Poster session presented at the *2024 Creative Activities and Research Presentations (CARP)*, Southern Illinois University Carbondale.
- **Mohammad, S.**, Amar, K., & Chowdhury, F. (2023, April). Tumorigenic pancreatic cancer cell classification with a combined deep and machine learning model. Poster session presented at the *2023 Student Research & Creative Activities Forum (SRCAF)*, Southern Illinois University Carbondale.

## ADDITIONAL PROJECTS

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- Developed ML models for plagiarism detection (cosine similarity) and sentiment analysis (Logistic Regression) of Amazon reviews (82% accuracy).
- Designed an LSTM-based time-series model for Apple stock forecasting (RMSE of 0.0153) and a bi-directional GRU with attention for neural machine translation (English to French).
- Projected the risk of heart disease from healthcare data with a k-NN predictor achieving 93% accuracy.
- Deployed BerryNet on Raspberry Pi 3 for real-time object detection and inference streaming.
- Enhanced misclassification detection in VGG models with confidence-based approaches (AUPR-Error improvement = 2.75%).

## TECHNICAL SKILLS

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**ML/DL:** PyTorch, TensorFlow, Keras, Scikit-learn, OpenCV, NLTK, spaCy, HF Transformers.

**Data Analysis:** NumPy, Pandas, SciPy, Jupyter Notebook.

**Data Visualization:** Matplotlib, Seaborn, Plotly, Tableau, TensorBoard.

**Cloud & Deployment:** AWS, Google Colab, Gradio, Streamlit, HF Spaces.

**Programming & Database:** Python, MATLAB, C, SQL (PostgreSQL), Git.

**Image Processing & Analysis:** ImageJ, LasX.

## COURSES AND CERTIFICATIONS

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Neural Networks, DNN Software Hardware Design, Edge Computing, Modern Biomedical Imaging, Digital Image Processing, PyTorch for Deep Learning, The Complete SQL, Scikit-learn in Python, Understanding and Visualizing Data with Python, Data Science Math Skills.

## AWARDS

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- **Dissertation Research Assistantship** 2024  
Dissertation Research Assistantship for working towards doctoral dissertation.
- **Doctoral Fellowship** 2024  
Doctoral Fellowship for continuing PhD studies.
- **Bangladesh Sweden Trust Fund Scholarship** 2021  
Govt.-sponsored travel grant.
- **OIC Scholarship** 2012  
Awarded for outstanding performance in the entrance exam at undergraduate university.

## REFERENCES

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- **Farhan H. Chowdhury**

Professor, Southern Illinois University Carbondale

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- **Shaikh Ahmed**

Professor, Southern Illinois University Carbondale

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