

Somak Goswami

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EDUCATION

SRM Institute of Science and Technology (CGPA - 9.05)

Chennai, India

Bachelor of Technology in Electronics and Computer Engineering

September, 2021 - June, 2025

PUBLICATIONS

Conferences:

- **Goswami, S.**, Srivastava, U., Chinni, P. M., & Dhanalakshmi, S. (2023, December). Enhancing Brain MRI Tumor Detection: Exploring Vision Transformers and Fine-tuned Convolutional Neural Network Architecture for Improved Performance. *Lecture Notes in Networks and Systems*.
- **Goswami, S.** & Dhanalakshmi, S. (submitted). Analysis of Respiratory Patterns Using FMCW Radar: A Study of COPD and Normal Subjects Under Varying Conditions. *IEEE PerComs 2025 Work-in-Progress (WiP) Session*

Journals:

- **Goswami, S.** & Dhanalakshmi, S. (accepted). Cross-Silo Federated Learning for Scalable Diabetic Retinopathy Imaging. *CRC Press, Taylor & Francis*

Pre-Print:

- **Goswami, S.** & Dhanalakshmi, S. (submitted). Analyzing Federated Learning for Enhancing End-User Privacy using EDGE Devices. *arXiv*

EXPERIENCE

Bachelor Thesis Student

August, 2024 - Ongoing

Indian Institute of Technology, Kharagpur

Kharagpur, India

- Conducting research under Dr. Sandip Chakraborty to analyze breath rate variability in patients with COPD, Asthma, and Pneumonia using FMCW radar.
- Collected radar data from patients during various physical activities such as walking, running, and climbing stairs for cardiological assessment.
- Utilized the Savitzky-Golay filter to measure inter-peak distances and calculate respiratory rate in breaths per minute (BPM).
- Developing a multi-modal classification model combining Vision Transformers and Wave2Vec features, trained with an SVM for disease detection based on images and audio data.

Undergraduate Research Assistant

February, 2022 - December, 2024

SRM Institute of Science and Technology

Chennai, India

- Conducted research under Dr. S. Dhanalakshmi on deep learning and computer vision techniques for biomedical applications.
- Implemented Vision Transformers for Brain MRI tumor detection, achieving 90.2% accuracy.
- Developed a **Federated Learning framework** for decentralized Diabetic Retinopathy imaging to assist in diabetes diagnosis.
- Worked on UNETR-based fetal ECG extraction, isolating fetal ECG signals from maternal ECG for advanced biomedical analysis.

Winter Research Intern

December, 2023 - January, 2024

Indian Institute of Engineering Sciences and Technology

Kolkata, India

- Conducted in-depth analysis and experimentation with Dr. Nirnay Ghosh to refine low-light image enhancement techniques, leading to a 20% enhancement in color accuracy.
- Developed the HWMNet+ model, a specialized architecture for brightening dark images for endoscopic imaging.
- Engineered a custom Half Wavelet Attention Block (HWAB) to optimize feature extraction from low-light images, boosting model performance by 15% and enhancing fine detail recognition in image data.

Summer Research Intern

June, 2023 - July, 2023

Indian Institute of Engineering Sciences and Technology

Kolkata, India

- Collaborated with Dr. Nirnay Ghosh to develop a novel weight-averaging methodology for improving Federated Learning models.
- Utilized the EMNIST JPEG dataset for training and validation of decentralized models.
- Calculated and integrated weighted averages of training rounds to enhance the performance and efficiency of the cloud-based model.

PROJECTS

NeoSense: Advanced Multimodal Detection for Fetal Distress

November, 2024 - Ongoing

OpenCV, Scikit-Image, VTK, pydicom, NumPy, PyTorch

- Developing a multimodal pipeline to predict fetal distress by correlating fetal heart rate (CTG graphs) with uterine contractions using advanced imaging techniques.
- Training an ML model to identify and predict fetal distress by integrating heart rate patterns and uterus imaging data for real-time monitoring.
- Designing and integrating an alarm system within hardware to notify doctors of emergency situations, enabling faster intervention and improved patient outcomes.

SleepNet: CNN-LSTM Framework for Obstructive Sleep Apnea Detection

June, 2024 - December, 2024

Tensorflow, Neurokit2, NumPy, Pandas

- Preprocessed and normalized 7-8 hours of sleep data from the Apnea-ECG dataset (PhysioNet) using a low-pass filter to remove noise and improve signal quality for apnea detection..
- Trained a hybrid CNN-LSTM model on the preprocessed dataset to detect and classify apnea events based on the extracted features from the ECG signals.
- Developed a detection algorithm that infers normal sleep based on stable signals and identifies apnea events when signals fluctuate, with variations observed across individuals.

TECHNICAL SKILLS

- **Languages:** Java, Python, C/C++, MatLab, R, SciLab
- **ML Libraries:** TensorFlow, PyTorch, Pandas, NumPy, Matplotlib, ScikitLearn, OpenCV, SciPy, Keras, Neurokit2