Rasel Ahmed Bhuiyan

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Summary

PhD candidate in Computer Science at the University of Notre Dame specializing in **machine learning, computer vision, and model interpretability**. My research focuses on **rigorous experimental design, model bias analysis, and human-in-the-loop training** to make AI systems more **interpretable, fair, and generalizable**. I have experience developing and evaluating **deep learning algorithms**, analyzing their **robustness and failure modes**, and building scalable pipelines for large imaging datasets. Published in **WACV, IEEE T-BIOM, and Journal of Vision**. Proficient in **Python, PyTorch, TensorFlow, and large-scale training workflows**. Seeking an **Internship/Full-Time Research Scientist position** to contribute to advances in **evaluation, fairness, interpretability, and alignment of machine learning systems**.

Technical Skills

Programming: Python, MATLAB, Bash
Libraries & Frameworks: PyTorch, TensorFlow, OpenCV, Scikit-learn, HuggingFace, NumPy, Pandas, Matplotlib
Research Expertise: Computer Vision, Deep Learning, Vision-Language Models (VLMs), Object Detection, Facial/Iris Recognition, Generative AI, Explainable AI, Model Interpretability, Optimization, Human-in-the-loop AI
Development Practices: Version Control (Git), Model Evaluation, Experiment Reproducibility, Large-scale Data Processing, Collaborative ML Research
Computing Platforms: Linux, HPC Clusters, Multi-GPU Systems

Research Experience

Graduate Research Assistant 01/2022 - Present
Computer Vision Research Laboratory (CVRL), University of Notre Dame *Notre Dame, IN*

- **Multimodal PMI Prediction:** Developed a cross-spectral vision model fusing **RGB and NIR** modalities to **reduce post-mortem interval (PMI) estimation error by 36%** (77.7 → 45.8 hrs), aiding criminal investigations and demonstrating **robust multimodal learning and domain adaptation**. GitHub
- **Infant Iris Recognition:** Created an end-to-end universal segmentation model **improving AUC from 77% → 99%**, enabling real-time newborn ID systems to **prevent baby swapping**, reduce **abductions**, and improve **post-natal health monitoring** globally. GitHub
- **Synthetic Data Generation:** Designed a **PMI-conditioned StyleGAN2 generator**, synthesizing **180K+ forensic iris images**, adressing data scarcity and enabling scalable data augmentation for model robustness. GitHub
- **Explainable AI for Biometrics:** Built the **largest post-mortem iris dataset (338+ subjects)** and released a forensic iris toolkit with **explainable AI** for human-in-the-loop analysis.
- **Iris Presentation Attack Detection:** Developed a deep-learning based **PAD model** with **>95% accuracy** on unseen attack types, enhancing biometric security. GitHub

Research Lead (as Lecturer) 10/2018 - 12/2021
Uttara University *Dhaka, Bangladesh*

- **Epileptic Seizure Recognition:** Segmented EEG signals into time windows, extracted statistical features, and applied an SVM classifier, achieving **99%+ accuracy** on the Bonn dataset for **automated seizure diagnosis**.
- **Human Activity Recognition:** Designed a window-based frequency-domain model using EPS features with SVM, **improving performance from 93% → 99%+ on DU-MD** and achieving **up to 99%+ class-wise accuracy on UCI-HAR**, surpassing state-of-the-art for **wearable health monitoring**.
- **Wearable Patient Monitoring:** Developed an **enhanced BoW features** with DWT and K-means, achieving **98% accuracy**, **surpassing BoW baselines** and **reducing computational cost** vs. state-of-the-art.

Research Assistant 03/2016 - 09/2018
Computer Vision & Pattern Recognition Lab, University of Asia Pacific *Dhaka, Bangladesh*

- **Hand Gesture Recognition:** Developed a gesture recognition system **improving accuracy from 61% → 78%** through advanced feature engineering and genetic algorithm–based optimization, enabling **enhanced communication for deaf and dumb users**.
- **ASL Recognition:** Built a low-cost, real-time HCI system using Deep-CNN feature extraction and multi-class SVM, achieving **94.6% accuracy** to support **interactive communication for deaf and dumb users**.
- **Arrhythmia Diagnosis:** Designed a hybrid PCA-ICA pipeline to extract statistical features from ECG signals, achieving **98.67% accuracy** in arrhythmia classification on the MIT-BIH dataset.

Leadership Experience

Social Chair 2023/2024

Bangladeshi Student Association, University of Notre Dame *Notre Dame, IN*

- Organized meetings, took meeting minutes, and published announcements to coordinate academic and social activities.

President 2016/2017

CSE Student Association, University of Asia Pacific *Dhaka, Bangladesh*

- Advocated for student welfare by identifying issues, proposing solutions to the administration, and organizing student events.

Awards & Honors

- **Best Paper Award – CV4Smalls - WACV 2025:** *Iris Recognition for Infants*, for developing a robust and accurate iris recognition system for small and challenging infant/toddler datasets.
- Fully Funded Graduate Assistantship, University of Notre Dame.

Education

Ph.D. Computer Science – University of Notre Dame, Notre Dame, IN 12/2026

Focus: Iris Recognition at Life Extremes | Advisor: Adam Czajka

M.Sc. Computer Science – University of Notre Dame, Notre Dame, IN 05/2024

Focus: Forensic Iris Recognition | CGPA: 3.83/4.00

B.Sc. Computer Science & Engineering – University of Asia Pacific, Dhaka, BD 03/2018

Graduated with **highest distinction** | CGPA: 3.94/4.00

Selected Publications

1 **Rasel Ahmed Bhuiyan**, Parisa Farmanifard, Renu Sharma, Andrey Kuehlkamp, Aidan Boyd, Patrick J Flynn, Kevin W Bowyer, Arun Ross, Dennis Chute, and Adam Czajka, "Beyond Mortality: Advancements in Post-Mortem Iris Recognition through Data Collection and Computer-Aided Forensic Examination," IEEE Transactions on Biometrics, Behavior, and Identity Science (T-BIOM), 2025.

2 Elia Shahbazi, Drew Nguyen, **Rasel Ahmed Bhuiyan**, Adam Czajka, Arash Afraz, "Visualizing the Unseen: Perceptographer, an AI Engine for Visualizing Brain-Stimulation-Induced Perceptual Events," Journal of Vision, 2025

3 **Rasel Ahmed Bhuiyan** and Adam Czajka, "Forensic Iris Image-Based Post-Mortem Interval Estimation", Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision (WACV), Tucson, Arizona, 2025.

4 **Rasel Ahmed Bhuiyan** and Adam Czajka, "Iris Recognition for Infants", Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision (WACV), Tucson, Arizona, 2025. [**Received Best Paper Award**]

5 **Rasel Ahmed Bhuiyan** and Adam Czajka, "Forensic Iris Image Synthesis", Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision (WACV), Waikoloa, Hawaii, 2024.

6 **Rasel Ahmed Bhuiyan**, Shams Tarek, and Hongda Tian, "Enhanced Bag-of-Words Representation for Human Activity Recognition using Mobile Sensor Data", Signal, Image and Video Processing (SIViP), Springer Nature, 1–8, 2021.

7 **Rasel Ahmed Bhuiyan**, N Ahmed, Md Amiruzzaman, and MR Islam, "A Robust Feature Extraction Model for Human Activity Characterization using 3-Axis Accelerometer and Gyroscope Data", Sensors, MDPI, 20(23):6990, 2020.

8 A Matin, **Rasel Ahmed Bhuiyan**, SR Shafi, AK Kundu, and MU Islam, "A Hybrid Scheme Using PCA and ICA Based Statistical Feature for Epileptic Seizure Recognition from EEG Signal", Joint 2019 IEEE 8^{th} International Conference on Informatics, Electronics, and Vision (ICIEV) and 3^{rd} International Conference on Imaging, Vision, and Pattern Recognition (IVPR), Eastern Washington University, USA, 2019. [**Nominated for the best paper award**]