Rasel Ahmed Bhuiyan

Ph.D. Candidate, Computer Science & Engineering · Computer Vision & Machine Learning

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SUMMARY

Computer vision engineer and researcher with 4+ years building end-to-end vision systems for medical and biometric imaging, from data collection and curation through model training, evaluation, and delivery of open-source tools. Experience combining deep learning with geometric methods (landmark localization, image alignment, projective correction) and building models that hold up under limited data and domain shift. Ph.D. candidate at the University of Notre Dame with 14 peer-reviewed publications and the Best Paper Award at the IEEE/CVF WACV 2025 CV4Smalls Workshop.

EDUCATION

Ph.D., Computer Science & Engineering — Jan. 2022 – May 2027
University of Notre Dame — *Notre Dame, IN, USA*

M.Sc., Computer Science & Engineering — Jan. 2022 – Aug. 2025
University of Notre Dame — *Notre Dame, IN, USA*

B.Sc., Computer Science & Engineering — Nov. 2013 – Mar. 2018
University of Asia Pacific — *Dhaka, Bangladesh*

TECHNICAL SKILLS

Languages & ML: Python, PyTorch, NumPy, scikit-learn, OpenCV, Pandas, Pillow, TensorFlow, Hugging Face, Bash, SQL, R, MATLAB

Computer Vision: Segmentation, classification, landmark localization and alignment, curve fitting, projective transforms, object detection, CNNs, ViTs, metric learning (ArcFace), self-supervised and few-shot learning, domain generalization, Explainable AI

Deployment & Tools: ONNX, TensorRT, quantization, Docker, Git, Linux, CUDA, HPC/SLURM, multi-GPU training, MLflow, Weights & Biases

RESEARCH EXPERIENCE

Graduate Research Assistant — Jan. 2022 – Present
Computer Vision Research Laboratory (CVRL), University of Notre Dame — *Notre Dame, IN*

- **Infant Biometrics** — Clinical Iris Segmentation & Privacy-Preserving Data (NSF-funded)
  - Built the first operational infant iris identification system for clinical populations (EER 3%, AUC 0.99).
  - Outperformed evaluated commercial systems, some of which rejected every image in the clinical dataset.
  - Trained segmentation models with no infant labels, using infant-style augmentations of adult iris images.
  - Synthesized and released a privacy-preserving infant iris dataset as an open resource.
  - Received the **Best Paper Award** at the IEEE/CVF WACV 2025 CV4Smalls Workshop. [code]
- **Iris Image Processing Toolbox** — NIST IREX-Vetted Open-Source Toolkit
  - Delivered image processing modules to a public, NIST IREX-vetted iris recognition toolkit. [code]
  - Paired learned models with geometry: canthi alignment, eyelid curve fitting, projective gaze correction.
  - Canthi detection model runs in NIST's internal iris recognition pipeline.
- **ColdIrisNet** — Foundation-Model Adaptation under Distribution Shift
  - Adapted a frozen DINOv3 (ViT-L/16) with ArcFace metric learning and a saliency-guided multi-task loss.
  - Designed a landmark-localization network to keep features aligned under extreme rotation.
  - Cut Equal Error Rate (EER) by 68% vs. prior state of the art across 70 days of post-mortem change.
  - Showed strong cross-dataset and live-to-deceased transfer performance.

- **Iris Presentation Attack Detection** — Generalization to Unseen Attacks
  - Trained models on 400K+ iris images covering live eyes and many attack types: printouts, synthetic irises, Kindle displays, textured contact lenses, post-mortem eyes, and artificial eyes.
  - Reached >95% accuracy on attack types held out from training.
- **PMI Estimation** — Multimodal Fusion & Regression under Domain Shift
  - Benchmarked deep regression models and built a multimodal NIR+RGB fusion framework.
  - Achieved 3.4-hour MAE on same-distribution data and 17.5-hour MAE on held-out subjects.
  - Cut cross-laboratory error by 40% with GAN-conditioned synthetic augmentation. [code]
- **Forensic Iris Synthesis** — Conditional Generative Modeling for Data-Scarce Domains
  - Built a conditional generator with latent hypersphere sampling for controllable identity synthesis.
  - Released 180K images across 18 rare conditions, passing 11/12 ISO/IEC 29794-6 quality checks. [code]
- **Beyond Mortality** — Data Collection & Fairness Analysis
  - Ran a demographic bias analysis across 32M+ comparisons covering age, gender, and decomposition stage.
- **Perceptographer** — Generative AI for Neuroscience (NIMH collaboration)
  - Designed and delivered a hybrid GAN–diffusion image generation engine with latent-space exploration.
  - Used to visualize brain-stimulation-induced perceptual events.
- **Ongoing Work** — Vision-Language Models & Foundation-Model Regression
  - Building a retrieval-augmented few-shot vision-language framework for PMI estimation from iris images.
  - Training SigLIP- and BioCLIP-based image–text models to predict PMI from NIR images and descriptions.
  - Applying LoRA fine-tuning and attention-based MIL to subject-disjoint PMI regression benchmarks.

Lecturer and Research Assistant 2016 – 2021
Uttara University & University of Asia Pacific *Dhaka, Bangladesh*

- Built ML pipelines for EEG seizure detection, ECG arrhythmia, and activity recognition (5 publications).
- Built sign language and gesture recognition with CNN transfer learning (3 publications).
- Lecturer, Uttara University (2018–2021): taught Algorithms, Digital Logic Design, ML, and AI.

SELECTED PUBLICATIONS

14 peer-reviewed publications. Full list on Google Scholar.

[1] **R.A. Bhuiyan**, et al., "Iris Recognition for Infants," *IEEE/CVF WACV Workshops*, 2025. **Best Paper Award**

[2] **R.A. Bhuiyan**, et al., "Beyond Mortality: Advancements in Post-Mortem Iris Recognition through Data Collection and Computer-Aided Forensic Examination," *IEEE T-BIOM*, 2025.

[3] **R.A. Bhuiyan**, A. Czajka, "Forensic Iris Image-Based Post-Mortem Interval Estimation," *IEEE/CVF WACV*, 2025.

[4] **R.A. Bhuiyan**, A. Czajka, "ColdIrisNet: Biology-Guided Fusion for Forensic Iris Recognition," *Information Fusion*, under review, 2026.

[5] **R.A. Bhuiyan**, A. Czajka, "Forensic Iris Image Synthesis," *IEEE/CVF WACV Workshops*, 2024.

[6] E. Shahbazi, D. Nguyen, **R.A. Bhuiyan**, A. Czajka, A. Afraz, "Visualizing the Unseen: Perceptographer, an AI Engine for Visualizing Brain-Stimulation-Induced Perceptual Events," *Journal of Vision*, 25, 2025 (abstract).

HONORS & FUNDING

- Best Paper Award, CV4Smalls Workshop, IEEE/CVF WACV 2025.
- NSF-Funded Research: Infant Biometric Identification (Grant 2237880).