

Debojyoti Biswas

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Results-driven ML researcher with 6+ years of experience building and deploying computer vision, robotics perception, autonomous systems, and multimodal AI solutions. Strong hands-on background in taking research prototypes to production using FastAPI, Docker, and AWS ECS. Delivered high-impact projects in 3D object detection, domain adaptation, video anomaly detection, and long-term video understanding using CLIP-based architectures. Skilled in developing scalable pipelines, optimizing models, and collaborating across product, research, and engineering teams.

SKILLS

Coding Tools: Python, C, C++, PyTorch, Tensorflow, OpenCV, LAVIS, HuggingFace, CUDA

MLOps: Docker, AWS S3, AWS ECS, AWS Sagemaker, FastAPI, Kafka

Data Science: Pandas, NumPy, Scikit-Learn, Seaborn, Matplotlib, MySQL, SQLite

Research Domain: Computer Vision, Machine Learning, LLM, Remote Sensing, Gen AI, Intelligent Transportation

EDUCATION

TEXAS STATE UNIVERSITY

San Marcos, TX

Doctor of Philosophy (Ph.D.)

July 2025

Major in Computer Science (CGPA: 3.69/4.0)

Thesis: *Domain Adaptive Small Object Detection with Real-Time Response from High-Variance Remote Sensing Data*

Relevant Coursework: Data Science; Computer Vision; Advanced ML; Deep Learning; Green Computing

NOAKHALI SCIENCE & TECHNOLOGY UNIVERSITY

Noakhali, BD

Bachelor of Engineering

September 2018

Major in Information & Communication Engineering (CGPA: 3.54/4.0)

Relevant Coursework: C; C++; OOP; Algorithm Design; Database; Operating Systems; Artificial Intelligence

WORK EXPERIENCE

Penn State University

State College, PA

Postdoctoral Researcher

Aug 2025 – Current

3D Object Detection for Autonomous Vehicles in Adverse Weather Conditions

- Developed a multimodal 3D object detection pipeline that fuses sparse lidar and radar point cloud data.
- Performed density and sparsity-aware feature extraction during early fusion. Introduced a neighborhood aggregation module to increase context-awareness. With a novel adaptive range-weighted loss function, we improved performance on distant objects and achieved a **3.2% mAP gain** on the **VoD** dataset.

Texas State University

San Marcos, TX

Doctoral Research Assistant

Sep 2021 – July 2025

Small Object Detection from Satellite Imagery

- Developed a deep learning pipeline using **CenterNet2** to detect small and densely packed objects in aerial and satellite images using saliency-aware adaptive difficulty score estimation, customized focal loss, and heatmap-based region proposals.
- To implement the project, we used Python with **PyTorch** and achieved **+1.8%** and **+2.3% mAP gains** over SOTA on **DOTA** and **DIOR** datasets, setting new detection benchmarks.

Paper Link: 10.1109/CICN56167.2022.10008383

Energy Efficient CNN for Object Detection

- Optimized **YOLOv5** for real-time object detection on UAV hardware using compressed convolutions, backbone shrinkage, and scale-aware predictions.
- Reduced **GPU memory usage by 34%** and power consumption by **10W** without compromising accuracy, achieving **63.86% mAP** on the DIOR with a **GFLOPS of 97.7**, enabling deployment in **JetsonTX2** and **JetsonNano** devices.

Paper Link: 10.1109/NAS55553.2022.9925528

Domain-Adaptive Small Object Detection in Satellite Imagery

- Introduced an intermediate domain using **GenAI** to translate from the source to the target domain. Performed feature alignment on local and global features using **contrastive learning** and heatmap-based region proposals.

- Customized the **Detectron2 RCNN** implementation and achieved **+7.4%** and **+4.6% mAP** improvements over SOTA on **DOTA** and **NWPU-VHR10**, establishing a benchmark for domain-adaptive object detection.

Paper Link: 10.1109/TGRS.2024.3391621

Debiased Contrastive Learning for Cross-Domain Object Detection

- Proposed a novel support-guided pseudo labeling using **K-means++** on object-level features, implemented **fine-grained feature alignment** on image and object level for better clustering on feature space with the **debiased contrastive learning**.
- Implemented and deployed using **Python, Pytorch, and AWS (S3 and Sagemaker)**, outperformed SOTA models with mAP gains of **+12.7% (Visdrone)**, **+3.9% (DIOR)**, **+3.2% (DOTA)**, and **+2.1% (UAVDT)**.

Paper Link: 10.1109/JSTARS.2024.3349541

Multimodal Video Anomaly Detection in Drone and CCTV Footage (MMVAD)

- Leveraged the power of **LLMs** to generate captions and design a **vision-language model (VLM)** for anomaly detection using adaptive long-short-term video segmentation (ALSVS) to capture both local and global context in surveillance footage.
- With **attention-based feature fusion** and saliency-aware **contrastive learning**, achieved **+3.8% (drone)** and **+3.3% (CCTV)** AUC improvement over SOTA on **Drone-Anomaly**, **UIT-Drone**, **UCF-Crime**, and **XD-Violence** datasets. Deployed the model with **Docker, AWS ECS, and FastAPI**.

Paper Link: <https://doi.org/10.1016/j.eswa.2025.127857>

Multilevel Prompt-Guided Frame Selection for Long Duration Video Anomaly Detection (MLPVAD)

- Designed a **text-guided frame selection pipeline** using a frozen CLIP Image-Text Matching network to filter task-relevant frames from long surveillance videos, addressing information and memory bottlenecks.
- Proposed a novel **Multi-level Prompt-guided (MLP)** feature learning strategy, outperforming SOTA methods with **88.84% AUC** and **85.37% AP** on **UCF-Crime** and **XD-Violence**.

Leading University

Lecturer

Sylhet, BD

Jan 2019 – July 2021

- Delivered lectures across **12+ undergraduate courses**, tutorials, lab demonstrations, and workshops across undergraduate and graduate courses, fostering strong conceptual and practical understanding.
- Supervised more than **100 student research projects** and served on thesis defense and evaluation committees.
- Contributed to departmental and institutional activities, including exam proctoring, script evaluation, seminar organization, and academic club advising.

AWARDS AND ACHIEVEMENTS

Graduate College Dissertation Fellowship, Texas State University.	2024
Computer Science Research Excellence Award, Texas State University.	2023
Graduate College Scholarship, Texas State University.	2022
Department of Computer Science Scholarship, Texas State University.	2022