

Prantik Howlader

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EDUCATION

- **Stony Brook University** New York, United States
• *Doctor of Philosophy (Ph.D.) - Computer Science (CV); GPA: 3.83/4.00* Aug 2018 - Dec 2025
- **National Institute of Technology, Calicut** Kerala, India
• *Master of Technology - Computer Science; GPA: 8.67/10* June 2014 - June 2016

SKILLS

- **Large (Vision & Language) Models:** CLIP, DINO, SAM, LLaVA, GPT-4, OpenFlamingo, LLaMA, Vicuna, Qwen, RAG
- **Frameworks & Tools:** PyTorch, TensorFlow, Hugging Face, LangChain, Strands-Agents, SentenceTransformers
- **Agent AI & Reinforcement Learning:** Building agent-based AI systems using reinforcement learning for multimodal reasoning, tool use, and decision-making.

RELEVANT RESEARCH PUBLICATIONS

- **VisChain: Vision-Language Segmentation through Chain-of-Reasoning and Tools** [CVPR '26 in review]:
 - Developed a multimodal routing MLLM agent that plans and executes reasoning steps for segmentation tasks.
 - Leveraged vision foundation models as tools to link high-level reasoning with pixel-level segmentation.
 - Integrated reflection-based verification, reducing error propagation and improving segmentation accuracy.
- **CORA: Consistency-Guided Semi-Supervised Framework for Reasoning Segmentation** [WACV '26]:
 - Segmentation of dense, high resolution scenes from complex user text using a multimodal LLM.
 - Enhanced scene understanding and image-text feature alignment by incorporating inter-object spatial relationships.
 - Achieved ~ **4% performance improvement** on natural and medical dataset.
- **Beyond Pixels: Semi-Supervised Semantic Segmentation with Patch-based Multi-Label Classifier** [ECCV '24]:
 - Segmentation in low labeled data environment for class-imbalanced medical and natural image datasets using context.
 - Incorporated contextual information in existing semi-supervised segmentation methods through a patch-based classifier.
 - Improved performance by ~ **2% in least labeled data scenario** across four state-of-the-art semi-supervised segmentation methods for two natural image datasets and also a medical dataset.
- **Weighting Pseudo-Labels via High-Activation Feature Index Similarity and Object Detection** [ECCV '24]:
 - Segmentation in low labeled data environment for natural image datasets using object detector predictions.
 - Introduced consistency between an object detector and a segmentation model to identify reliable pseudo-labels.
 - Achieved ~ **3% improvement in low-label scenarios** across four state-of-the-art semi-supervised segmentation methods on two natural image datasets.
- **Variational Auto Encoder based Class-imbalanced Few Shot Hematopoietic Cell Classification** [MIDL '21]:
 - VAE to generate data for classes with low training data for class-imbalanced Hematopoietic Cell Classification.
 - Developed Relational VAE model incorporating neighborhood relationships to enhance hematopoietic cell classification and generate data for under-represented cell maturation stages, improving robustness.
 - Improved performance by ~ **2.5% for 1-shot setting** in class-imbalanced high-resolution histopathology image dataset.
- **Grad-CAM++: Generalized Gradient-based Visual Explanations for Convolutional Networks** [WACV '18]:
 - Introduced weighted positive partial derivatives of the last convolutional layer's feature maps to improve visual interpretability of convolutional network predictions (Explainable AI).
 - Improved performance by ~ **20% over baseline Grad-CAM** in capturing the most salient features.
 - **Citations: Most cited paper in WACV till date**

EXPERIENCE

- **Amazon** Bellevue, USA
• *Applied Scientist Intern* May 2025 - Present
 - Researching methods to improve customer return experience by generating context-aware visual questions from customer images and product metadata.
 - Developed a multimodal multi-agent system with agentic tools for detection and VQA, using **reinforcement learning to optimize tool selection and reasoning**.
- **Zebra Technologies** New York, USA
• *Machine Learning Researcher* May 2022 - May 2025
 - Researched deep learning-based fake transaction detection using barcodes & partial object views on low-resource devices.
 - Deployed **Transformer (ViT, MobileViT etc) based segmentation networks in memory and computation** constrained grocery self-check-out centers.
- **Amazon** Seattle, USA
• *Applied Scientist intern* May 2020 - Aug 2020
 - Researched improving product recommendations for users using product data and text descriptions in few-shot scenarios.

- Introduced consistency between image features from convolutional encoders (ResNet, AlexNet, VGG etc) and text features from LLM (GPT-2, T5 etc) to improve product recommendation by $\sim 3\%$ in 1-shot scenario.
- **Cisco** Bangalore, India
Software Engineer II Aug 2016 - Aug 2018
 - Developed deep learning models to predict wireless device usage and improve band allocation in congested networks
- **Wipro** Bangalore, India
Project Engineer Dec 2012 - July 2014
 - Worked on layer two network devices. Rack and Blade Server management, upgradation and testing.

OTHER RESEARCH PROJECTS & PUBLICATIONS

- **Segmentation based on User Text Query:** Research focused on alignment of visual features from image encoders (CLIP, SAM etc) with multi-modal features from LLM-based VLMs (LLaVA, GPT-4, OpenFlamingo, and BLIP-2). Introduction of conditional visual prompting improved this alignment, leading to a 6% increase in segmentation performance.
- **Cancer classification based on cancer cell development hierarchical tree:** A constraint based on the hierarchical tree of cancer cell development was introduced, ensuring that cells of similar classes are closer in embedding space if they share the same parent. This additional constraint improved cancer stage classification by $\sim 4.5\%$ in the Hematopoiesis dataset.
- **Unsupervised domain adaptation-based cancer segmentation:** Nucleus classification was introduced as an auxiliary task to better align features from different tissues (Breast, Skin, Lung, and Prostate), leading to an $\sim 3\%$ improvement in segmentation performance across various tissues.
- **Fine Grained Classification:** Introduced Grad-CAM prediction heatmaps to increase attention on salient parts of objects to improve fine grained classification. This led to $\sim 4\%$ improvement in classification performance for CUB dataset.
- **Boundary segmentation:** Introduced entropy of deep network predictions to increase the attention on border regions of objects. This led to 2% improvement in segmentation of border regions in Cityscapes Dataset.
- **Few-shot Classification:** Introduced few-shot object detectors to provide attention to the objects in the image. This led to 3% improvement in 1-shot classification performance for CUB dataset.
- **Cell classification using spatial statistics:** We introduced neighborhood spatial relationship into existing deep learning based classification networks by measuring Ripley's K-function around the cell of interest. We observed $\sim 5\%$ improvement in Haematology cell classification.
- **Challenges in Interpretability of Neural Networks for Eye Movement Data:** Investigated how existing LSTM-based methods for interpreting eye movement data fail to capture the spatial component of eye tracking and the historical context behind a gaze at any given point in time. [ETRA '20]
- **Predicting Facebook-Users' Personality from their Status:** Predicted the BIG5 personality traits of Facebook users from their status updates using regression and topic analysis along with other linguistic features. [ACM, SAC '18]
- **Degree Centrality, Eigen vector Centrality and relation between them in Twitter:** Investigated the variation in indegree and eigenvector centrality of users participating in a hashtag in Twitter, with respect to change in the amount of interactions to find the most influential users. [IEEE, RTEICT, '16]

ACHIEVEMENTS

- Co-authored work "**Grad-CAM++: Generalized Gradient-based Visual Explanations for Convolutional Networks**" is the *most cited paper from WACV conference since its inception*.
- Received research grant from Zebra Technologies for 2022 – 2024.
- Top 5 in machine learning hackathon at Zebra 2023.
- Top 3 in the Cisco Innovation Challenge 2017.
- Secured rank 1 in Wipro programming Challenge in Bangalore.
- Received best performer award in Wipro PRP 2012-2013.

SERVICES

- Reviewer in Conference: ECCV '24, ML4MI '22
- Mentored 2 MS and 1 PhD student

TEACHING EXPERIENCE

Stony Brook University Aug 2018 - May 2019

- CSE310 Computer Networks
- CSE564 Visualization and Visual Analytics
- **Responsibilities:** Creating exam & assignment questions, grading papers, holding office hours

RELEVANT COURSEWORK

- Computer Vision, Natural Language Processing, Machine Learning, Pattern Recognition, Probability and Statistics