Vivekjyoti Banerjee

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WORK EXPERIENCE

Machine Learning Engineer, *Carnegie Robotics LLC* — March 2022 - Present

Minefield Hazard Detection:
- Improve neural network for military application to recognize a variety of buried hazards using Ground Penetrating Radar (GPR) signals and traditional signal processing techniques to improve state-of-the-art detection models by over 10%.
- Rewrite ResNet backbone to create novel fusion block, combining 2d & 3d convolutions on volumetric data
- Develop a 7-stage automated, parallelized, and reproducible pipeline to filter GBs of sensor data and correct inconsistencies, tripling dataset size while reducing data generation time from 30+ hours to 2 hours.
- Reconstruct receiver end-effector positions for a 5-degree of freedom arm to improve and create dense radar data representation for machine learning
- Run ablation studies with multiple backbones, fusion blocks, and data construction methods to uncover the best algorithm for single and multi-class hazard detection

Manifold Visualizer:
- Compare self-supervised constrastive learning vs. momentum encoding vs. self-distillation with no labels frameworks for image retrieval tasks on proprietary data
- Redesign and improve ResNet and vision transformer-based networks to generate embedding spaces
- Design and iterate on a 4-stage parallelized multi-model inference pipeline to generate embeddings for 900+ logs on EC2 using LogQS (cloud storage system for robotic logs) with 50x speedup
- Implement an interactive tool to visualize and explore 3D embeddings spaces of various datasets with Dash
- Generalize visualization tool to be integrated and used for a variety of detection and segmentation tasks
- Manage an intern, create and delegate tasks, and review intern git pull requests

Machine Learning Researcher, *University of Maryland, Center for Automation Research (CFAR)* — May 2020 - Dec 2021
- Design controlled experiments to differentiate twin, fraternal, and sibling faces and measure human accuracy against a neural network developed by the lab during the IARPA Janus program
- Evaluate network's and humans' performance on a variety of viewpoints to conclude that the network performs at the level of the best humans in the study or outperforms them with statistical significance
- Reduce 512-dimensional face feature vectors using t-SNE and principal component analysis to identify similar face clusters used in experiment data
- Co-author and publish journal paper, and present abstract at the Vision Science Society 2022 conference

Big Data Analytics Center Intern, *Bechtel* — June 2021 - July 2021
- Research and apply SOTA document segmentation networks for engineering blueprints and table detection to digitize proprietary data
- Experiment with transfer learning with a ResNet model fine-tuned on company documents to achieve 98% detection accuracy
- Develop synthetic data to leverage the benefits of an annotated dataset to improve accuracy by 10% on scanned data

SKILLS

Neural Networks: ResNet (2D/3D), (Vision) Transformer, (Grounded) SAM, DINO, MoCo-V2, CLIPSeg
Learning Frameworks: (Momentum) Contrastive Learning, Active Learning, Self-Surpervised Learning
Tools/APIs: PyTorch, Git, AWS (EC2), LogQS, Qdrant, OpenCV, Dash, Plotly Express, Pandas
Programming Languages: Python, C++
Spoken Languages: English, Spanish, Bengali, Hindi

EDUCATION

University of Maryland, *College Park*

B.S. Computer Science (Machine Learning Specialization) & B.S. Mathematics — GPA: 3.72
Publications: Twin Facial Recognition, Cancer Research Publications
Honors Program: Quality Enhancement Systems and Teams (QUEST)

PROJECT EXPERIENCE

Programming Projects, *Computer Vision and Data Science* — May 2022 - Present
- Train MoCoV2 (Contrastive Learning framework) to cluster twin faces (Notre Dame twin dataset)
- Create tool to visualize the weights of a trained Neural Network backbone
- Generate data augmentations using CLIPSeg on sparse classes