Santhosh Sankar

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EDUCATION

Master of Science in Robotics   May 2023
Northeastern University, Boston, MA   **CGPA:** 3.838
Coursework: Deep Learning, Reinforcement Learning and Sequential Decision Making, Pattern Recognition and Computer Vision, Mobile Robotics, Robot Sensing and Navigation, Robot Science and Systems

Bachelor of Engineering in Mechanical Engineering   May 2020
Anna University, Chennai, India

TECHNICAL SKILLS

Programming and Query Languages: C++, Python, MATLAB, SQL
Machine Learning and Parallel Programming: TensorFlow, Keras, PyTorch, CUDA, OpenMP
Software Libraries: OpenCV, PCL, numpy, pandas, matplotlib, scipy, scikit-learn
Software Tools and Operating Systems: MySQL, Nsight Systems, ROS, Git, Docker, Windows, Linux

PROJECTS

Chatbot using sequence-to-sequence Transformer   July 2023 - August 2023
- Designed and implemented an end-to-end chatbot based on sequence-to-sequence Transformer with **Python** and **TensorFlow** and a data preprocessing pipeline to extract and process the data for training.
- Trained the model using Kaggle TPUs on Cornell movie dialog corpus with over 200,000 conversational exchanges and improved BLEU score by **3%** with word tokenizer and significant hyperparameter tuning.

Parallel image processing with CUDA   May 2023 - Jun 2023
- Developed baseline sequential code with **OpenCV** in **C++** for processing input images and live video feed with Gaussian, Sobel, magnitude, quantization, and cartoonization filters.
- Accelerated filtering operations using GPU with **CUDA** and profiled code with **Nsight Systems**, optimizing memory access and reducing execution time by at least **75%** from baseline implementation.

Siamese networks with attention for large-scale landmark retrieval   Mar 2023 - Apr 2023
- Devised a data preprocessing pipeline in **Python** that yielded new landmark pairs and similarity scores from 1.6 million images in the Google Landmark Dataset (GLDv2) while training to prevent overfitting.
- Designed and trained Siamese networks in **TensorFlow** on GPU cluster, pairing ResNet-101 with spatial, channel, CBAM, and SE attention modules as subnetworks to retrieve images similar to a given image.
- Achieved **9.46%** higher mAP than the baseline classifier with the SE module and improved the mAP further by **4.4%** with an ensemble of spatial, SE, and CBAM attention modules.

German to English translator using Transformer   Feb 2023 - Mar 2023
- Built a Transformer-based sequence-to-sequence model to perform machine translation from German to English using **Python** and **PyTorch**, with a custom module to compute multi-head attention.
- Trained and assessed the Transformer model on the Multi30k dataset with over 30,000 German translations of English descriptions, achieving a high BLEU score of **78%** on the validation dataset.

Pedestrian tracker and counter using YOLOv3 and DeepSORT   Oct 2022 - Dec 2022
- Constructed YOLOv3 with **Python** and **TensorFlow** utilizing the Darknet-53 architecture to perform pedestrian detection on video frames and incorporated weights pre-trained on the COCO dataset.
- Integrated the YOLOv3 object detector with the DeepSORT algorithm for pedestrian tracking and counting and visualized the pedestrian paths over the most recent 50 frames with a **Python** script.
- Evaluated DeepSORT with YOLOv3 and Faster RCNN on MOT16 benchmark, with YOLOv3 attaining **6%** higher tracking accuracy (MOTA) and **3%** higher tracking precision (MOTP) over Faster RCNN.

Performance comparison of RL algorithms in Super Mario Bros   Oct 2022 - Dec 2022
- Developed and trained DQN, DDQN, and PPO deep reinforcement learning agents to complete one level of Super Mario Bros using **Python** and **PyTorch** and assessed the performance over 1000 episodes.
- Achieved **1%** and **30%** higher success rates, **2.4%** and **22.7%** higher average returns, and **4.1%** and **34.9%** lower mean steps per episode with DDQN and PPO agents, respectively, over the DQN agent.