Vikas Nataraja

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EDUCATION

Master of Science, Electrical and Computer Engineering — ***May 2020***
University of Colorado, Boulder — *GPA - 3.51/4.0*

Bachelor of Engineering, Electrical & Telecommunication Engineering — ***June 2018***
Visvesvaraya Technological University, India — *GPA - 3.6/4.0*

WORK EXPERIENCE

Professional Research Assistant at LASP - *Boulder, CO* — ***December 2019 - Present***

- Leading the ML team in building a new convolutional neural network architecture based on UNet in Keras to retrieve 3D cloud optical thickness from cloud images as part of the NASA ORACLES mission.
- Surpassed current state-of-the-art methods (preliminary) by 22% and **publishing a paper** highlighting the work behind data masking, neural network optimizations, and architecture advances.

Software Engineering Intern at Allvision IO - *Pittsburgh, PA* — ***Summer 2019***

- Developed convolutional neural network models with AWS EC2 instances in Linux using TensorFlow for detection and recognition of license plates using camera and LiDAR data from an autonomous vehicle.
- Achieved an AP score of 0.78 using Faster R-CNN and 0.69 using SSD, both performed using transfer learning and evaluated on COCO detection metrics using AWS S3 for model storage.

Lead Software Engineer at Maxwell CubeSat Satellite - *Boulder, CO* — ***September 2018 – May 2020***

- Designed an Extended Kalman Filter and software drivers for sensors in C and C++ in Linux for attitude determination of satellite to achieve pointing knowledge within ±2° and pointing accuracy within ±10°.
- Led the team's software efforts in implementing coding standards and performing code reviews with efficient workflow distribution and **published a paper** at the SmallSat 2020 Conference.

ACADEMIC PROJECTS

TAMER-ER: Augmenting TAMER with Expression Recognition - *CU Boulder* — ***Spring 2020***

- Developed a model using Reinforcement Learning with Variational AutoEncoder (VAE) to augment facial expressions to TAMER to enhance agent belief and improve experience recall.
- Achieved on-par performance with TAMER and fine-tuned facial classification performance using encoder-decoder (unsupervised learning) models in OpenAI Gym environments.
- *Tools/Technology Used:* Python, dlib, Pandas, TensorFlow/Keras, Git, OpenAI Gym

Fully Autonomous RC-sized Vehicle - *CU Boulder* — ***Fall 2019***

- Developed an autonomous vehicle where I worked on LiDAR and camera-driven perception as well as motion planning optimization using "Follow-the-Gap" path planning algorithm.
- Designed perception algorithms using 2D RPLiDAR and RealSense cameras for vision and depth perception on an Nvidia TX2 GPU using ROS with OpenCV.
- *Tools/Technology Used:* Python (OpenCV), C++, TensorFlow/Keras, ROS, CUDA, Git

AV Lane Switching using Monocular RGB Camera Data - *CU Boulder* — ***Spring 2019***

- Developed a convolutional neural network model using UC Berkeley DeepDrive dataset in Python to enable autonomous vehicle decisions including lane switching using camera (RGB) data only.
- Created and experimented with Decision Trees, Random Forests, Logistic Regression, and Gradient Boosting and Bagging machine learning models to establish a baseline of 82% accuracy.
- *Tools/Technology Used:* Python (Scikit-Learn, OpenCV), Pandas, TensorFlow, Git

Pedestrian Detection and Tracking for Autonomous Vehicles - *CU Boulder* — ***Spring 2019***

- Developed object tracking algorithms to detect and follow pedestrian movement across a steady video stream from a camera of an autonomous vehicle.
- Designed a Histogram of Oriented Gradients with contour matching model for human detection and Kalman Filter for tracking using Python to find and predict pedestrian movement in a video stream.
- *Tools/Technology Used:* Python (OpenCV, HOG), MATLAB (Computer Vision System Toolbox), Git

PUBLICATIONS

1. Aaron P. Aboaf et al. A Methodology for Successful University Graduate CubeSat Programs. *Smallsat 2020.*
2. **Vikas H. Nataraja**, Hong Chen and Sebastian K. Schmidt. Cloud Optical Thickness Retrieval using Deep Neural Network Segmentation based on 3D Radiative Transfer. 2021.*