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ABHINAV RAI

Work Experience

National University of Singapore – Research Assistant (Prof Angela Yao) Sep 2019 - Present

Interactive Segmentation -

- Design an interactive neural network that extracts relevant object from the image using user clicks as guidance maps.
- Used superpixels and object proposals to further improve the accuracy of the network.

Hi-Tech Robotic Systemz – Research Engineer June 2017 – June 2019

Forward Collision Warning (FCW) System:

Association and Tracking -

- Developed motion (i.e by Kalman Filter) and visual cues (i.e. Custom Local Binary Pattern (LBP)) for the obstacles in the environment and thus associating the detections over the frames.
- Designed and developed CUDA Implementation for the Custom LBP feature and its weighted histogram.
- Implemented Kalman Filter and Hungarian Algorithm using SIMD instructions.

Depth Computation -

- Computed Disparity Map for Stereo camera using Block Matching algorithm. Implementation done using CUDA and SIMD.
- Computed Depth of obstacles using Pin-Hole Camera Model for Monocular camera.

Semantic Segmentation -

- Modified ResNet Architecture by adding Feature Pyramid Network for accelerated training and incremented accuracy.

Automatic Calibration -

- Designed and developed Focus of Expansion (Fuzzy FOE) algorithm for auto calibration of camera on a vehicle.

Joint Object Detection and Segmentation -

- Designed a neural network to simultaneously detect obstacles on the road and segment out the drivable region
- The network was inspired from SSD with MobileNet as base network for speed optimization.

Autonomous Driving Vehicle:

Object Detection (Traffic Light) -

- Designed a neural network architecture for object detection inspired from SSD and deployed it on Jetson TX1.

Dynamic Obstacle Avoidance for Autonomous Vehicle –

- Hands on experience on sensors such as, Velodyne (LIDAR), stereo cameras, GPS/INS etc.
- Worked on PCL (Point cloud library) for extracting and analyzing LIDAR data.
- Used MoveBase package (provided by ROS) for vehicle navigation.

Technical Skills

- Programming Languages – C/C++, Python, Java, PHP
- Experience with Ubuntu and Shell Scripts
- Parallel Programming using CUDA, SIMD instructions and OpenMP
- Image Processing and ML/DL Libraries such as OpenCV, Keras, Tensorflow and Caffe.
- Robot Operating System(ROS), PCL, Eigen library.

Education

- Master's in Artificial Intelligence – National University of Singapore (Expected Graduation Dec 2020)
- Bachelor of Technology (Computer Engineering) – Jamia Millia Islamia University, New Delhi (8.71 GPA)
- CBSE Senior Secondary Examination – 90.2% CBSE Secondary Examination – 9.4(CGPA)

Achievement

Smart India Hackathon April 2017

- Led the team that devised a solution for the Aviation Ministry to prevent the entry of drones into the air space or areas defined as restricted zones.
- Won the first prize in the hackathon event organized by the Government of India in which over 7000 teams participated.

Publications (Elsevier Journal)

- Detecting distraction of drivers using Convolutional Neural Network, Pattern Recognition Letters, 2018, ISSN 0167-8655, (https://doi.org/10.1016/j.patrec.2017.12.023).

Open Source Contributions(Shogun Machine Learning Toolbox)

- Contributions include parallel code implementation using OpenMP and implemented the Scala Interface for the toolbox (https://github.com/shogun-toolbox/shogun/blob/develop/NEWS#L133).

Projects

Pixelate

- Designed an algorithm to solve a given maze using an overhead camera and then guide the bot through the correct path.

Squad

- Developed Android Application to control Aerial Vehicle using mobile devices.
- Image processing algorithms such as face detection and object tracking. were incorporated in the UAV.

Motor Control Using Reinforcement Learning

- Used Deep-Learning based Reinforcement Learning Techniques to train a musculoskeletal model built using OpenSim to perform basic tasks such as standing on both or single leg, crouching etc.