

# VARUN SHIJO

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## EDUCATION

**University at Buffalo, Buffalo, NY** - MS in Computer Science (2017-19)

**University of Mumbai, India** - B.E in Information Technology (2013-17)

## EXPERIENCE

**Intern: Drona Aviation Ltd, IIT Bombay, India Jun 2016 – Jul 2016**

- Researched and prototyped optic flow analysis for the Pluto nanodrone using a mouse sensor thus improving in-flight stabilization.
- Added failsafe landing sequence protocols to the nanodrone based on RSSI and voltage estimates eliminating crashes due to low battery and signal loss.
- Researched and prototyped push-prop integration feasibility for high speed flight.
- Technologies used: OpenCV, Embedded C (CleanFlight), Raspberry Pi (Prototyping), NumPy

### **Publication:**

- "Artificial Intelligence based Autonomous Robot" in International Journal of Scientific & Engineering Research (IJSER), April 2017.

## PROJECTS

### **Hand PointNet**

**PyTorch, NumPy**

- Implemented model described in paper by Ge et. Al. For hand pose estimation with a reduction in error by 0.2 mm from 8.5mm to 8.3mm by addition of a decoder.

### **Urban Sound Classification**

**TensorFlow, NumPy, librosa**

- Studied the implementation and performance of different architectures to classify sounds from the UrbanSound8K dataset.
- Implemented the solution using Multilayer Perceptron and LSTM network using features extracted from the audio manually.
- Implemented the solution as a computer vision problem by converting the audio to spectrograms and passing it to a CNN.

### **Collaborative Mapping using Robot Swarms**

**ORB-SLAM, Python + OpenCV**

- Implemented a proof of concept for concurrent mapping using multiple RPi camera feeds, speeding up mapping of large areas using ORB-SLAM
- Implemented realtime camera streaming at 30 fps over sockets with MJPEG.

### **Spatial Pyramid Matching for Scene Classification**

**MATLAB Image Processing Toolbox**

- A system that uses bag-of-words(BOW) approach for classifying a scene based on heuristics gained by the train data sets.
- Classified images via K-means clustering, to represent them in the form of visual words and generated a dictionary.
- Extended the model to a Multi resolution pyramid matching system along with a model evaluation metric. Average accuracy was 56%.

### **Amazon Dynamo-based Key-Value Storage**

**Android, Java**

- Designed and developed real-time messaging app with multi-cast capability along with failure detection and recovery, based on Amazon Dynamo for distributed key-value storage for replication.
- Implemented FIFO and total ordering to ensure messages are received in the same order across all devices.

### **Image Domain Automatic Music Transcription**

**Keras+TensorFlow, librosa, NumPy**

- Implemented an end-to-end CNN that takes in spectrograms of music and transcribes the notes that make up the song.
- The dataset used was the MAPS MIDI dataset

### **Pintos - Basic OS Kernel**

**C, gdb**

- Implemented priority scheduler, user program stack, syscall handler and paging.

### **Autonomous Mobile Mascot**

**Python, OpenCV, Java Kinect, PocketSphinx, Raspberry Pi**

- Implemented face detection, gesture recognition, object tracking, speech recognition, TTS, path planning and obstacle avoidance for a mobile mascot robot.

### **VR streaming**

**C++, OpenCV, Python**

- Implemented wireless streaming to a VR headset from a camera mounted on a robot car to provide FPV driving experience.
- Implemented warping and offsetting of images to induce parallax distortion for VR depth illusion.

## SKILLS

- **Programming Languages:** Python (Proficient), MATLAB, Java, C, C++.
- **ML/AI:** PyTorch, Keras+TensorFlow, Pandas, Numpy, sklearn, SciPy
- **Computer Vision/Image Processing:** OpenCV, PIL
- **Robotics:** ROS, ORB-SLAM
- **General:** Linux, Git