Simulating Self-driving Cars: Traffic Sign Recognition

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Robot Overlords

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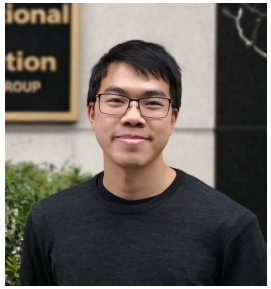
Team Introduction

Please welcome your new Robot Overlords

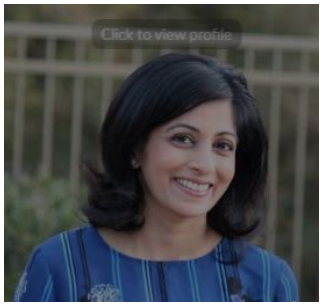
Francis Anthony Leung

- Venture Capital



Swati Akella:

- Managed Services



Matt McElhaney:

- Data Science / Innovation O&G

Motivation For Project

- Tremendous efforts by companies to make self-driving cars operational
- Autonomous cars should:
  - Accurately detect and identify a traffic sign
  - Make suitable decision
- **We wanted to be a part of this effort!**

Dataset

German Traffic Sign Recognition Benchmark

- European traffic signs
- Size: 422 mb
- More than 39,000 images
- 42 classes
- Single image multi-class image classification

Mapillary Traffic Sign Dataset

- Traffic signs across the globe
- Size: 47.1 gb
- More than 52,000 images
- 312 classes
- Object detection

Object Detection

Object detection training on Mapillary dataset

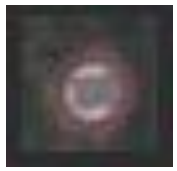
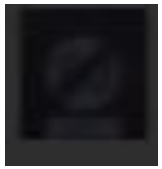
- Uploading the dataset to Object Storage took a while
- Not all images had annotations and vice versa
- Annotated objects boundary outside image size
- Self annotated a subset of images
- While training, Tensorflow Object Detection model encountered multiple deprecation issues

Object Detection

Dataset Preprocessing and Augmentation

Variation in Training Data

- Shortlisted 10 classes for training
  - Speed limit signs, stop sign and yield
- Images taken in variety of lighting and weather conditions
  - Images taken at a distance
  - Images taken in poor lighting

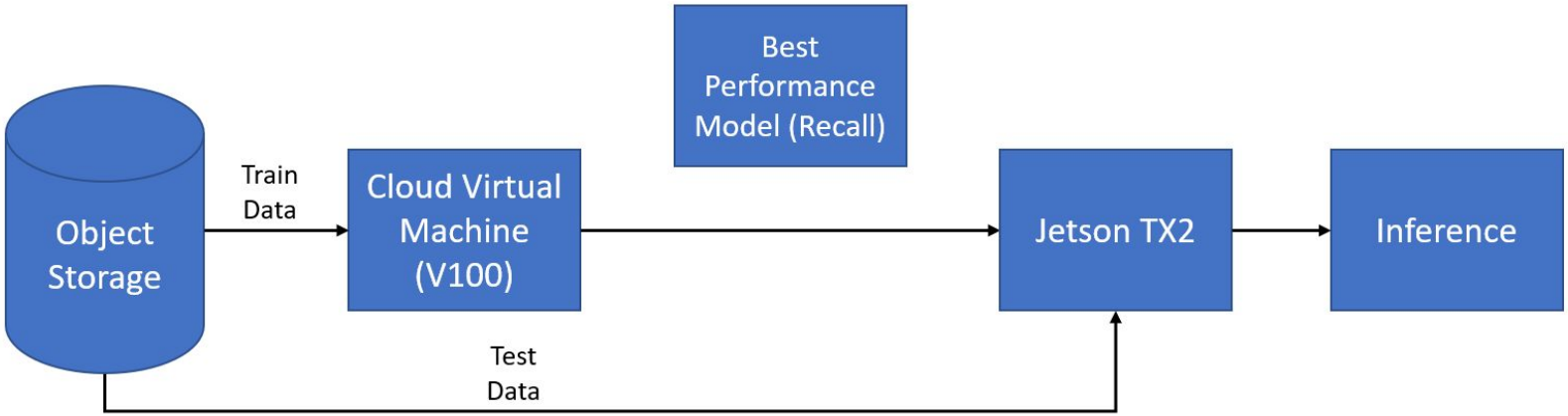




- Dataset Augmentation
  - Cropped Images from Mapillary dataset
  - Added translations, rotations (clockwise/counterclockwise), noise and blurring
- Training - 17,250 images
- Validation - 4,310 images

Model Selection

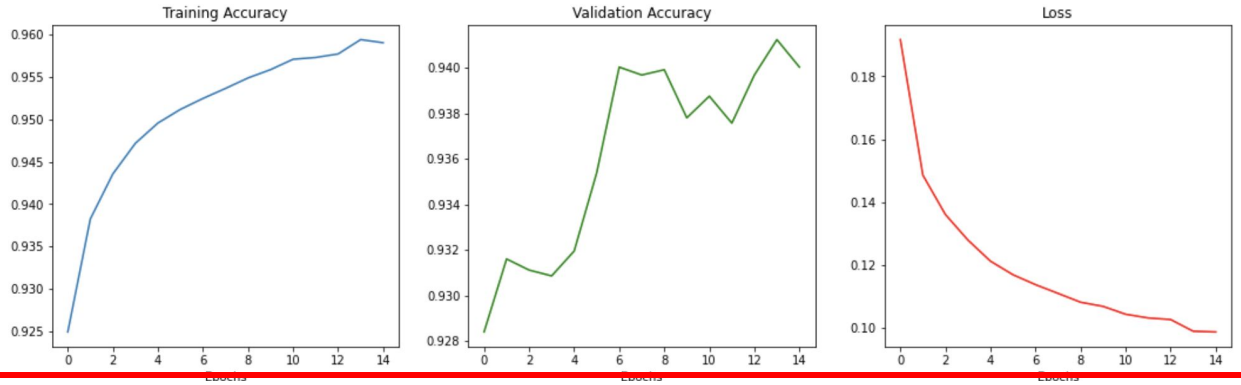
- Approach:
  - Transfer learning with Google's pre-trained models
- Candidates:
  - Inception V3
  - ResNet V2 (101 Layers)
  - Inception-ResNet
- Methods:
  - Keras Feature Extractor
  - Keras Data Generator

Training in the Cloud

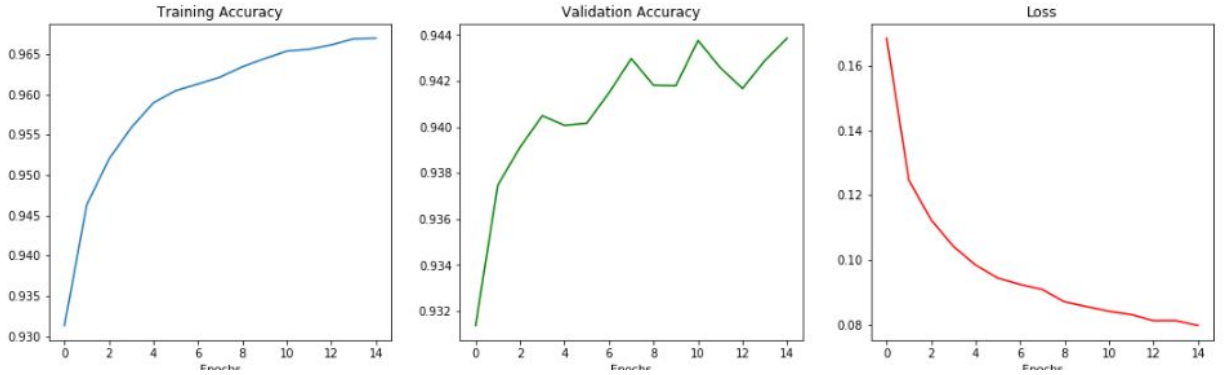


Validation Results

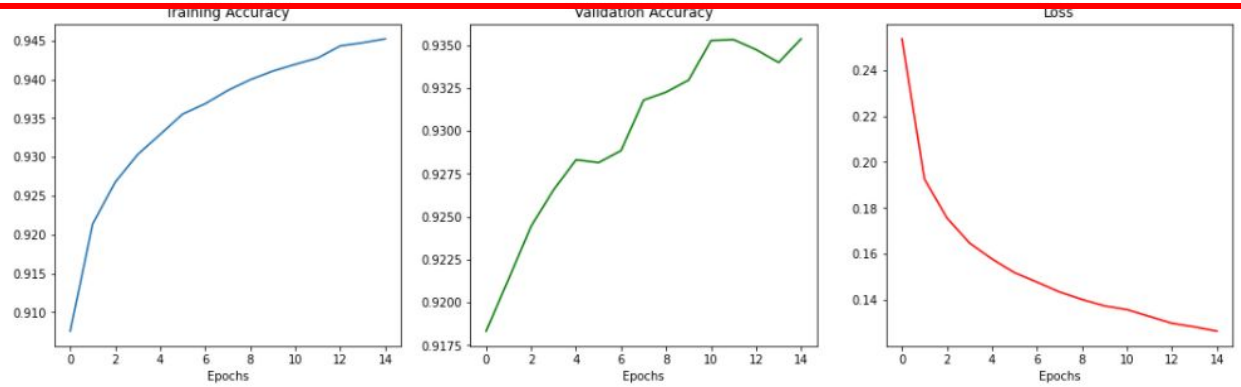
Inception V3



ResNet 101

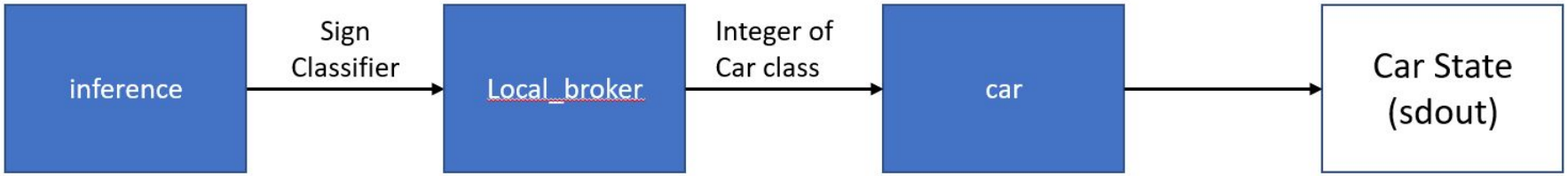


Inception - Resnet



Executing on the Edge

End to End Architecture



Packages:
- Tensorflow
- Python 3
- Pillow
- Mosquito

Software:
- Inference script
- Trained model
- Test Route

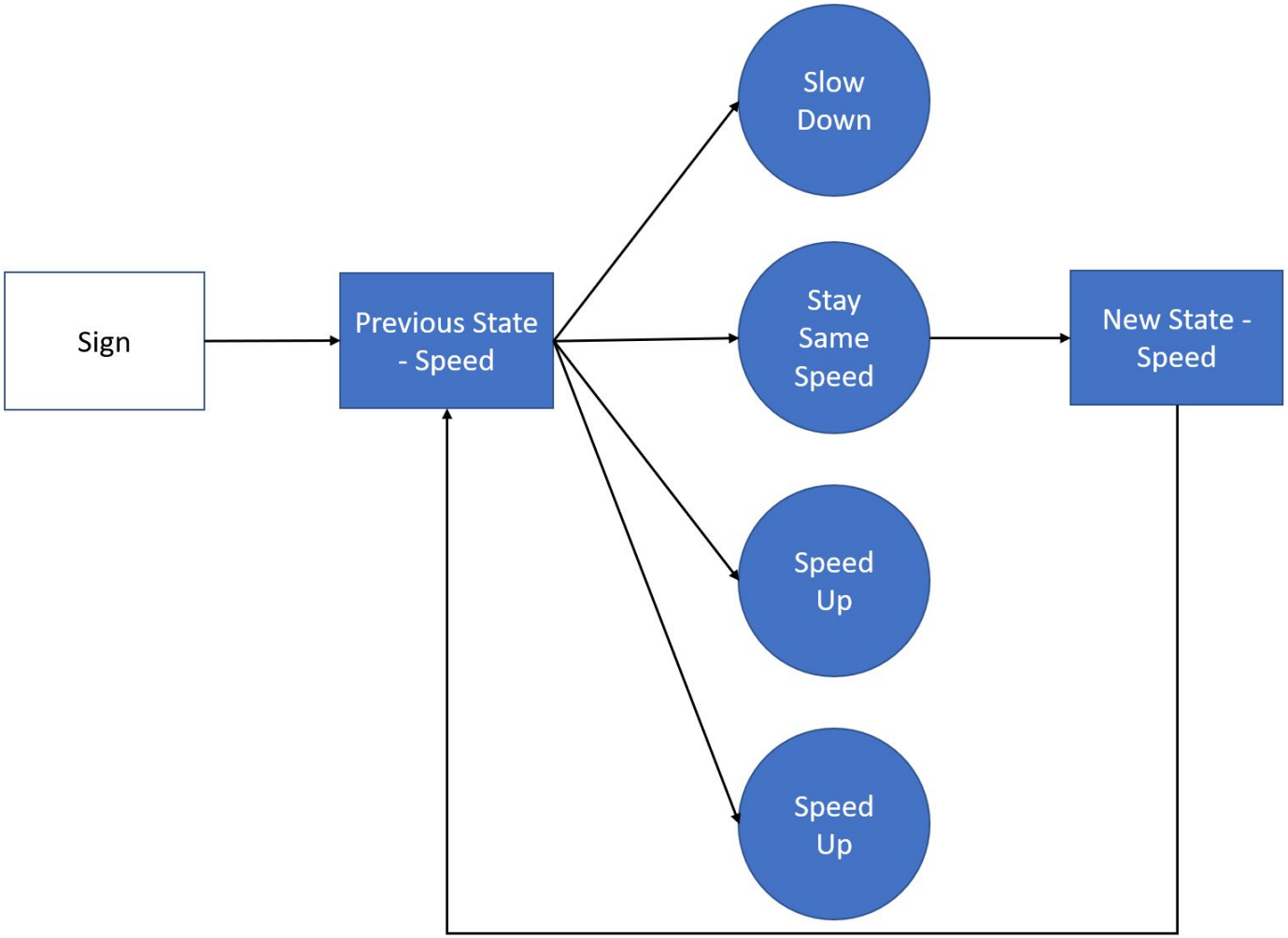
Packages
- Alpine
- mosquito

Packages
- Alpine
- Python3
- Simplejson
- Mosquito

Software:
- Car class
- Keys.json

Executing on the Edge

Creating a Car Class



Test Results

- "Test Route" of 18 images unseen by model
- Video Recording: Inference On Jetson

Takeaways and Future Scope

- 39% accuracy not good enough
- Having enough high quality training data is very important
- Another attempt at object detection

Questions?