# Simple Smart-Driving Skill Evaluation System

Yuan-Pu Hsu  Tianxiang Sun  Department of Electrical engineering , University of California Riverside
Instructor: Salman Asif

## Introduction:

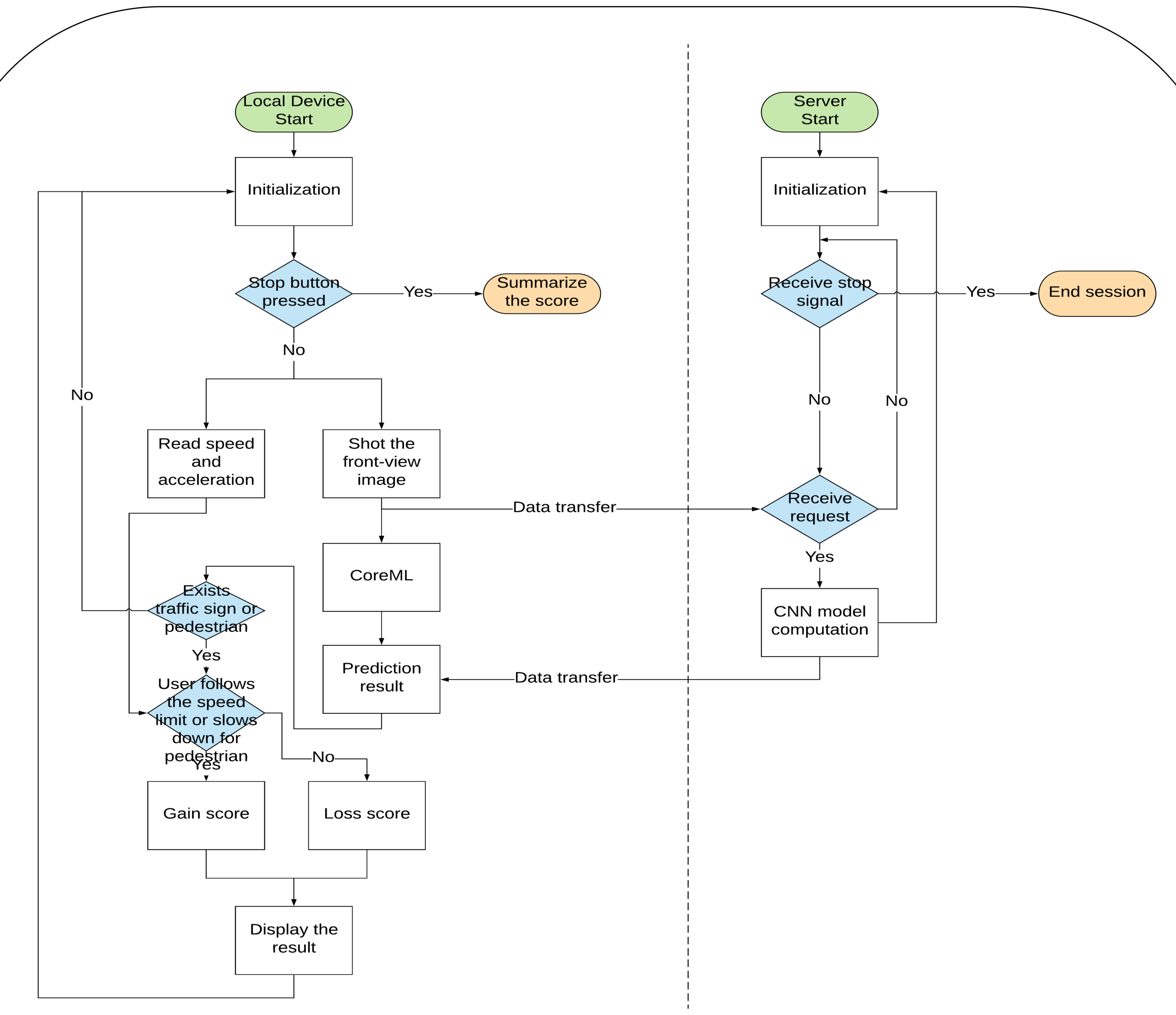
Since driving has became an indispensable portion of American's daily life for decades, we want to make a simple system to evaluate driving skill of drivers. By using this system, users would get their own driving skill scores after finishing a tour. The information is valuable for the users themselves and insurance companies. In our project, we built an application on mobile devices, and made it as a platform to be put behind the windscreen of the vehicle to recognize and analyze different patterns on the road. Specifically, the patterns we recognized in our project are restricted to traffic light and different kinds of traffic signs via convolutional neural network, with 99.8\% accuracy. Furthermore, taking advantages of GPS and accelerometer on the phone, it can automatically compare the speed of the car and the recognized traffic signs to give the score in real-time.

## Related Work:

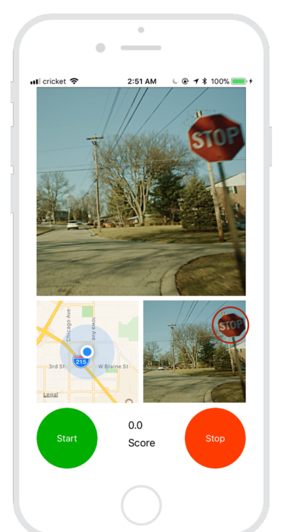
When it comes to the details, we want to build an application in the smart phone (in our case, iPhone). The user can place the device behind the front windscreen, and let it automatically analyze the image and recognize different patterns on the road. In this project, we restrict the targets within the vision to traffic lights, stop signs, speed limit signs, and pedestrians. Besides, we will take advantage of the GPS and accelerometer on the phone to calculate the speed and acceleration of the car. After comparing the speed of the car and patterns gotten by the mobile device, we can evaluate his/her driving score by the information. For example, if the user did not slow down while meeting a pedestrian, he/she would lose some points; if the user drive smoothly for a period of time, he/she would gain some points.

Mainly, we are going to implement Convolutional Neural Network (CNN) for pattern recognition with the method by Shustanov, A. et al., Habibi Aghdam, H,. et al., and optimize the speed for real-time scenario with the method of Kardkovacs, Z. et al. We want to use the dataset called German Traffic Sign Recognition Benchmark (GTSRB) and LISA dataset as the training set of traffic signs. On the other hand, we are using cascade classifier by Angelova, A. et al. to detect pedestrians for low latency with Caltech dataset.

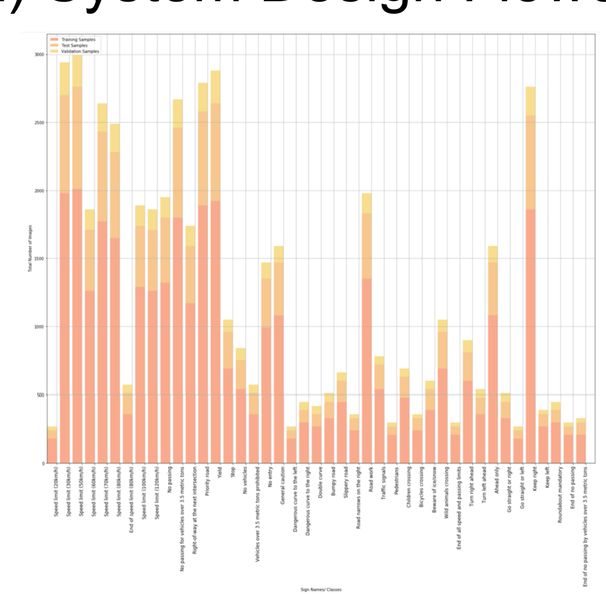
## Implementation:




a) System Design Flowchart



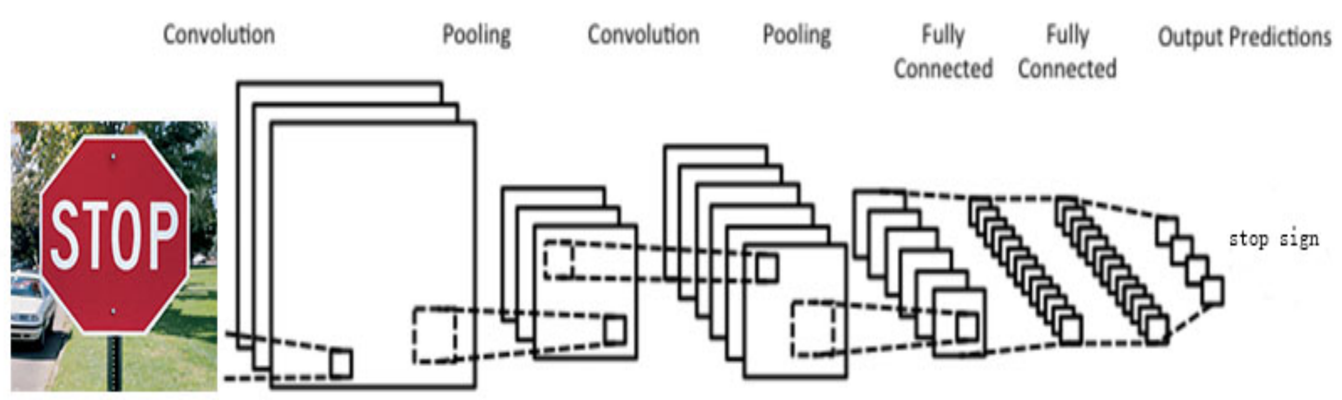
b) Designed iOS app



c) Dataset Distribution

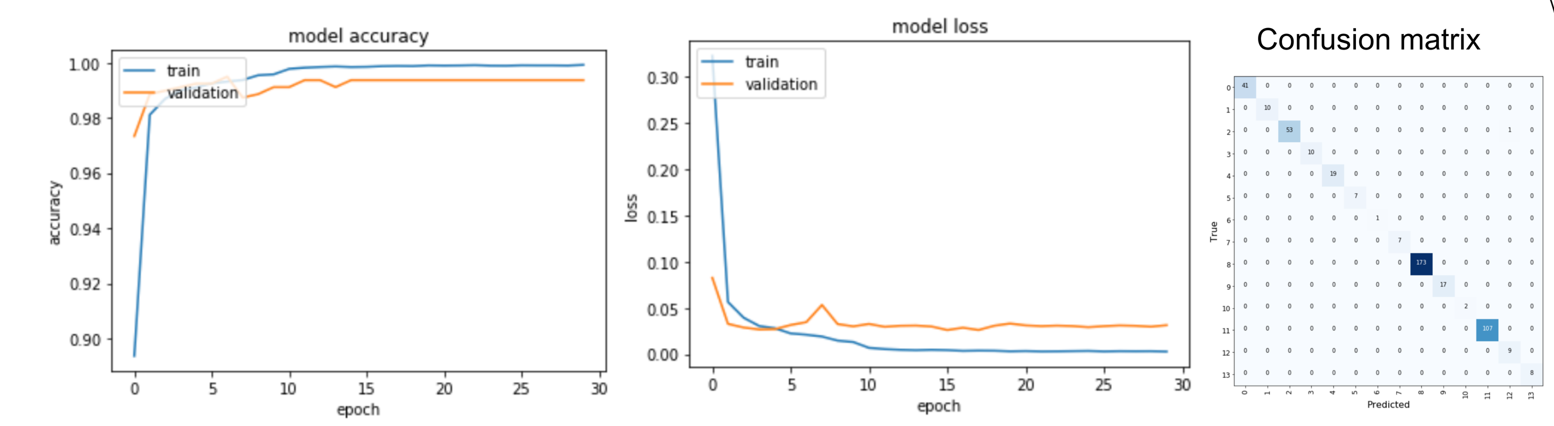
d) Examples of The Dataset

## Convolutional Neural Network

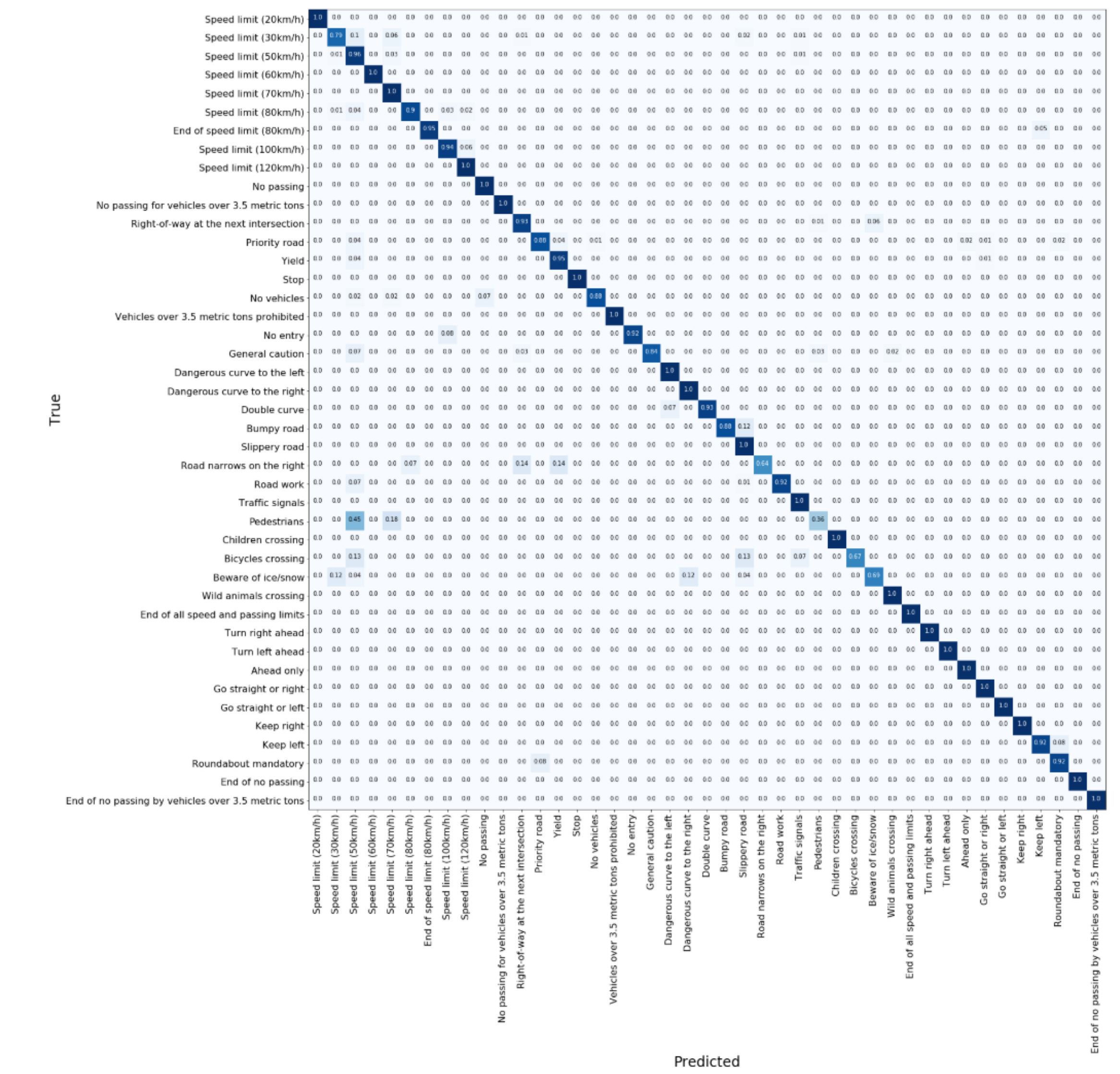



## Evaluation and Result:

### I) 6 layers CNN model with LISA dataset




### II) VGG model with GTSRB dataset




## Conclusion:

1. 6 convolutional layers, 3 max-pooling layers, 3 drop-out layers, 1 fully-connected layers with softmax, trained by LISA Dataset, achieved testing accuracy: 99.8%
2. VGG-based neural network, trained by GTSRB dataset, achieved testing accuracy: 94.6%
3. Completely integrated to iOS app coreML and feasible for real-world implementation