CS229
Machine Learning
Team #924

Be Alert! Accidents Hurt!

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Introduction

- Driving distraction has always been a driving safety issue.
- With the goal of detecting driver distractions, we want to design a driver posture classification system—classify the input image into 10 classes, such as texting, drinking, etc.
- Fully Connected Neural Network (FC), Basic Convolutional Neural Network (CNN), Transfer learning using VGG-16 and Inception-v4 are compared in this classification problem.

Data

- Use the dataset provided by the State Farm in the Kaggle Challenge. Consists of mages (640x480 pixels RGB) with different drivers' behaviors.
- Train set contains 22,400 labeled images, test set contains 79,727 unlabeled images.

- Use K-folds cross-validation method to split training data into training set and validation set.
- Resized the images from size 640x480x3 into 150x150x3.

Method

- We use the log loss function given as follow:

$$logloss = -\frac{1}{N}\sum_{i=1}^{N}\sum_{j=1}^{M} y_{ij} log(p_{ij})$$

Models

Fully Connected(FC)

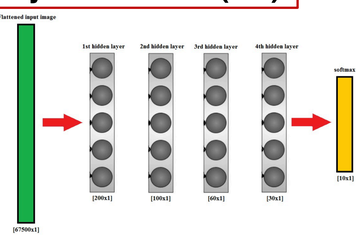


Fig.1 FC neural network architecture

Basic CNN

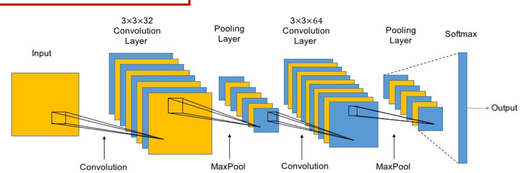


Fig.2 Basic CNN architecture

VGG-16

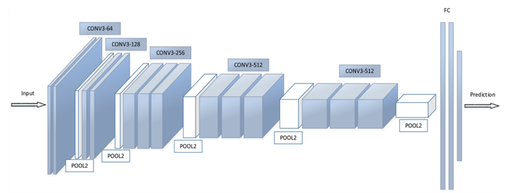


Fig.3 VGG-16 architecture

Inception-v4

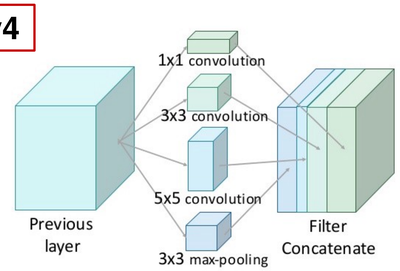
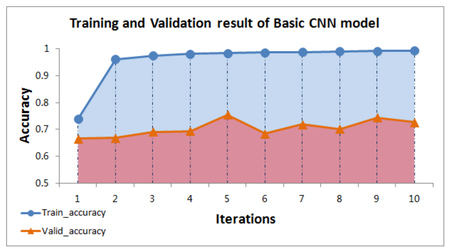


Fig.4 Inception-v4 architecture[3]

Results & Analysis

Models	Epoch	Batch Size	Validation Accuracy	Validation Loss	Kaggle Score
VGG-16	15	16	85.01%	0.4954	0.64
Basic CNN	20	64	74.38%	1.2081	1.32
Fully Connected	20	64	11.4%	6.1	6.8
VGG-16 + KNN	15	16	86.23%	0.4523	0.58

Table 1 Results comparison of different models



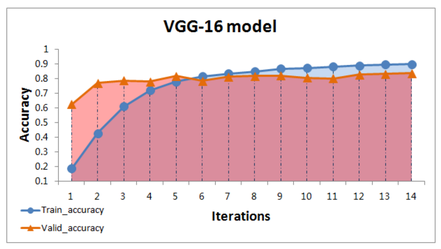


Fig.5 Train & validation accuracy using basic CNN and VGG-16

Confusion Matrix

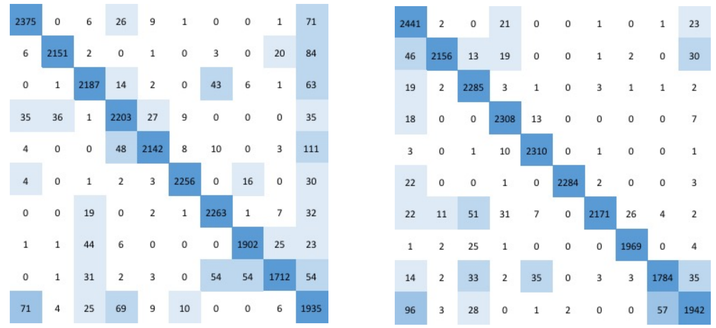


Fig.6 Confusion matrix using basic CNN(left) and VGG-16(right)

Summary

- **Fully Connected Neural Network**: High bias with the lowest accuracy and Kaggle score. Deeper and more complicated model should be proposed.
- **Basic CNN**: Improve performance dramatically but still have serious overfitting problem. We use adam optimizer with learning rate 0.001and trained the model with 20 epochs.
- **VGG-16**: Relatively low bias with high overfitting problem. We use adam optimizer with learning rate 0.001 and trained the model with 15 epochs.
- **VGG-16 + KNN**: Improve VGG-16 model a little bit but still need future improvement.

Ongoing & Future Work

- Perform the data augmentation
- Currently training and debugging Inception-v4 model.
- Pseudo Labeling

Reference

[1] cs 229 http://cs229.stanford.edu/proj2016/report/SamCenLuo-ClassificationOfDriverDistraction-report.pdf
[2] Kaggle. State Farm Distracted Driver Detection. https://www.kaggle.com/c/state-farm-distracted-driverdetection/data
[3] https://github.com/jonas-pettersson/fast-ai/blob/master/statefarm.ipynb