Machine Learning Engineer Nanodegree

Capstone Proposal

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Proposal (Accident Prevention)

Domain Background

An accident is an unplanned event that results in injury, deaths, damage to property or some other losses. Accidental Deaths can be classified as deaths due to forces/factors of the nature termed as 'Natural Accidental Deaths' or due to deliberate or negligent conduct of human beings, 'Un-natural Accidental Deaths' or due to causes not covered in the above two categories and with no initial apparent cause of deaths categorised as 'Other Causes of Deaths' like poisoning, sudden death etc.

According to National Crime Records Bureau (NCRB), traffic accidents are around 53% of total accidental deaths. According to accidental death report digitised by NCRB in 2015 (http://ncrb.gov.in/StatPublications/ADSI/ADSI2015/chapter-1%20accidents.pdf), there has been 4.9% increase in traffic accidents from year 2014 to 2015 as shown in table below:

Cause	2014			2015			% Variation during 2015 over 2014
	No.	% Share	Rate (No. of deaths per 1,00,000 population)	No.	% Share	Rate (No. of deaths per 1,00,000 population)	4.9
Traffic	1,69,107	53.4	13.6	177423	52.8	13.4	

According to https://www.prsindia.org/policy/vital-stats/overview-road-accidents-india 18-34 year olds are most affected by these traffic accidents. This age group is the most productive group for any country. Losing them can affect the growth of country. This is the reason I was motivated to do this project to help prevent dome accidents.

Problem Statement

Given a dataset of dashboard camera images, an algorithm need to be developed which can estimate if any driver is not driving properly and can lead to an accident. Algorithm should be able to detect driver's behaviour like on phone, texting, etc.

Datasets and Inputs

Driver images taken in a car with a driver doing something in the car (texting, eating, talking, on phone, etc.) are taken as input.

The 10 classes to predict are:

0. Safe driving
1. Texting – right
2. Talking on the phone – right
3. Texting – left
4. Talking on the phone – left
5. Operating on radio
6. Drinking
7. Reaching behind
8. Hair and Makeup
9. Talking to Passenger

Following files have been received from Kaggle State Farm Distracted Driver Detection Competetion (https://www.kaggle.com/c/state-farm-distracted-driver-detection/data)

- driver_imgs_list.csv: a list of training images, driver id and class id
- sample_submission.csv: a sample submission file in the correct format
- imgs.zip: zipped folder of all (train/test) images

Solution Statement

Will implement a CNN using Tensorflow/Keras to detect the behaviour of driver in images. Will try to optimize the CNN using multi-class logarithmic loss. Prediction score will be calculated and validated on test data.

Benchmark Model

The model with the Public Leader board score of 0.08690 will be used as a benchmark model. Will try to be among top 50% of the Public Leader board submissions.

Evaluation Metrics

Submissions are evaluated using the multi-class logarithmic loss. Log Loss takes into account the uncertainty of your prediction based on how much it varies from the actual label. For each image, you must submit a set of predicted probabilities (one for every image). The formula is then,

$$logloss=-1N\sum i=1N\sum j=1Myijlog(p_{ij}),$$

where N is the number of images in the test set, M is the number of image class labels, log is the natural logarithm, y_{ij} is 1 if observation i belongs to class j and 0 otherwise, and p_{ij} is the predicted probability that observation i belongs to class j.

The submitted probabilities for a given image are not required to sum to one because they are rescaled prior to being scored (each row is divided by the row sum). In order to avoid the extremes of the log function, predicted probabilities are replaced with *max(min(p,1−10−15),10−15)*.

Project Design

(approx. 1 page)

Computer vision will be used to obtain the solution. CNN will be used for the implementation. Tensorflow/Keras libraries will be used to implement CNN.

Initially data exploration will be carried out to understand possible labels, range of values for the image data and order of labels. Then pre-processing of data will be done based on data exploration result. Data randomization will be done to get better predictions.

Finally predictions on test data will be done and evaluation will be done on same.