Configuration Manual

MSc Research Project
Research Project

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MSc Project Submission Sheet

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Lecturer:	Dr Catherine Mulwa
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Configuration Manual

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1 Introduction

This Manual will give detailed information of Software setup and all hardware requirements that are needed to build the whole system from the models. The Configuration Manual will give replica of the work that has been done in the research by using practical way. Here all the evaluations done in the code are attached with the interface.

Basically, Configuration Manual will contain 6 parts without including Introduction. They are:

1. Environmental Setup
2. Libraries
3. Dataset Description
4. Interface
5. Evaluations
6. Code Description

2 Environmental Setup

2.1 System Hardware Configuration

8GB RAM
512 GB HDD
1.6 GHz Intel. Core I5
Cores 4

2.2 Software Requirement

Windows 10
Python 3.8.9

3 Libraries

In this chapter I have included the libraries that are used in the python.
Required packages that need to be installed

```
pip install tensorflow-gpu
pip install matplotlib
pip install pandas
pip install scikit-learn
pip install random
pip install itertools
```

TensorFlow
The main purpose of the TensorFlow is to do the numerical computation fast and it is a base library that is used to create Deep Learning models directly.

Pandas
It is widely used library in the python environment and it is the inbuilt library in python which is easy to use and handle the data including academic and commercial purpose for statistics, analytics etc.

Matplotlib
It is the visualization package which widely used in the python to make plots from data or images. It can be used in the web application servers.

Itertools
To iterate over data structures that can be walked over using a for-loop, Python's Itertools module is utilized. Iterables are also known as iterable data structures. Efficiencies in the use of computing resources are built into this module. As a result of using this module, the code is more readable and maintainable. Before utilizing it in the code, the itertools module must be imported.

Random
Integers are chosen from a range in the same way. For sequences, there is a function that randomly picks an element, a function that makes a random permutation of a list in place, and a function that randomly picks a new element.

4 Dataset

Basically, the data I have choose is in the video format and the video was braked or trained into the images. Video which is trained is around 70minutes.
After that the Data is prepared for the pre-processing and next data is split into test and train dataset and then code is executed. Dataset used for this project is very large so for the access of data I have given drive link below through which dataset can be accessed. The dataset in google drive is named as “Datasets.zip”.

https://drive.google.com/file/d/1sWvKhOG-d2jI3ZFImgwfTeIsVef35n_L/view?usp=sharing

5 Evaluation and Code

As I have huge amount file in my zip for the artefact, I have uploaded my entire code part in the google drive and link is given below:

https://drive.google.com/file/d/1v2HnmaC_j0uUniIYvO0VDKBs3K43F3kJ/view?usp=sharing

```
images_path = "/driving_dataset/"
Steer_angles = "/driving_dataset/data.txt"

images = []
Angles = []
```

Figure 1 Snippet of the Data Preparation

Fig 1 shows the data paths and for measuring image paths we will use images and for the prediction of steering angle we use angles.

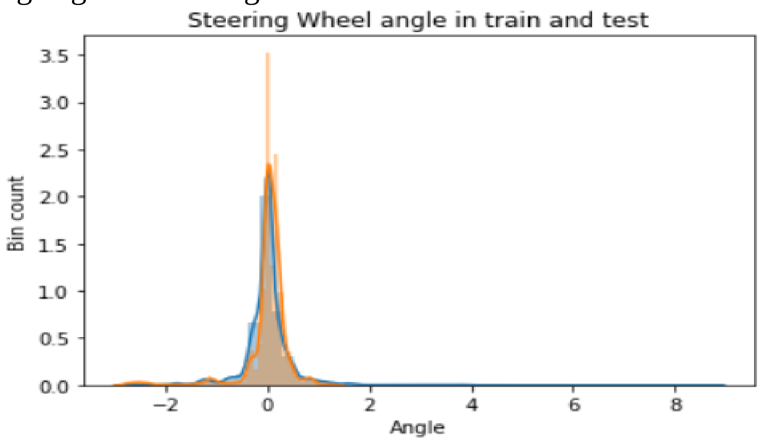

Figure 2 Steering Wheel angle test and train

The above Fig 1 gives us the overview about test and train data of the models. Data is train and test into 80:20 ratio.

```
Total Input Images in Train set : 36324
Total Output Values in Train set : 36324
Total Input Images in Test set : 9082
Total Output Values in Train set : 9082
```

Figure 3 Dimensions of data

In the above fig 3 the values of train input images and train output images and as well as test input images and test output images are mentioned.

CNN	Convolution Layers	Kernels	Learning Rate	Epochs
PilotNet	5	24, 36, 48, 64, 64	Adam =0.0001	30

Figure 4 Learning rate of Pilot Net

The above Fig 4 will help to study deeply about the CNN, layers, kernals, learning rate, epochs.

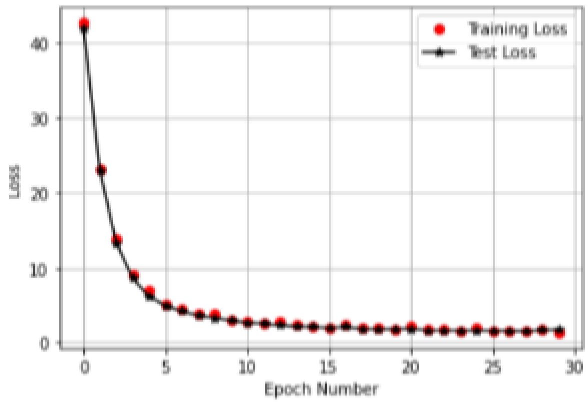

Figure 4 Train loss for pilotnet

The above Fig 4 will showcase the training loss where the x axis shows us the number of epoch and y axis will show the loss. Figure 5 will tells us about average of training loss but both of them have no much difference.

```
Avergae Training loss =  5.186817431891959
Avergae Training loss =  4.995085770224532
```

Figure 5 Avg training loss of Pilot Net

CNN	Convolution Layers	Kernels	Learning Rate	Epochs
PilotNet-2	5	24, 36, 48, 64, 64	Adam =0.001	10

Figure 6 Learning rate for Pilot Net for 10 Epochs

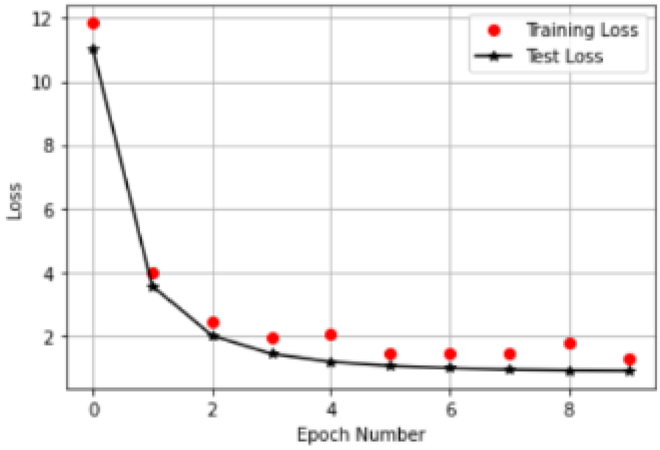

Figure 7 Train and test loss for Pilot Net for 10 epochs

Above Fig 6,7 showcases the CNN, kernals, learning rate, Layers, Epochs but in this case, we have reduced the epochs to compare the variations when there are high epochs and less epochs.

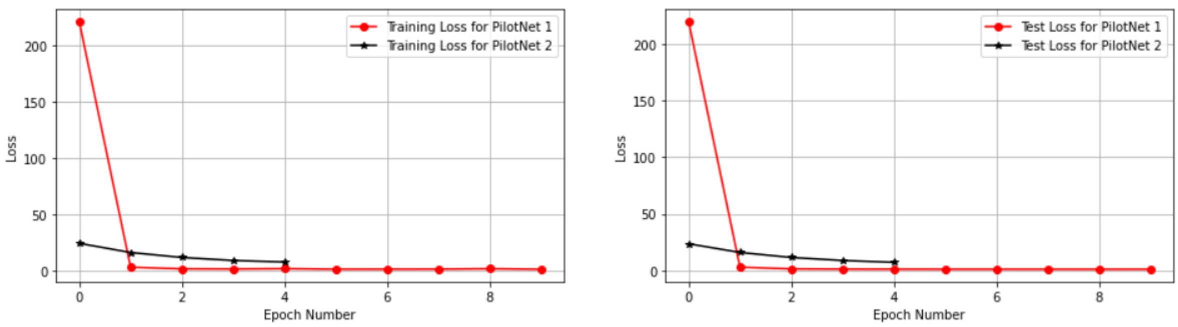

Figure 8 Comparison of Loss in Pilot Net

In the above Fig 8 shows us the comparison between the epochs and loss of training and test of both the Pilot Net 1 and 2.

```
Avergae Training loss for 10 Epochs=  2.9682659363551O5
Avergae Training loss for 10 Epochs =  2.389635551210493
```

Figure 9 Average training loss for 10 epochs

Fig 9 is the overview of the Average train loss for 10 Epochs the values got don't have much difference.

CNN	Convolution Layers	Kernels	Learning Rate	Epochs
PilotNet-3	5	24, 36, 48, 64, 64	Adam =0.0001	5

Figure 10 Learning rate for Pilot Net for 5 Epochs

The above Fig 10 will elaborate us about the CNN, layers, kernals, learning rate, epochs of 5.

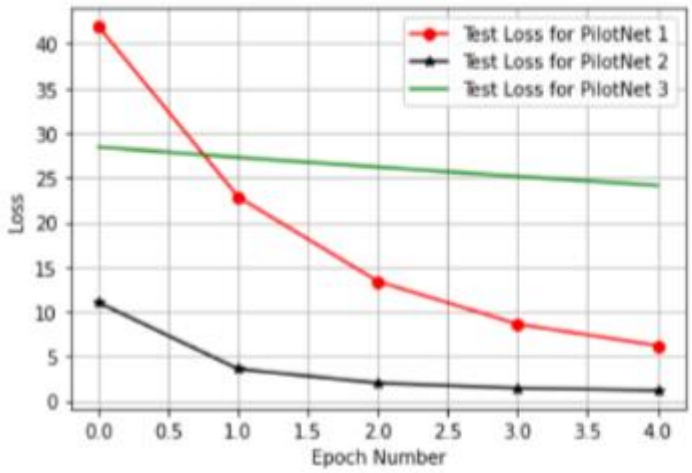

Figure 11 Comparison for all the three Pilot Net with different epochs

The above Fig 11 will describe the three different Pilot Net with different epochs of 30, 10, 5.

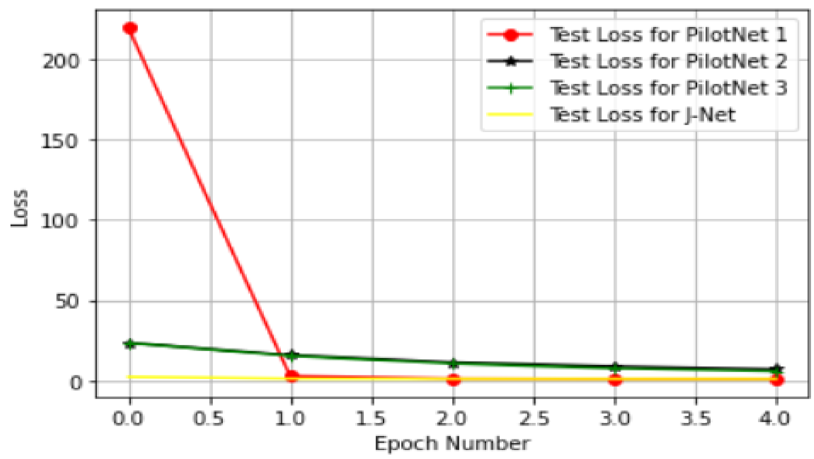

Figure 12 Test loss for pilot net and J net

The above Fig12 will describe the test loss for pilot net and J net.

Table 1 Comparison of Models

Model Name	Size	Steering angle Prediction	Straight Road Prediction	Predicted Turns	Trained Time
Pilot Net	15MB	Perfect	Perfect	Perfect	8 hours
Alex Net	430MB	Bad	Bad	Bad	2 days
J-Net	3.5MB	Good	Good	Medium	3 hours

The above Table 1 will illustrate the comparison of the three models that are used for the prediction of the steering angle of the vehicles. Where the Pilot Net has the very good prediction while it is in any of the conditions. Alex Net is not having bad performance because it has highest MB of the images which takes more time to train the values. Whereas the J-Net which has been created has got good performance for prediction of steering angle.

After comparing all the models, we will get the predicted values which are stored in the folders and then the final output steering will be appeared and the images will be played in output and the steering will be rotating accordingly as per the roadway.

Figure 13 Creation of folders

The folders are created accordingly with the epochs given as shown in the Fig 13.

Figure 14 Steering of the vehicle

The above figure is the steering image which we have generated through implementing the models. When we run the code, we will get a video output where we can clearly observe how the steering is been rotated in the automated cars according to the road while car is in motion.

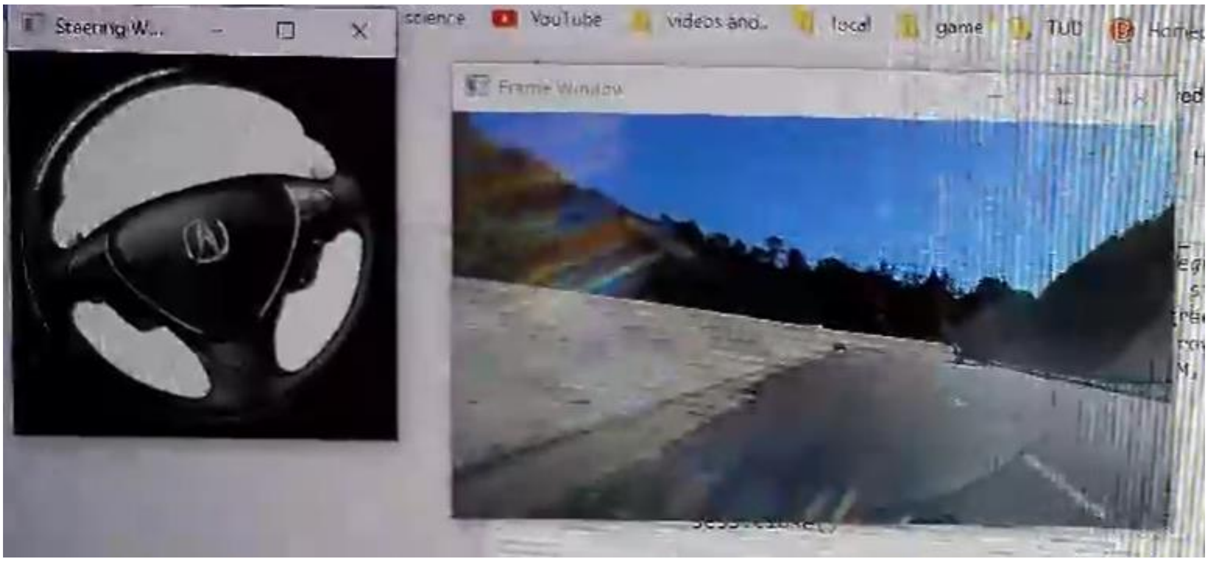

Figure 15 Output of steering angle

The above Fig 15 showcases us about the how the steering is being rotated when the car is in motion and how it is identifying when roads are curved.

References

Brownlee, J. (2016) ‘Introduction to the Python Deep Learning Library TensorFlow’, *Machine Learning Mastery*, available: https://machinelearningmastery.com/introduction-python-deep-learning-library-tensorflow/

What Are Itertools in Python? [online] (2021) *Educative: Interactive Courses for Software Developers*, available: https://www.educative.io/edpresso/what-are-itertools-in-python

Random — Generate Pseudo-Random Numbers — Python 3.10.1 Documentation [online] (2021) available: https://docs.python.org/3/library/random.html