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# Making the Vehicle (Car) Navigate in Traffic by Avoiding Collisions Using Deep Learning

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**Abstract**

Deep learning (DL) which is subset of Machine learning (ML) along with Transfer-learning (TL) can significantly help vehicles (car's) to achieve human- level ability to safely navigate in unpredictable dynamic environments, but in order to develop an autonomous vehicle we need lots of training data and obtaining data from real world using a car is a complicated task as it is time consuming to set up everything, as it requires high end cameras along with humungous amount of time in gathering the data, further it's not very safe and it's less convenient, so let's try developing an autonomous vehicle using a game which will be able to navigate safely by avoiding collisions as much as possible here we are using a game to build an autonomous vehicle be cause it's very easy to setup everything, a gaming environment is much similar to that of a real-world environment.

***Keywords:*** *Deep learning, Tensorflow, Keras, Tensor Board, OpenCV, Numpy.*

## 1. Introduction

Since we are going to deal with enormous amount of data its preferable to use Deep learning as it outperforms other techniques when size of the dataset is too large, another important reason to consider Deep learning over other techniques is because when there is lack of domain understanding of feature analysis Deep learning[8] comes in handy as it automatically extracts the features from the given image and Deep learning is based on[9] Convolutional Neural Nets

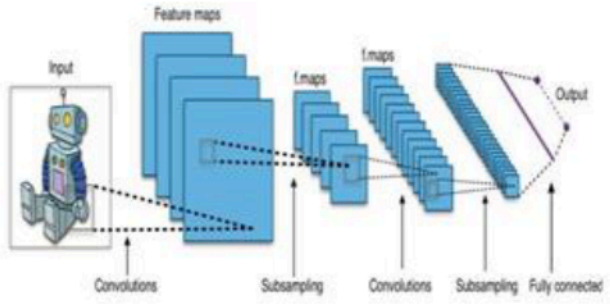


Figure 1: Convolutional Neural Network

Convolutional Neural Network[7] helps the model to learn more discriminative, abstract features from the data provided but its necessary to have less noise in the data that is used for training hence maintaining the aspect ratio of the images used in the dataset plays a significant role in model accuracy. With enough time and sufficient training examples a deep learning system can learn new features on their own and later use these features to solve some complex real-world problem's. The only downside of these systems is that they fail to report on the features that has been discovered during training so these systems that is deep learning models are capable of identifying similar features on their own but these models can't disclose the information about how they arrived at a particular conclusion[11]. The Global status report on road safety 2018 indicated that annual road traffic deaths has reached 1.35 million the report also indicates that people aged between 5-29 years are the major victims of road accident. Hence this is a serious issue to consider so we need some reliable technology in order to help the people navigate automatically and most importantly prevent the collisions as much as possible[6].

TEST Engineering & Management

*May - June 2020*
*ISSN: 0193-4120 Page No. 5076-5080*


Figure 2: Accidents due to human error

Since vast majority of human lives, (1.35 million) are lost in accidents out of which 94% of the time the primary reason is due to the human error, so in order to reduce this number we employ Deep learning in order to prevent the vehicle from collision and save precious lives here we aim at creating a model that would be as generic as possible and help the vehicle navigate without undergoing any collisions.

## 2. Step's To Be followed

1. Firstly we will set the game environment.
2. Obtain the screenshot of the environment along with the input keys.
3. Make sure that the collisions are as minimum as possible because this data will be used for training for model.
4. Save the collected data in a numpyfile.
5. Generate the trained model with the available data from numpyfile.
6. Evaluate the obtained model by making the model to predict the next move in the game and making the vehicle navigate without making any collisions.

## 3. Proposed Methodology

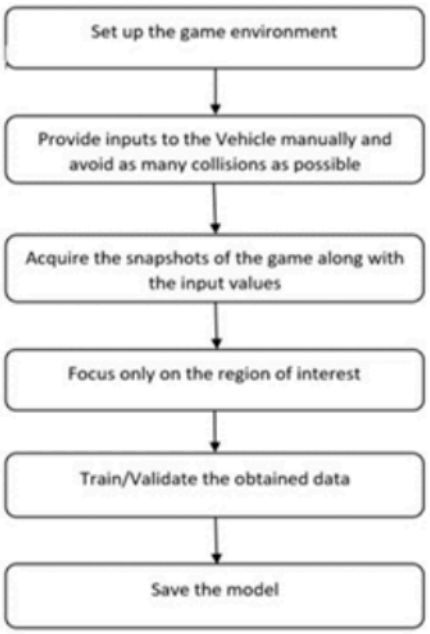


Figure 3: Training and Saving

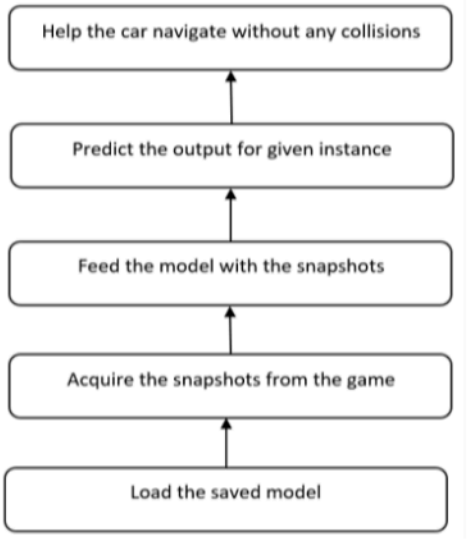


Figure 4: Loading and Validating

## 4. Modules Identified

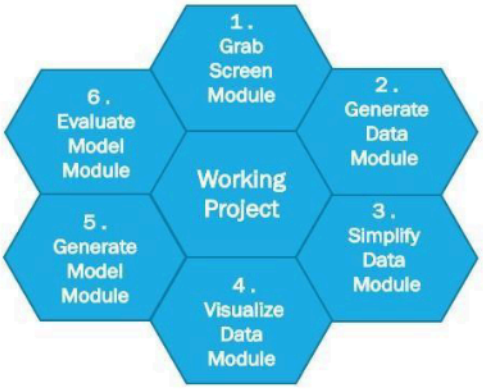


Figure 5: Modules

- ❖ Grab Screen Module: This module is used to get the screen shots of the game, used mainly during generating training data and evaluating the trained model.
- ❖ Generate Data Module: This module is used to convert the images[10] obtained from grab screen module into a numpy array and save this data in a .npyfile.
- ❖ Simplify Data Module: This module is used to load the .npyfile saved by generated at a module and extract equal number of samples (FORWARD, BREAK, LEFT, RIGHT)and save this data again in a new.npyfile.
- ❖ Visualize Data Module: This module is used to convert numpy array into image format which helps in visualizing the saved data, this module helps the user to identify weather proper samples are extracted for [2]training the final model.
- ❖ Generate Model Module: This module is used once after the user is satisfied by seeing the information generated by visualize data module, this module accepts a .npyfile

May - June 2020
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and performs training operation and generate a trained Model.

❖ Evaluate Model Module: This model accepts the trained model obtained by generate[3] model module and performs the prediction on the real world samples.

Some of General modules which we used in this process are,

➢ OpenCV is a library mainly focused in real-time computer vision i.e OpenCV is mainly used in all the operations related to Images.

➢ Numpy is a package which is mainly focused on computing complex scientific calculations.

➢ Keras is Neural Network Library which is mainly used for developing Deep-Learning models.

➢ Tensor Board is a tool which is used for obtaining visualizations (GRAPHS) which is needed to determine the performance of the model.

## 5. Objective

The one and only objective is to reduce the number of collisions of the vehicle during travelling, since humans are more likely to commit collisions because of various factors such as stress, anxiety etc.

Here we employ Deep Learning to prevent the collisions from happening and save vast majority of precious lives.

## 6. Results & Discussion

**1)** Setting up the Game Environment.

Figure 6: Game while running

Firstly we will install any racing game[4] and collect the information for training our model.

**2)** Saving the extracted data in a numpyfile.


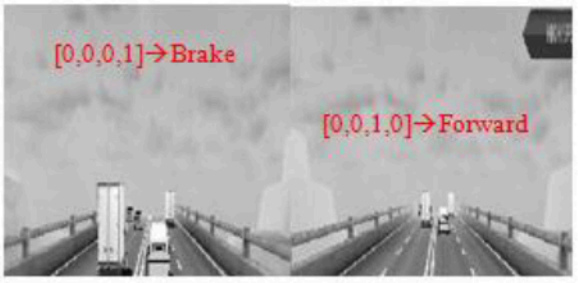


Figure 7: Captured Images with Keystrokes

Here we are collecting the snapshots of the game using Open- CV along with the keystrokes from the keyboard. All the images are collected in grayscale format to increase the [5]training efficiency and reduce the size of both training and validation data[1]. The collected images along with the keystrokes are converted into a numpy array and saved in a npyfile.

**3)** Training &Validation

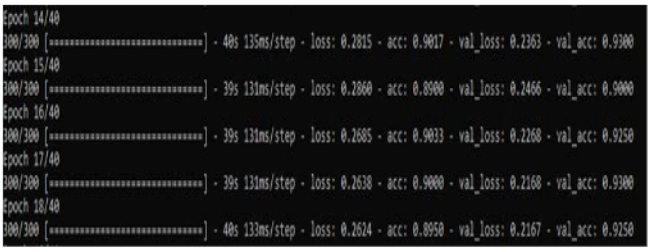


Figure 8: Training & Validation

**4)** Training

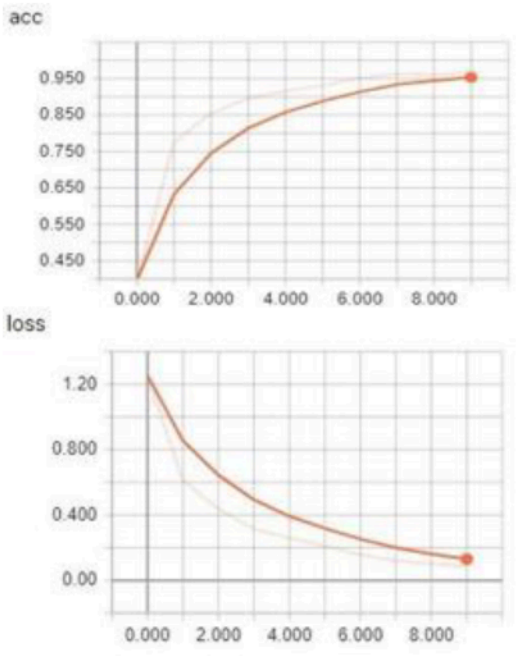


Figure 9: Graph of Training accuracy and loss

May - June 2020
ISSN: 0193-4120 Page No. 5076-5080

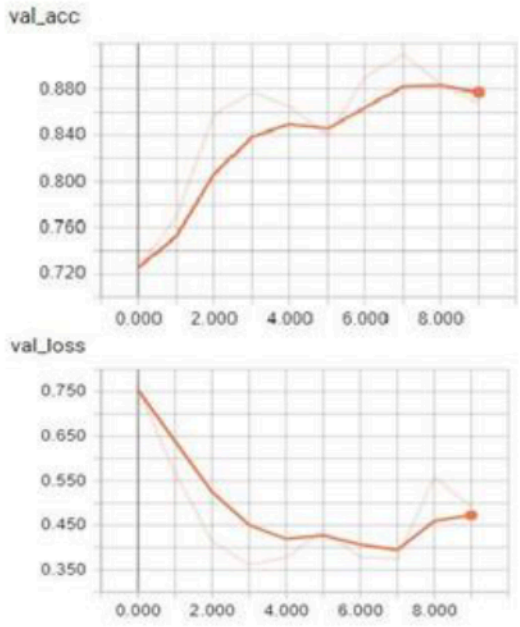


Figure 10 Graph of validation accuracy & loss

## 7. Working Model


Figure 11: Click start to run the model

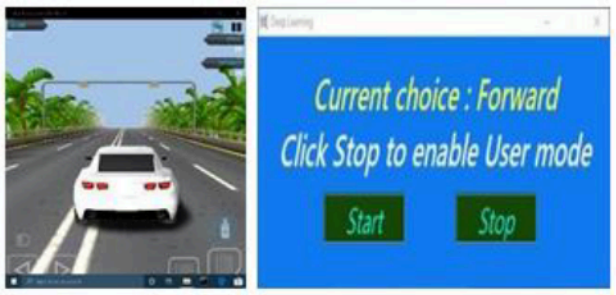


Figure 12: Model Prediction: FORWARD

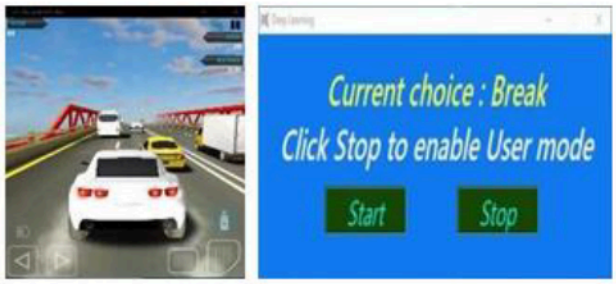


Figure 13: Model Prediction: BREAK


Figure 14: Model Prediction: LEFT

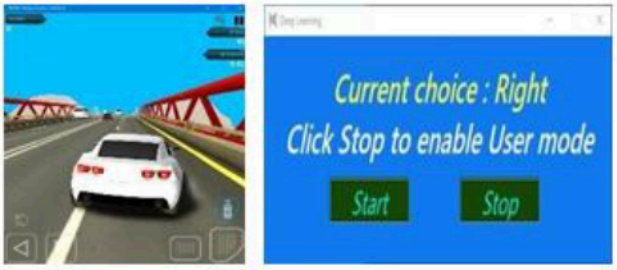


Figure 15: Model Prediction: RIGHT

## 8. Conclusion & Future Scope

Million's of deaths happen every year which are related to automobiles these deaths are mainly because of inevitable human errors while driving the vehicle but by using self driving car technology the number of deaths which are occuring can be significantly reduced because this automation technology will not be effected by unnecessary distractions. Future of the self driving cars is inevitable though it may result in many people loosing their jobs but in terms of safety its really reliable however one should always aim to develop full autonomous "death proof vehicles" for commuting, because of tremendous progress in the field of AI and Computer Vision the future of complete self driving cars is really close enough.

## 9. Acknowledgement

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*May - June 2020*
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