SELF-DRIVING CAR USING DEEP LEARNING

DEEP LEARNING INDABA

ABSTRACT

Within the cutting edge period, the vehicles are focused to be automated to give human driver loose and relaxing driving, Cars today already include many semi-autonomous features, like assisted parking and self-braking systems. And completely autonomous vehicles—able to operate without human control—are rapidly becoming more of a reality. You're probably familiar with Google's version, which has made headlines with its Google Chauffeur software, which the company hopes to bring to market by 2020. All new Tesla cars have the hardware needed in the future for full self-driving in almost all circumstances.
We trained and compared three different convolutional neural network (CNN) to map raw pixels from three front, left, right cameras directly to steering commands. This end-to-end approach proved surprisingly powerful. With minimum training data from humans the system learns to drive

DATA AND DATA PREPROCESSING

The Data was collected by driving through udacity self driving car simulator in the training mode,The data collected are the three cameras images left, right, center, steering angle, throttle, reverse and speed, we use only the three cameras images and the steering angle for training our agent.

Our agent uses convolutional neural network to extract features from three cameras images and perform regression task in which it converts the images into scalar value between negative and positive one.

1- Eliminate the Bias we have plotted a histogram which indicates the steering angle versus the frequency of images recorded with each steering angle in the training phase , the histogram indicated large bias around zero steering angle - go forward- so we divided our data into bins shuffled the data and made high threshold to the frequency of steering angle eliminating the high bias of specific steering angle .

2-convert the image from colored into grayscale so reduce the size of the image and allowing the algorithm to run faster, noting color doesn't matter a lot in edge detection what real matter is the brightness of pixels.

3-Gaussian blur the image smooth the image and reduces the noise in the image.

4-Decrease the size of the image to 128x128 since gpu prefers squared images.

5-Data Augmentation since collecting new images is time consuming we uses data argumentation on our already collected dataset. Data augmentation consist of four main functions zoom, pan, random brightness change and flip all are called with 50 percent for them each to be applied in an image.

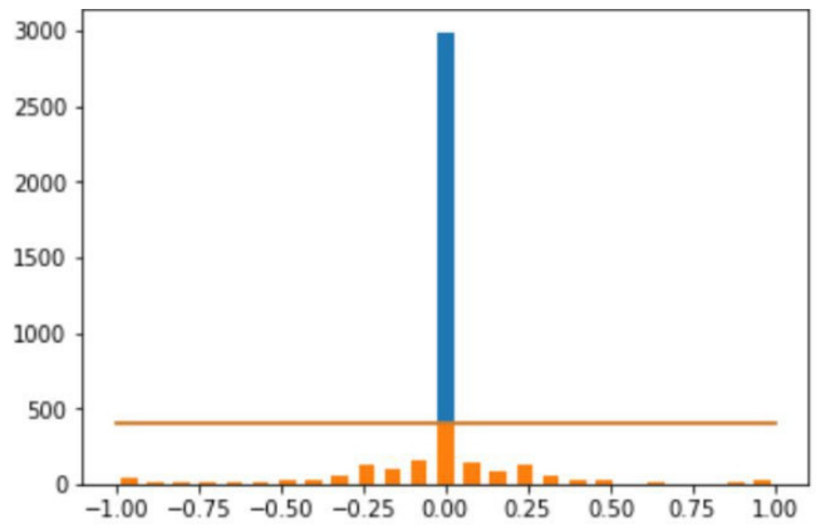
5.1-zoom: zoom the image until the zoomed image is 1.25 size the original image.

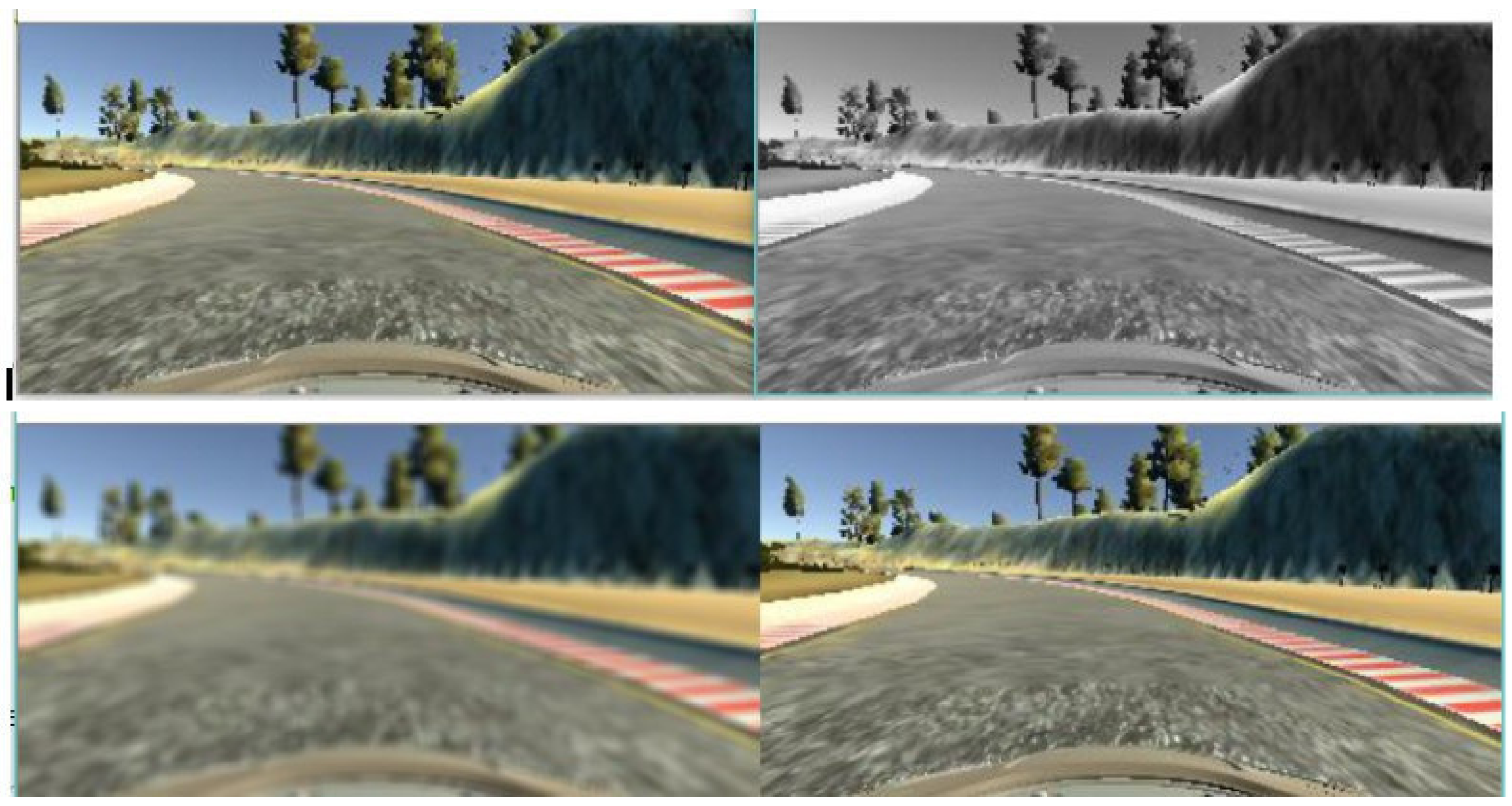
5.2- pan: the panned image is going to be +/-10% in the vertical and horizontal directions from the original image.

5.3- random brightness: change the brightness of the image pixels.

5.4-flip : flip the images and steering angle.

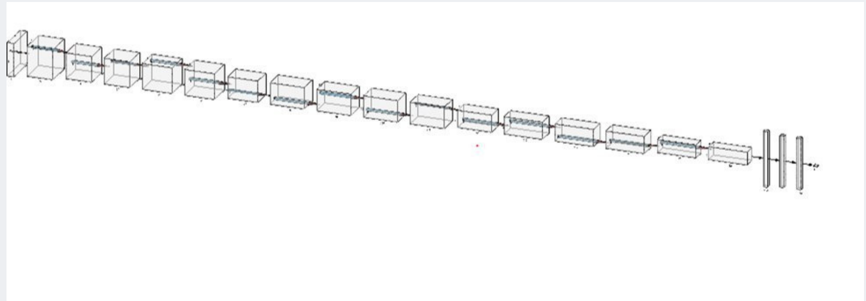
5.5- Final Data Augmentation: Combine all the above process with probability 50% each of the zoom, pan, random_brightness, and flip been applied to the image

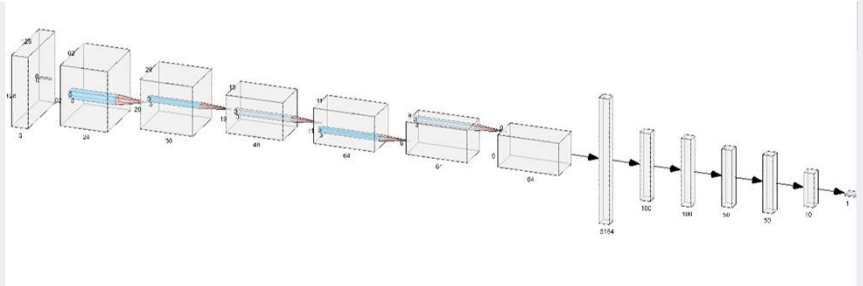


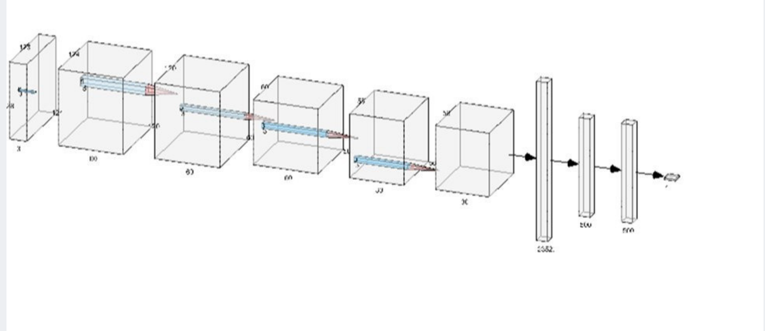


METHOD MODEL

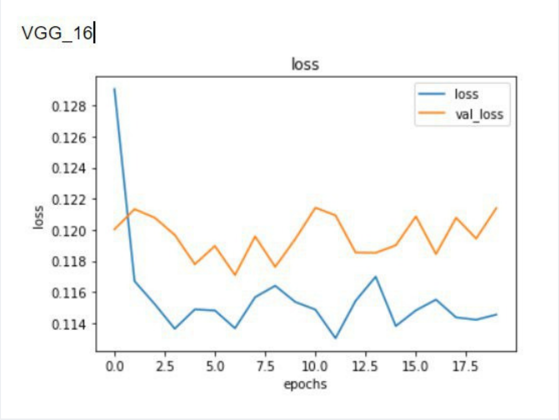
We build three different agents one using LeNet neural network, first we applied image preprocessing and pass the images to the CNN modeles using behavioral cloning, and those are respectively: VGG, Nvidia, LeNet.

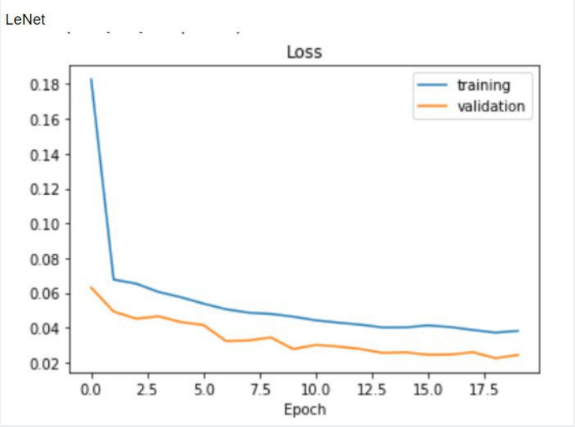


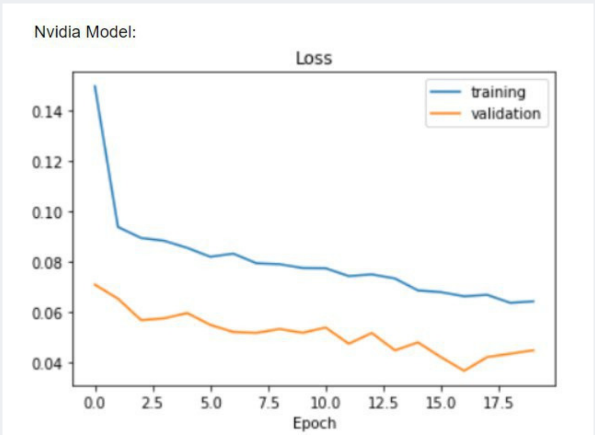




Result







Future work

The agent managed to drive itself in Udacity Simulator environment using images from three cameras and converting those images into steering angle, the environment used to test the agent contains many turns but contains no moving objects crossing the street, also it contains no traffic lights, the next state I am going to be building self-driving car in environment more crowded and more like real world environments to achieve this task the network has to output the throttle and brake beside the steering angle.

Refrences

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3-https://github.com/naokishibuya/car-behavioral-cloning