Vehicle Classification Using Convolutional Neural Network

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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APPROVAL

This Project/internship titled **"Vehicle Classification Using Convolutional Neural Network"**, submitted by Toushiat Shaikh, ID No: 161-15-7530 and Nasir Ahammad, ID No: 161-15-7524 and Sumaya Rahman, ID No: 161-15-6962 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 06 Dec 2019.

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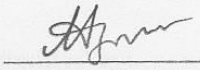

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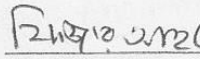

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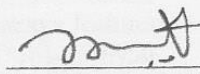

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Nusrat Jahan, Lecturer, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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ABSTRACT

Convolutional Neural Network (CNN), a class of artificial neural network that has gotten to be most well known in a few computer vision assignment. In this work, we will presents convolutional neural organize for classifying the vehicle. Vehicle classification plays vital role of various application such as surveillance, security system and to prevent accident. The most challenge of computer vision to achieve due to variations in shapes and colors of vehicle. To classify the vehicle there are two methods consists of extract of feature and classification. Above two methods work using convolutional neural network. The method shows good performance in rousing on objective standard data set. In our mentioned method has reached absolutely best accuracy. We have got 86% accuracy from our dataset.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

Object classification is colossal field of inquire about in computer vision and machine learning that points to classify objects show in pictures into significant categories [1-5]. Within the setting of brilliantly activity frameworks, object classification of expect a crucial part and have a wide run of work such as traffic surveillance, course optimization, and peculiarity location .Automatic analysis of activities is an important and urgent issue due to a large number of traffic rule violations and their adverse effects on daily traffic management[6-8]. Detection is used on roads, highways, parking or any other place to detect or track the number of s present on the spot. This will help the surveillance to judge the traffic s, average speed and category of. Compared with conventional machine learning assignments, profound learning-based strategies have made incredible breakthroughs in activity reconnaissance methods, and have accomplished great execution in commonsense applications such as detection, feature extraction and track identification. In these areas of research, accurate and real-time detection and preliminary classification are the most fundamental and important work. We imagined that ready to do a significant convolution neural organize (CNN)[9] based movement area. In this manner, we are proposing a novel approach to classify diverse sorts of vehicle utilizing Convolutional Neural Organize and Deep Learning[10-11]. In machine learning picture[12] preparing and pattern acknowledgment include extraction starts from a fundamental set of measured information and develops advanced values aiming to be instructive and non-redundant, encouraging the taking after learning and generalization moves[13-14], and in a few cases driving to superior human translations.

1.2 Objective

Now, this is the time of technological revolution. In today's digital age we are using technology everywhere. Our main objective is to classify our proposed vehicle. There are different types of vehicle. We want to classify different type of vehicles by using deep convolutional network. So we can describe these goals in a list like this:

- Our goal is to study how to classify or recognize different type of vehicles.

- To develop a platform that will be able to detect all kind of vehicle.
- To visualize some analytical analysis of vehicle like car, cng, rickshaw, cycle classified by classifier algorithms.

1.3 Motivation

We were interested to do something different. So we decided earlier that we will do research on Artificial Intelligence (AI) and Machine Learning (ML) field and then we started to search for some ideas. But no idea couldn't satisfy us. Then we want to improve our traffic system for that we decided to classify different type of vehicle. At first we wanted to do something about make/model and color classification to recognize with a large image or video data set. But we found that it was a tall level work and may be intense for us and after that ready to do some research on vehicle classification. We have reached on an awesome idea and it's called "**Vehicle Classification Using Convolutional Neural Network.**" These made us interested to do such kind of inquire about based work. Our work is completely related with machine learning strategies.

1.4 Rational of the Study

There's no question that there are thousands of works done on Picture preparing or protest classification space. In later a long time, the convolutional systems have been utilized to address the sort classification errand, but with unmistakable datasets and approaches. Image preparing is a progress approach it can be part into diverse categories: one of these is Picture Compression another picture improvement and the final is the reclamation, and estimation extraction. It makes a difference to decrease the sum of memory which is required to store a computerized picture. Picture can be abandoned. By digitization handle and by deficiencies picture can be absconded .Absconded picture can be rectified utilizing Picture Upgrade procedures.

1.5 Expected Outcome

In this section there's a few focuses given that focuses was our main expected result. Expected result of this inquire about research based project is to build an algorithm or making a complete efficient procedure that will categorize cricket shots with respect to the built model of train dataset

- CNN based vehicle classification.

- It will increase security system
- It will help to decrease accidents.

1.5 Research Questions

It was so challenging for us to complete this work. In order to have a realistic, efficient and accurate response to the problem, the researchers wishes to propose following questions to express the feelings and outcomes this problem

- Can we collect row image data for deep learning research?
- Is it possible to pre-process the row data using deep learning approach?
- Is it possible to improve cricket coaching system using this approach?

1.6 Layout of the Report

Chapter one have illustrated the presentation to the venture with objective, motivation, research questions, and anticipated result, this section describes the entire format of this report.

Chapter two provides the discussion on what already done in this domain before. Then the later section of this second chapter shows the scope arisen from their limitation of this field. And exceptionally final, the root impediments or challenges of this research are explained.

Chapter three describes the theoretical discussion on this research work. To discuss the theoretical part of research, this chapter elaborates the statistical methods of this work. Besides, this chapter shows the procedural approaches of CNN and Machine Learning classifier. And within the final area of this chapter, to approve the show as well as to appear the precision name of the classifier, confusion matrix analysis is being displayed.

Chapter four provides the experimental results, performance evaluation and discussion of result. Some experimental pictures are presents in this chapter to make realize the project.

Chapter five talked about with summery of the think about, future work and conclusion. This chapter is dependable to appear the full venture report following to suggestion. The chapter is closed by appearing the limitations of our works that can be the long run scope of others who need to work in this field.

CHAPTER 2
BACKGROUND

2.1 Introduction

In this section, we will discuss related works, research summary and challenges about this research. In related works section, we will discuss other research paper and their works, their methods, and accuracy which are related to our work. In research summary section we will give the summary of our related works. In challenges section, we will discuss how we increased the accuracy level.

2.2 Related Works

In 2013, R.Sindoori et al. prescribed a methodology for vehicle disclosure structure from groveling pictures. Vehicle disclosure is finished by pixel clever grouping procedure. The essential part of the paper is to remove the incorporate and arrange the vehicle shading. Extraction of incorporate incorporates edge and corner area. For edge revelation, the Canny edge locator strategy is applied. The Harris corner discoverer handle is associated with corner identification. Adaboost is used for the extraction of vehicle shading to isolate vehicle and non-vehicle hues. Totally, morphological activities are associated with the improvement of the vehicle revelation[15]. In 2013, Youporn Hu et al. Proposed the Haar features and Histograms of Oriented Gradients (Hog) as strong features for the area of the vehicle independently. They propose a system to distinguish vehicles in accounts and order them into two sorts relying upon consolidated the Haar features and HOG features. Because of this system, it can arrange and distinguish the vehicles in multi-directions with extraordinary grouping comes about[16]. In 2015 Chiman Kwan, Bryan Chou took a shot at Compressive Vehicle Tracking Using Deep Learning. They show a couple of preliminary vehicle following comes about using compressive estimations from the principal infrared video. Here, the compressive estimations are implying video traces with discretionarily lost pixels. CNN's have outlined predominant execution in picture classification[17], and have been, all things considered, associated for question area, video classification[18], and division. These impels have too added to an unused focus in asking about on tall execution CNN frameworks. The plans of these frameworks have too observed their execution pushed ahead by using increasingly significant and progressively broad structures[19]. Simonson et al. proposed VGGNet[20], which empowered the

ask about by using significant structure in PC vision. Szegedy et al showed GoogleNet that contains the inception modules, defining a cutting edge condition of the craftsmanship for ImageNet Challenge.

2.3 Research Summary

Profound learning might be a method for completing Machine Learning. It is made of artificial neural frameworks. Neural frameworks fill in as similar to our minds. CNN meaning Convolutional Neural Network is one of the most grounded systems in significant learning. It is a fake neural mastermind, which is furthermore known as feed-forward ANN. In a "feed-forward" sort out information streams directly through the frameworks.

Yann Lecun was the maker of CNN. Roused from human structures he made it. Truly CNN works like the regular visual cortex. CNN is one of the chief fruitful models in picture grouping. CNN's grouping precision is predominant than some other regular picture order estimations. In CNN we don't need to be done include assurance, however in other picture characterization computations, we have to do it. There are assorted sorts of layers that are used on CNN. Convolution layer incorporates a moving channel or bit which goes through the image. All around it goes through a 2D arrange (portrayal of the picture) and take a specific package and applies bit duplication and stores it in another lattice.

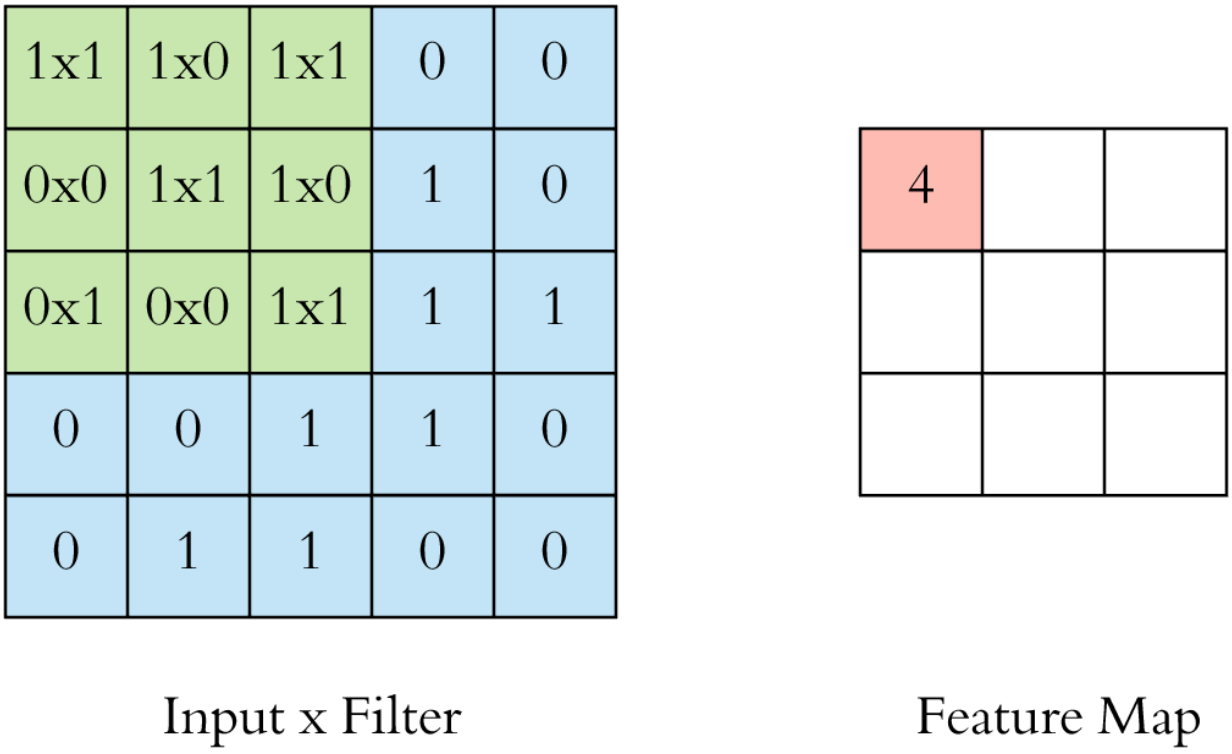

Figure 2.3.1: Convolution of a filter over 2D image [21]

Measurement of the output matrix can be calculated by an condition. We will see an equation bellow where,

output- Output dimension

input- Input dimension

fsize - Window size

stride- Stride

$$output = floor\left(\frac{\square\square\square\square\square - \square\square\square\square\square}{\square\square\square\square\square}\right) + 1 \quad (1)$$

The over condition is used to find Output of the measurement.

The pooling layer, for the most part, sits alongside convolution layer. It basically used to lessen memory and for a quick calculation. It lessens the volume. Max pooling is one of the most utilized layers on CNN. It sets a bit and finds the maximum number from the network.

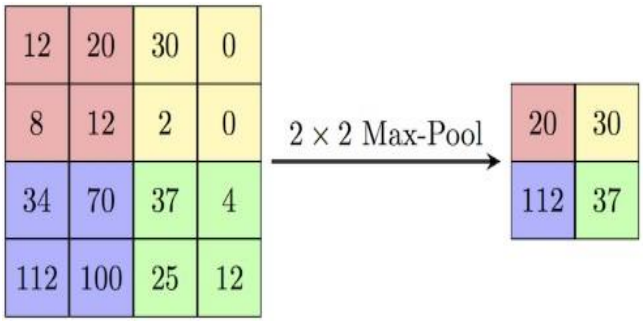

Figure 2.3.2: Max Pooling [22]

Fully connected layer gets 2D or 3D array as input from previous layer and converts the 2D or 3D array into 1D array.

The output layer of a convolutional neural network shows the probability of the classes. It is calculated by "Softmax" function. The equation of calculating the probability is given bellow.

$$\sigma(\square_{\square}) = \frac{\square^{\square_{\square}}}{\Sigma_{\square}\square^{\square_{\square}}} \quad (2)$$

2.4 Challenges

The main challenges of this work is collecting and processing the dataset, dealing with the data set was too hard. To clean and normalize we used several steps and methods. After all training with many layers with different size of epoch took long time in our machine, so getting the final output we waited so much with keeping patience. There was not another dataset or resources regarding this paper domain. There was not enough work done before so we have to start from our own motivation.

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CHAPTER 3
RESEARCH METHODOLOGY

3.1 Introduction

In this area we are attending to elaborate the workflow of our novel approach to classify diverse sorts of vehicle. There are a few key point like information collection, processing, proposed model too described with important condition, chart, table and description. Claim created CNN based show connected and possess dataset utilized in this work. The chapter is being closed by giving the explanation of our project's measurable theories and other than, giving the clear concept of the execution requirements.

3.2 Research Subject and Instrumentation

Inquire about subject can be called as research area that was reviewed and studied for clearing concepts. Not only for implementation but also for design model, collecting data, implement or process data and training the model. On the other section is Instrumentation that is which technology and method we used. We used windows platform, python language with many packages like numpy, pandas, skit learn, matplotlib etc. Google Colab was used for all the training and testing process, Google Colab is a free and open-source dispersion of the Python and R programming language for information science and AI applications.

3.3 Workflow

This research have few stages of workflow such as data collection, data processing data resize and augmentation, model selection etc.

Stage 1 - Data Collection: We collected data from website and created our own data-set by processing those raw data. Collecting data was so challenging, there is not a single dataset available in this domain.

Stage 2 - Data Processing: All information have been prepared class by class after collection from different sources. There are lots of data having noise and errors. We manually process those data first then implement the selective dataset to the next step.

Stage 3 - Data Resize and Augmentation: After processing class by class data have been augmented and resized. For purpose of training we had to go through data augmentation and resize. Augmented data give some overfitting that's why we have done only a few and most important augmentation.

Stage 4 - Model Selection: To train and validate our data for better accuracy we choose out some model. There are hundreds of convolutional neural networks. To get better accuracy with our machine configuration we implement few model and finally one model was selected for final training and testing process.

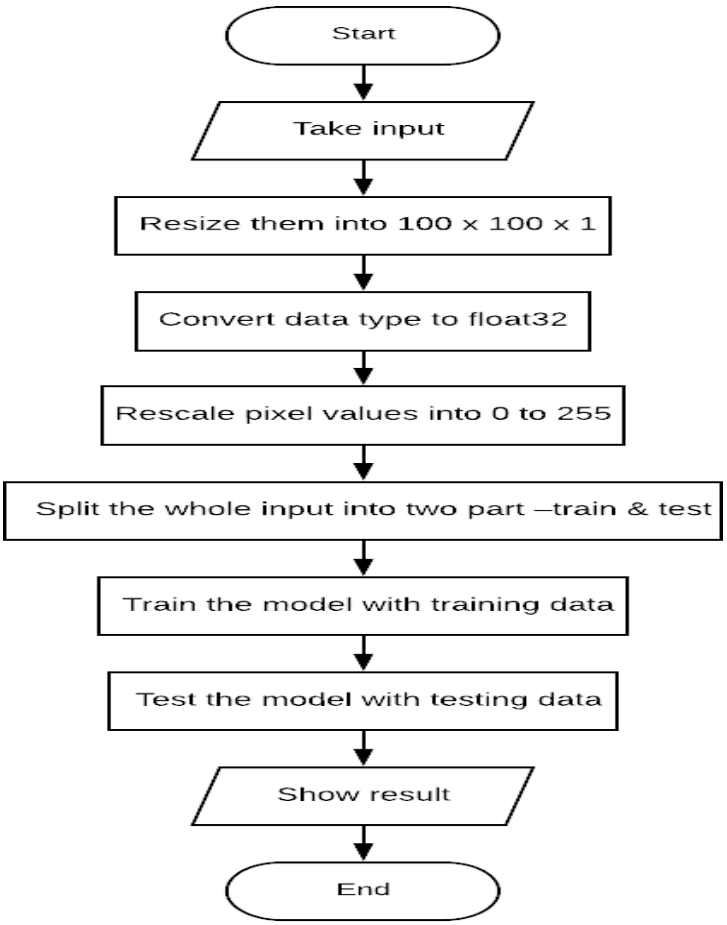


Figure 3.3.1: Workflow of our approach

Stage 5 - Performance Evaluation: In this section, all the results have been discussed with graph. After training and testing those process gave us few accuracy graph with validation loss and

accuracy. We also calculated the confusion matrix and a table for showing the precision, recall and f1 measure.

Stage 6 - Conclusion and Future Work: In this section there will be a conclusion and future work map.

3.4 Data Collection Procedure

For our experiment, we used the Polytecnic University of Madrid vehicles database and a vehicle database including 4 different Bangladeshi vehicles.

The University of Madrid vehicle Database compares 3425 pictures of vehicles taken from distinctive focuses of view. We took 3000 images from the dataset to train the model and took 425 images to test the model.

In Bangladeshi database (prepared by us), there are 297 different images of each of 4 distinct vehicles. These images were taken at different times under varying radiance ,distance and occlusions. These images are preprocessed by us .

Figure 3.4.1: Images of vehicles from the University of Madrid Database [23]

Figure 3.4.2: Images of vehicles from Bangladeshi database

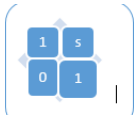
3.5 Data Processing

Data handling system has two steps one is information augmentation another one is information planning. When we bargain with the push information, the victory generally depends on the pre-processed information. The more effectively information will be pre-processed; the result will be more precise. In one word, it is the starting challenge for such kind of inquire about based work

3.5.1 Data Augmentation

We misleadingly extended the dataset to maintain a strategic distance from overfitting. It includes esteem to base information by including data determined from inner and outside sources inside an venture. It makes a difference to extend the amount of significant information within the dataset. We expanded the most information in 5 diverse strategies, these strategies given below:

- Rotate left -30 degree : To increase data set we use rotate left -30 degree augmentation.
- Mirror : Mirror augmentation is the most popular augmentation to increase the dataset.
- Salt and pepper: A toned down version of this is the salt and pepper noise, which presents itself as random black and white pixels spread through the image.
- Shear : To do shear augmentation we use this function

A= 

3.5.2 Data Preparation

All the pictures of our dataset have diverse statures and widths. Since our demonstrate requires a settled pixel for all pictures, we resize our dataset into 100 x 100 pixels.

We have moreover changed over the pictures into grayscale. Since we have not way better Graphics Processing Unit in our computer that we have utilized to prepare the show .So we utilized grayscale images to prepare the model.

3.6 Proposed Methodology

We proposed our possess Convolutional Neural Network demonstrate, which have 13 layers

- The first layer has 32-3 x 3 filters and activation function is ‘linear’.
- The second layer has 64-3 x 3 filters and activation function is ‘linear’.
- The third layer has 128-3 x 3 filters and activation function is ‘linear’s.

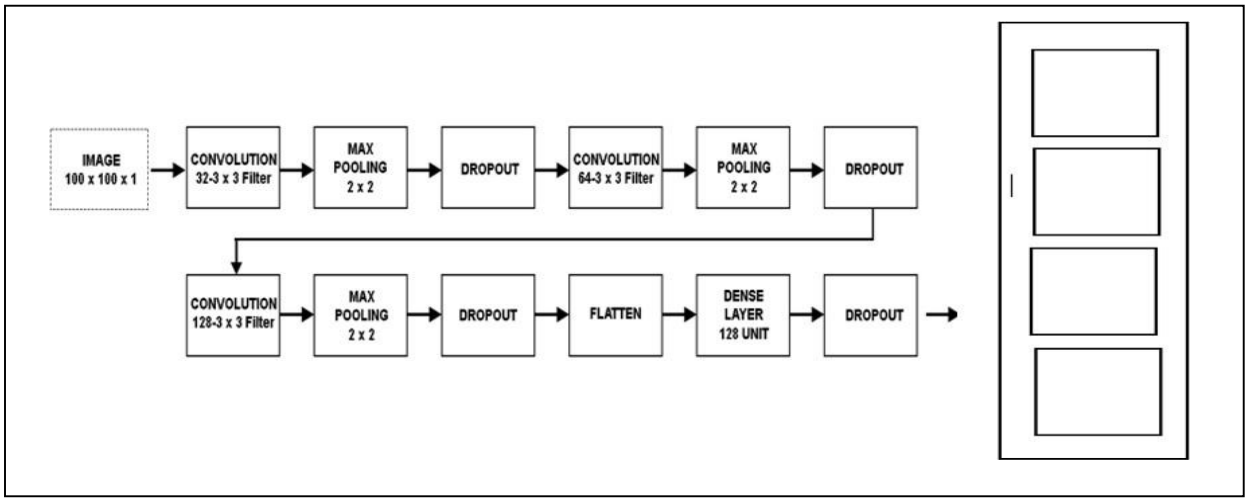


Figure 3.6.1: Proposed CNN layer

In extension, there are three max-pooling layers every one of gauge 2 x 2. There are four dropout layer with parameter 0.20. We have a smooth layer, inside the show. At last there are two thick layer , where in one we used 'straight ' as actuation work and inside the other we used 'delicate max' as initiation work. We used delicate max incitation work to ask the probability of each less. We should have a concise exchange about these layers underneath.

3.6.1 Convolutional Layer

CNNs have wide applications in picture and video acknowledgment, recommender frameworks and normal dialect handling. Convolutional neural systems. Sounds like a peculiar combination of science and math with a small CS sprinkled in, but these systems have been a few of the foremost persuasive advancements within the field of computer vision. 2012 was the primary year that neural nets developed to conspicuousness as Alex Krizhevsky utilized them to win that year’s ImageNet competition (essentially, the yearly Olympics of computer vision), dropping the classification mistake record from 26% to 15%, an shocking advancement at the time. When a computer sees picture (takes an picture as input), it'll see an cluster of pixel values. Depending on the determination and estimate of the picture, it'll see a 32 x 32 x 3 cluster of numbers (The 3

alludes to RGB values). In a conventional convolutional neural arrange design, there are other layers that are blended between these conv layers. I'd emphatically energize those interested

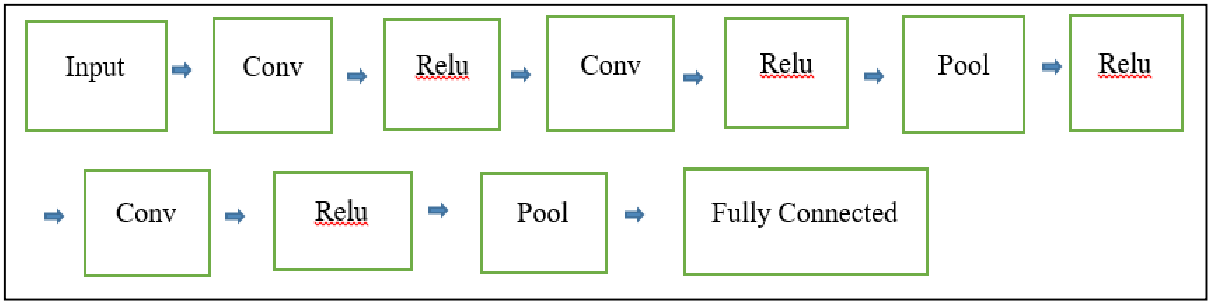


Figure 3.6.2: A classic CNN architecture

3.6.2 Feature extraction

Convolution is one of the most building pieces of CNN. The term convolution alludes to the scientific combination of two capacities to deliver a third work. It consolidates two sets of data. Within the case of CNN, the convolution is performed on the input information with the utilize of a channel or part to at that point create a highlight outline. We execute a convolution by sliding the channel over the input. At each area, a network duplication is performed and sums the result onto highlight outline.

3.6.3 Max pooling

Max Pooling could be a down testing procedure in Convolutional Neural Systems. The objective is to down-sample an input representation decreasing its dimensionality and permitting for assumptions to be made approximately highlights contained within the sub-regions binned. It is essentially utilized to diminish the measure of the picture since the bigger number of pixels contribute to more parameters which can include huge chunks of information. In this way we require less parameters such that a CNN can still distinguish the picture. Max pooling is disposed of 75% of the enactments and controlling overfitting.

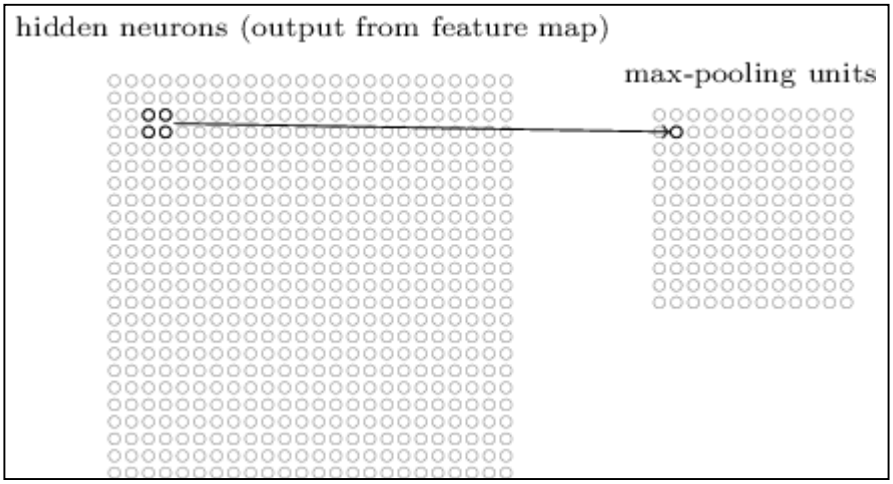


Figure 3.6.3: A pooling unit outputs the maximum activation.

3.6.4 Dense Layer

A dense layer is fair another title of the completely connected layer. Comparable operations take put in the thick layer where each neuron is associated with each other. It is additionally called dense since it speaks to a thick association of thick neurons. A thick layer has weights related to each neuron combine and with one of a kind values. Diverse sorts of work like softmax enactment work, SVM, and numerous others are utilized here for high-level thinking within the neural arrange. But in our demonstrate, we adhere utilized softmax for classification. After a few convolutions and pooling layers, we get a few high-level highlights as input. These input picture highlights are utilized as classifying to investigate different classes. But when we combine the convolution layer`s highlights and surveying layer`s highlights it gives the way better results of classifications. In Completely Associated layers summation of yield probabilities is 1.One Conv layer share weights with other Conv layers. It is exceptionally troublesome to join all hubs with a softmax layer.

3.6.5 Soft-max

Let us consider a classification model to classify with n classes. This model takes input datasets and an algorithm and produces a score of each class.the softmax activation function converts from score to the probability between 0 to 1. The summation of all probabilities have 1.we utilized this work to the ultimate layer of convolutional neural systems to classify the classes. this work is delivered numerous lessons from an input array. the likelihood dissemination of softmax work is:

$$\square(\square_{\square}) = \frac{\square^{\square_{\square}}}{\sum_{\square=1} \square^{\square}} \quad (3)$$

Where i =1, 2, 3 ……. n and j =1, 2, 3 …….n

3.6.6 Dropout layer

Dropout may be a method utilized to move forward over-fit on neural systems. The data structure of a neural arrange could be a coordinated chart where each hub speaks to an inclination, whereas each edge speaks to a weight. In case there are unity with predisposition b, and in edges e1,e2,e3 with weights w1,w2,w3, at that point, when the signals that comes into y along e1,e2,e3 are x1,x2,x3 separately, the yield of y is w1x1+w2x2+w3x3+b. As we as of now know, the more profound the arrange is, the more parameter it has. For illustration, VGGNet from ImageNet competition 2014, has a few 148 million parameters. That's apart. With that many parameters, the arrange might effortlessly overfit, particularly with little dataset. CNN must work inside a vigorous environment thus dropout becomes fundamental. Dropout is fundamentally chosen between 0.2 to 0.8. Dropout evacuates the neurons arbitrarily based on the parameters given by the client like 0.4 etc.

3.6.7 Flatten Layer

The reason to utilize this can be to got to embed this information into a counterfeit neural arrange afterward on. Completely associated layers do not have a nearby restriction like convolutional layers (which as it was watching a few nearby portions of a picture by utilizing convolutional channels). This implies it can combine all the found neighborhood highlights of the previous convolutional layers. Each highlight outline channel within the yield of a CNN layer could be a "straightened" 2D cluster made by including the results about of numerous 2D parts (one for each channel within the input layer.

3.7 Training the Model

The University of Madrid vehicle Database compares 3425 pictures of vehicles taken from distinctive focuses of view. We took 3000 images from the dataset to train the model and took 425 images to test the mode .In Bangladeshi database (prepared by us), there are 400 different images of each of 4 distinct vehicles. We used 80% dataset to train the model and 20% dataset used to test

and valid the dataset. We have prepared the network for 25 epochs.

3.8 Implementation Requirements

After the proper analysis on all necessary statistical or theoretical concepts and methods, a list of requirement has been generated that must be required for such a work of image Classification. The probable necessary things are:

Hardware/Software Requirements

- ✓ Operating System (Windows 7 or above)
- ✓ Hard Disk (minimum 500 GB)
- ✓ Ram (Minimum 4 GB)

Developing Tools

- ✓ Python Environment
- ✓ Google Colab

CHAPTER 4
EXPERIMENTAL RESULTS AND DISCUSSION

4.1 Introduction

In this area we depicted the development process diverse sorts of vehicles. They generally prepare of the demonstrate isolated into few steps like dataset collection, information planning, information increase, information resize and proposed.

4.2 Performance Evaluation

Preparing precisionis ordinarily the exactness when the demonstrate is connected to the preparing information. When the demonstrate is connected to randomly-selected pictures from the distinctive lesson, it is known as approval precision. Fig appears a chart which contains preparing and approval exactness of our method.

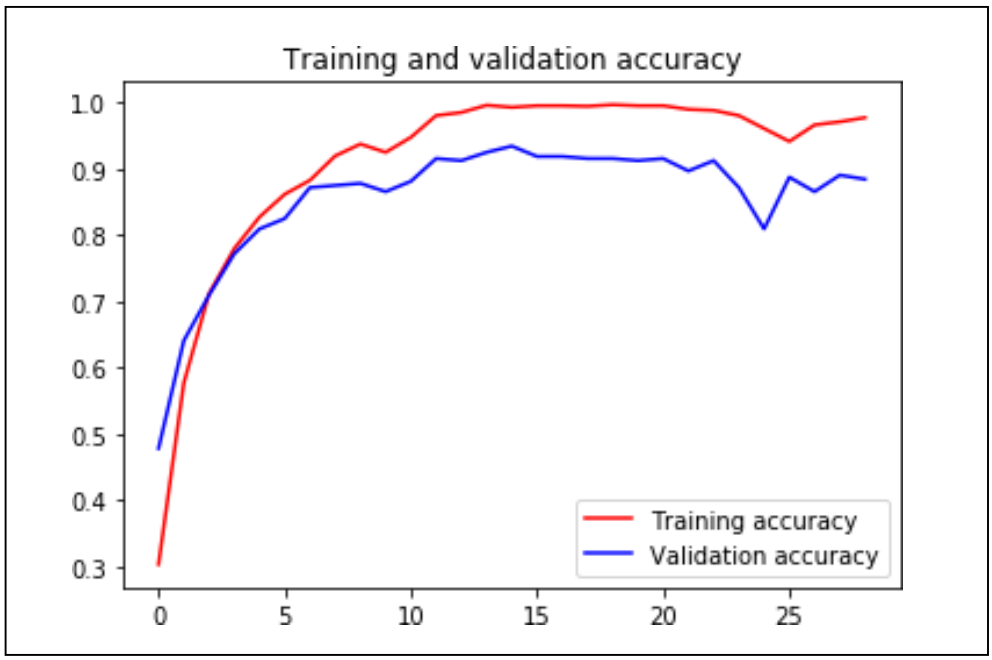


Figure 4.2.1: Training and validation accuracy

Training loss is the mistake of preparing a set of information. Approval misfortune is the blunder after running the approval set of information through the prepared network. Fig appears a chart that contains preparing and approval loss of our demonstrate.

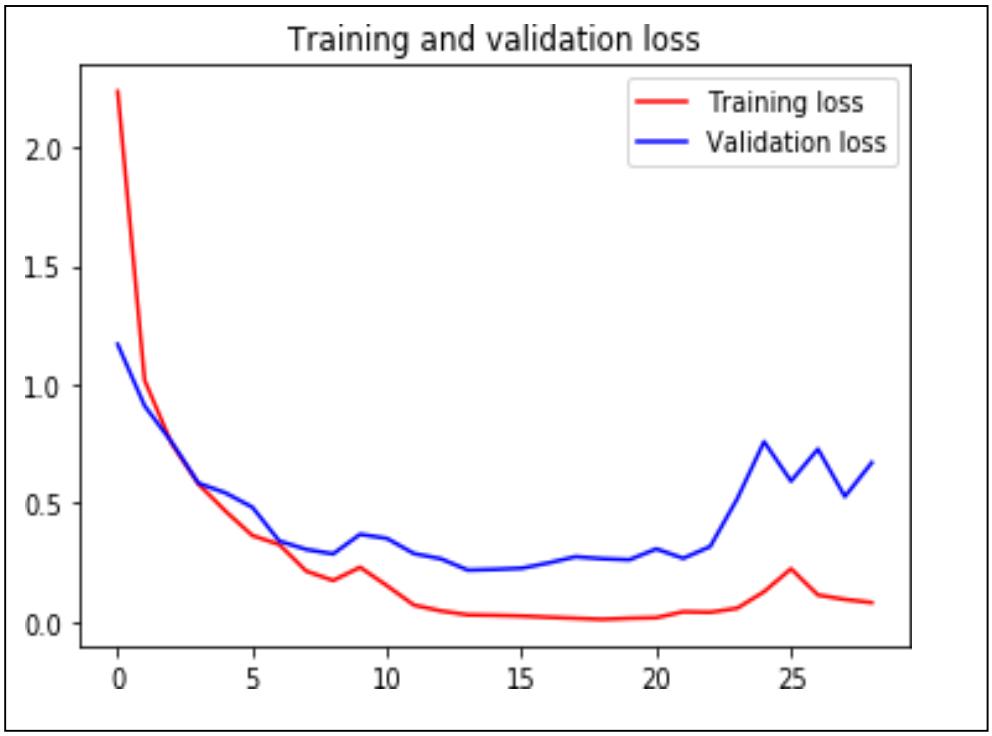


Figure 4.2.2: Training and validation loss

4.3 Result Discussion

In this project we determined Precision, Recall, f1-score and support from test dataset containing 150 pictures. From the order report, we can see Precession normal is 0.80, Recall normal is 0.79,f1-score 0.80 and support 120. So, it very well may be said that the execution of our classifier is wonderfully incredible. We can see that the classifier achieved a decent accuracy, which is 81%

Table 4.3.1: Result Discussion

Class	Precision	Recall	F1-Score	Support
Car	0.91	0.90	0.90	100
CNG	0.83	0.86	0.84	100

Bicycle	0.85	0.89	0.87	100
Rickshaw	0.88	0.81	0.84	100
Avg	0.86	0.86	0.86	100

Table 4.3.2 : Recognition Accuracy

Database	Accuracy
University Of Madrid	94%
Bangladeshi Vehicle	86%

Precision: Within the field of data recovery, precision is the division of recovered reports that are pertinent to the inquiry:

$$\text{Precision} = \frac{tp}{tp+fp} \quad (4)$$

Precision is utilized with the review, the percent of all pertinent archives that's returned by the look. Note that the meaning and usage of "precision" within the field of data recovery contrasts from the definition of exactness and exactness inside other branches of science and innovation.

Recall: Recall is the piece of pertinent occasions that have been recovered over the full amount of relevant occurrences. The tall recall implies that a calculation returned most of the significant result.

$$\text{Recall} = \frac{tp}{tp+fn} \quad (5)$$

Accuracy: accuracy refers to the familiarity of the measured value to a known value.

$$\text{Accuracy} = \frac{tp+tn}{tp+tn+fp+fn} \quad (6)$$

Prediction:

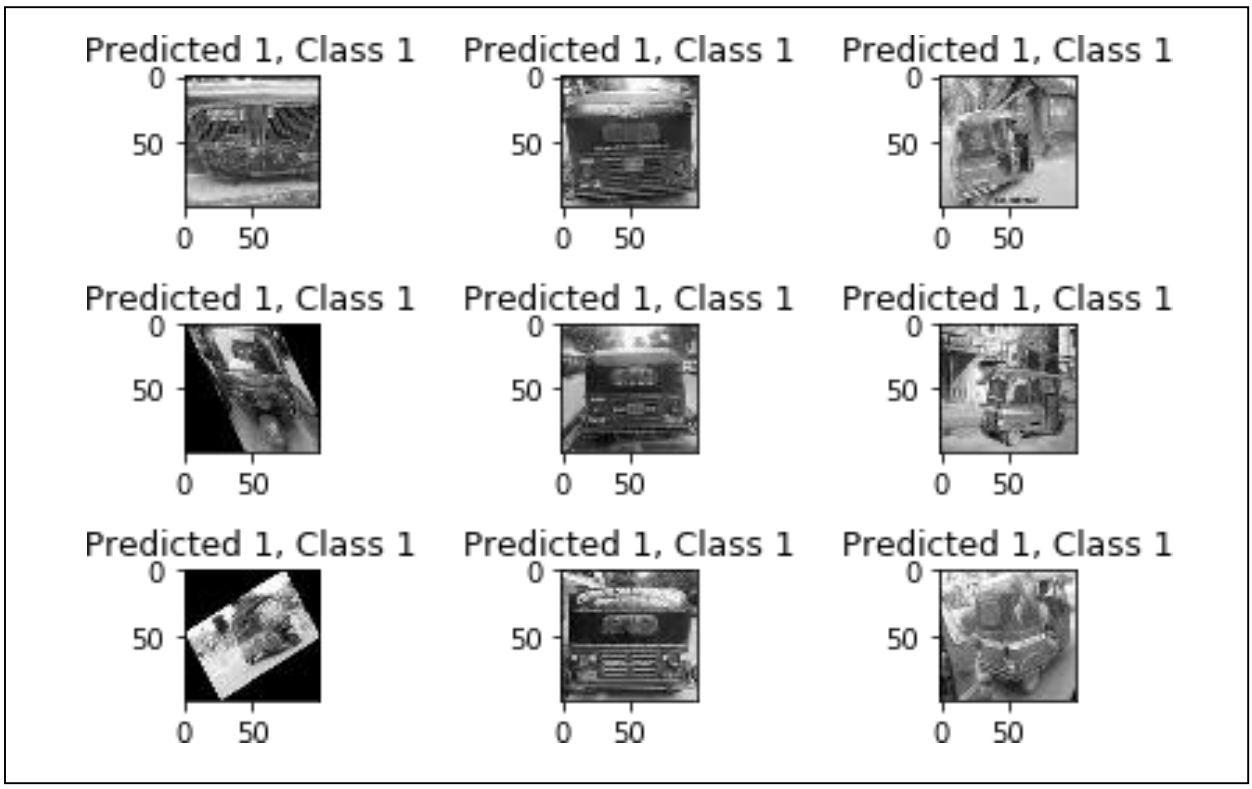


Figure 4.3.1: Prediction Images

In the above figure, we have shown some prediction images from Bangladeshi database which are prepared and processed by us. Here we assigned CNG as class 1.All the images of this figure are recognized by Convolutional Neural Network.

CHAPTER 5

CONCLUSION, RECOMMENDATION AND FUTURE WORKS

5.1 Summary of the Study

It has no doubt that there is a lot of research works on. Basically first of all we are proposed a model for this project. We had to collect so many data from different place. Then we preprocessed our dataset for training and testing purpose. We used an algorithm which known as convolutional neural network (CNN). Finally we find our expected result which accuracy is better than rest of the project related work. Vehicle recognition and classification are some of the important domains of traffic. In a variety of applications, it has become important. Nowadays there are many kinds of technology used in traffic, so this approach will invent a new technology which is our main goal to find out something for traffic and security arena.

5.2 Conclusion

In this task, we give a methodology of the vehicle order approach by our convolutional neural system (CNN) model. We utilized three convolution layers, three max surveying layers, four dropout layers, one straighten and two thick layers. For increment information, we took the help of growth. For example, turn less 30 degrees, shear, mirror. We use dropout layers to diminish overfitting. The outcome we've accomplished is truly encouraging. Ideally, this methodology will be sought after and created in the future as a feature of further commitments in vehicle.

5.3 Future Works

In our proposed procedure we can order particular sorts of vehicles, we have used convolution neural frameworks to develop a model for our vehicle information. Our future objective is to frame a superior and more grounded precision. We have a mastermind to do a 3D significance picture based order by significant learning. Where we are going to use MS Kinect or Intel Real Sense. We are going use unmistakable sorts of computation which will choose the beneficial one. As you realize that in this report are portrayed the entire procedure of this venture. Presently its segment of future extension. As you realize that our title name seems to be "vehicle classification". Furthermore, an arrangement can be utilized in numerous parts. In AI characterization additionally can be utilized generally. In this venture related future extension can be vehicle number plate

discovery. It likewise can be utilized in vehicle locations as well. We figure it will bring another period. Since our truck drivers most extreme time drive so generally. By this calculation, we can without much of a stretch catch the driver data. Furthermore, we additionally such a large number of recognition as well, as bike, Bus, Cruiser thus numerous things.

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APPENDIX

To complete the project we confronted so numerous issues, to begin with, one was to decide the methodological approach for our venture. It was not conventional work it was an inquiry about the based venture, moreover, there was not much work done sometime recently on this range. So we might not get that much offer assistance from anyplace. Another issue was that collection of information, it was a huge challenge for us. There was no dataset accessible on this kind of vehicle. Here is the some snap images of our vehicle dataset.

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