TRAFFIC SIGN RECOGNITION SYSTEM (TSRS)

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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 titled **"Traffic Sign Recognition System (TSRS)"**, submitted by Nazmul Hasan and Tanvir Anzum 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 8 July 2020.

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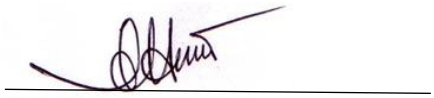

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Nusrat Jahan, Sr. 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.

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ABSTRACT

TSRS (Traffic Sign Recognition System) may plays a significant role in self-driving car, artificial driver assistances, traffic surveillance as well as traffic safety. Traffic sign recognition is necessary to overcome the traffic related difficulties. The traffic sign recognition system consists of two parts- localization and recognition. In localization part, where traffic sign region is located and identified by creating a rectangular area. After that, in recognition part the rectangular box provided the result for which traffic sign is located in that particular region. In this paper, we describe an approach towards traffic signs recognition system. Here, we worked on 12 selected sign to traffic sign detection and recognition purpose. In this intention, we used Support Vector Machine (SVM) and Convolutional Neural Network (CNN) individually to detect and recognize the traffic signs. We obtained 98.33% accuracy for SVM with 80:20 train and test data ratio. On the other hand, the test result was 96.40% accurate for CNN.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

With the rapid growth of technological development, vehicles have become an essential part of in our routine lives. It makes the road traffic more and more intricate, which leads to more traffic accidents every year. In recent times road accidents are happening regularly in increasing manner across the world. Leading reason of most road accidents is the ignorance or unawareness of the traffic sign. The meaning of traffic sign is any object, device, or mark on the road that object is to carry to road users, or any specified class of road user, restrictions, prohibitions, warnings or information of any explanation. Therefore, it includes not only marks on posts, but also road markings, road studs, traffic signals and other traffic control devices to provide smooth car driving.

Traffic Sign Detection and Recognition System (TSRS) is an important issue to reduce traffic and increase the sustainability of self-driving car without any incidence. TSRS plays a crucial role in autonomous vehicle, smart driving and smart traffic system. The traffic sign is used in Bangladesh since 1930's and those are inadequate in this current traffic situations. So, we need to underpin TSRS to provide an autonomous vehicle to reduce traffic as well as road accident.

An approach assembles with video camera and an active computer with the vehicle is a simple driver assistance system based on frame by frame analysis of the motion frames can be developed and there by generated the alert signals accordingly. So, the driver would be able to take the decision effortlessly. Road sign analysis is one of the significant aspects for automated driver support system. Real time qualitative road sign analysis is the root for any updated transport system. In this paper, we proposed this system to recognize traffic sign with supervised classification algorithms. The outcome of this study can be used for recognizing traffic signs and direction also to slow down or direct driver to another safe route.

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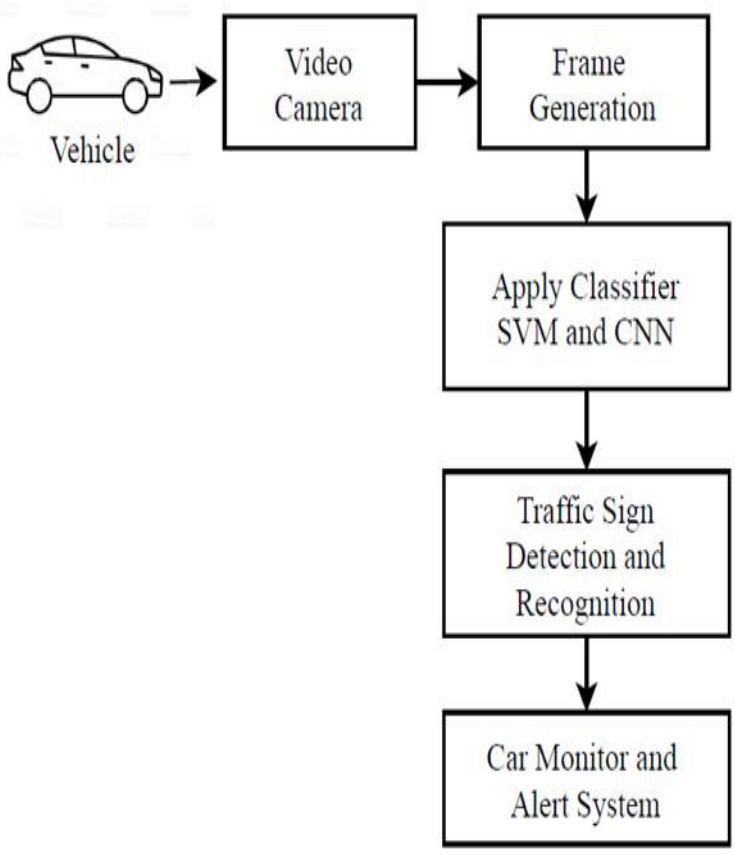

Figure 1.1.1 Basic block diagram for traffic sign recognition system (TSRS)

A simple block diagram to present the overall prospective has depicted in figure 1.1.1. With the help of this diagram, we demonstrated the proposed system towards automated car. In our proposed approach images is captures from vehicle using a video camera. After pre-processing input data classification algorithm was established to detect and recognize the traffic signs. Finally, we introduce a driver alert system to minimize the error of car driving approach.

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1.2 Motivation

Every year so many people died because of road accident. Many of them occur because of driver were unconscious about traffic signs. In that Cyber Physical World every system is technologically connected. So we decided to improve traffic system using modern technology. For this, we will do research on Artificial Intelligence (AI) and Machine Learning (ML) field and then we started to search for some ideas. Then we found so many classification methods to classified traffic signs from it using large amounts of images and videos data set. Finally, we have reached on an awesome idea and it's called "**Traffic signs recognition system (TSRS)"** Based on Image processing. These made us interested to do such kind of inquire about based work. Our work is completely related with machine learning strategies.

1.3 Rational of the Study

Undoubtedly there are thousands of works done on traffic sign recognition using different classification methods. We work with two different types of methods known as SVM (Support Vector Machine) and CNN (Convolutional Neural Network), we are trying to improve accuracy. We will compere those classification methods and implement a system with SVM or CNN which give best accuracy. Image classified as a three level: One of these is select training areas another Generate signature file and the final is Classify. If there are many data provided for training and testing it gives more accurate result. Provided image should be collected from valid sources. It will fulfill the gap of traffic sign detection and recognition. It will be helpful for future researcher to find a solution of TSRS (Traffic Sign Recognition System).

1.4 Research Questions

When we were doing that research that was challenging for us. In order to find a realistic, efficient and accurate solution of the problem, the researchers wish to propose following questions to express the feelings and outcomes this problem,

- The Common research question is what classification technique is use to

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classified?

- How can we detect the Traffic Sign?
- Is it possible to improve traffic system using this approach?
- Is it will be helpful to reduce accident?

1.5 Expected Outcome

After development procedure, classified and trained a large amount of datasets we expect that research based project will be helpful to contribute as,

1.5.1 SVM, CNN based Traffic Sign classification.

1.5.2 It will detect Road side sign like as Stop, Turn Left, Speed Limit, etc.

1.5.3 It will increase traffic safety system.

1.5.4 It will be helpful for driver and autonomous vehicle.

1.5.5 It will help to decrease accidents and that is our main goal.

1.6 Project Management and Finance

In this project we collecting some data from video cropping, and some data collecting from onsite observation. In onsite observation we spend some money to collect data. If we installed our system in any car there will be some cost, like camera cost, device cost, monitor cost, etc.

1.7 Report Layout

Chapter one for 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 by the previous worker/researchers in that regarding area. 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 is design to describe the theoretical discussion on this research work. To

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discuss the theoretical part of research, this chapter elaborates the statistical methods of this work. Besides, this chapter shows the procedural approaches of SVM, CNN and others Machine Learning classifier. And within the final area of this chapter, to approve the show as well as to appear the accuracy of the classifier 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 impact on society, environment and sustainability. In our project how to impact on society and environment good or bad discuss about this chapter.

Chapter six 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.

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CHAPTER 2
BACKGROUND

2.1 Terminologies

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

This section for highlights some recent related research works. Autonomous car is a recent research topic. We found many researches on this field and the working progress is too high.

In 2019, Wei-Jong Yang et al. proposed an approach to recognize traffic sign. They worked with shaped based detection algorithms and for classification purpose they choose convolutional neural network. After simulation they got 97% sign recognition accuracy [1]. In this paper [2] author proposed SVM based classification algorithm to recognize traffic sign. Here, they considered 8 types of road signs. For training purpose, they used 600 different images for each signs and for test purpose 120 images was considered. In this paper, they tested individual signs with real data and their accuracy level was 66.6% to 100%. Prashengit Dhar et al. in 2017 proposed a Traffic Sign Recognition (TSR) system. Here, they were used HSV color model and deep CNN for automatic features extraction as a classifier. After this study, they achieved 97% accuracy [3]. In 2019 [4] Aashrith et al. used Convolutional Neural Networks (CNN) to recognize traffic sign. They found 99.18% accuracy on using Belgium Data and German Traffic Sign Benchmark (GTSDB). Whereas they got 99.50% accuracy almost 0.32% improvement at accuracy. In 2016 at paper [5], Di Zang et al. classified their dataset using Support Vector Machine then detection part is done by CNN. Their

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accuracy was almost 96.50%, and they used GTSDB dataset. In 2017 at paper [6], Ardianto et al. used SVM to classified object and got 91.5% accuracy in detection purpose and they also used GTSDB dataset. They improved it to add a feature called Histogram of Oriented Gradients (HOG) that help to increase its accuracy up to 98%. In 2017 Shi et al., applied SVM to detect which region of image contain a traffic sign [7]. Pavly Salah Zaki and et al. worked on traffic sign detection multi object detection systems. Faster Recurrent Convolutional Neural Networks and Single Shot Multi Box Detector with several feature extractors they used in 2019 to detect traffic sign. However, they underpin F-RCNN to get best results. Here, they used the GTSDB dataset. The GTSDB holds complete 900 images, where 800 for training and 100 for testing [8]. In 2020, Yanmei Jin and et al. also worked with GTSRB dataset to propose a Single Shot Detector algorithm combine with multi feature fusion and they called it MF-SSD. However, in this time they divided total 900 images into 600 training and 300 as a test data to detect traffic sign [9]. In 2017, Yassmina Saadna and Ali Behloul discussed an approach to detect and recognize traffic sign. Their main goal was to find detection methods for localizing the regions of interest that contain traffic sign. They divided the methods into 3 steps- color based, shape based, and finally learning based methods [10]. In 2016, they proposed an approach to detect and classify the traffic signs. It has 2 main steps: road sign detection, and classification with recognition. To classify the traffic signs they used neural network and four types of traffic signs: Stop Sign, No Entry Sign, Give Way Sign, and Speed Limit Sign are used. Considered total 300 sets images, and they got 90% and 88% accuracy for detection and recognition purpose [11]. So, traffic sign detection and recognition is necessary to build an autonomas car driving system. 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 [13]. In 2015 Chiman Kwan,

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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 [14], and have been, all things considered, associated for question area, video classification [15], 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 [16].

2.3 Comparative Analysis and 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. A CNN convolves learned features with input data and uses 2D convolutional layers. This mean that, this type of network is ideal for processing 2D images. A CNN,

- Starts with an input image
- Applies many different filters to create a feature map
- Applies a ReLU function to increases non-linearity
- Applies a pooling layer to each feature map
- Flattens the pooled images into one long vector
- Inputs the vector into a fully connected ANN
- Processes the features through the network. the final fully connected layer provide the voting of the classes that we're after
- Trains through forward propagation and back propagation for many, many epochs. This repeats until we have a well-defined neural network with trained weights and feature detectors.

A SVM (Support Vector Machine) is a discriminative classifier formally defined by a

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separating hyperplane. In other word, it is given labeled training data (Supervised learning), the algorithm outputs an optimal hyperplane which categorizes new example. In 2D space this hyperplane is a line dividing a plane in 2 parts where in each class lay in either side.

2.4 Scope of the problem

Using that TSRS system driver can easily recognize and detect traffic signs. It will assist a driver on new roads because at new road driver can't easily find the traffic signs. To form smart driver assistant, autonomous vehicle or build better traffic system TSRS can help. Since 1980's regarding that topics research is conducting till now, in future any researcher can use that research and can elaborate the dataset to get better results.

2.5 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 are many work with this topic, so it is so difficult for us to get more accurate in our result.

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CHAPTER 3
RESEARCH METHODOLOGY

3.1 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, skit learn, matplotlib, tensorflow, etc. Google Colab and Pycharm was used for all the training and testing process, Google Colab is a free and open-source dispersion of the Python programming language for information science and AI applications. Pycharm free community version free for all user.

3.2 Data Collection Procedure

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. Our dataset sample are shown in table 3.1.

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Table 3.1. 12 Traffic Signs with Description.

Description	Traffic Sign	Description	Traffic Sign
Turn Left		Danger	
Stop		40km/h	
Only Left		30km/h	
Only Right		Turn Right	
Road Merges Ahead		Pedestrian	
Speed Breaker		Bike	

3.3 Statistical Analysis

To complete this study a dataset was built from onsite observation collected data. We also collect some random videos and crop traffic sign area to build a real dataset. Then, we categorized its own classes and split the whole data into training and validation dataset. We have total 1200 images to propose SVM and CNN model. We have considered 12 different classes and each class completed with 100 images. Split the whole dataset as training and validation purpose. To generate a model with SVM, 80% data for training and 20% data for testing purpose is considered. Meanwhile, for CNN classification we have divided dataset into two classes train and validation. For training purpose data volume was 1080 images and 120 images for testing purpose,

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where total 12 different traffic signs were contained. Table 1 to represent the selected 12 traffic signs. Here, we illustrated every traffic sign with sample an image.

3.4 Proposed Methodology

We proposed two novel image classification method CNN and SVM. In this section we discuss about CNN and SSM full features. A sample flowchart for our proposed model on CNN and SVM is given in figure 3.4.1.

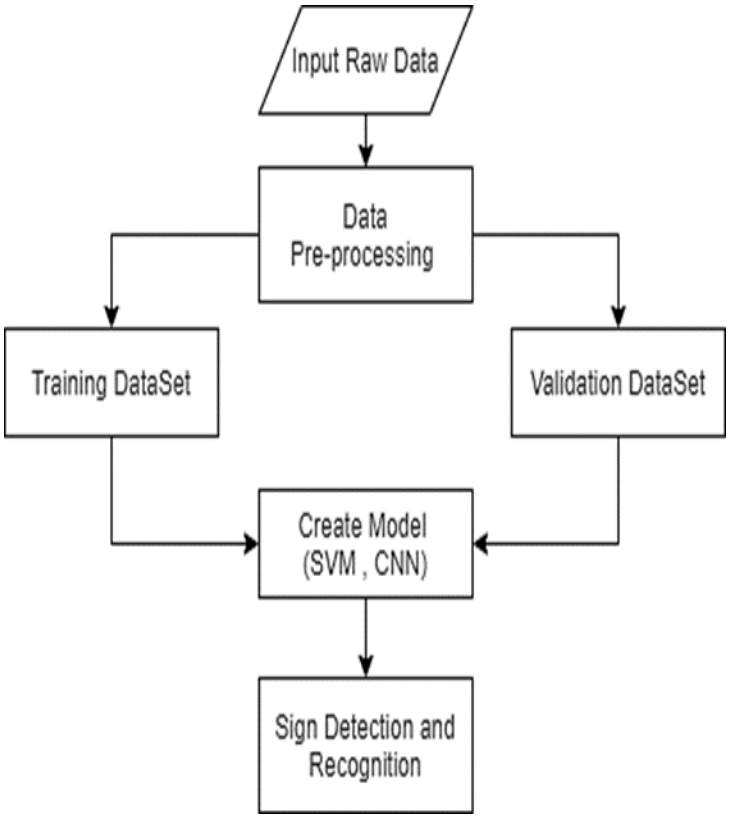

Figure 3.4.1. Flowchart of our model

3.4.1 Convolutional Neural Network

The convolutional neural network is a class of deep learning neural network. Convolutional neural network represents a huge breakthrough in image recognition. In this recent era CNN is one of the most popular machine learning algorithms. Many research fields focused on CNN to achieve the highest accurate result. A CNN model constructs with following

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four layers:

- Convolutional layers
- Relu function
- Polling layers
- Fully connected layer

Here, Convolutioal operates on two images in 2D format. One as a input image, and other as a filter of the input image, to produce an output image. A convolution of two funcation f and g is defined with following the equation [17] –

$$(f * g)(i) = \sum_{j=i}^{m} g(j) * f(i - j + \frac{m}{2}) \quad (1)$$

The rectified linear unit is another step to implement convolutional layer. In this layer applying an activation funcation “relu” onto feature maps to increase non- linearity in the network. On the other hand, Polling progressively decrese the size of the input representation. It makes it possible to detect objects in an image. It helps to decrese the number of parameters and the amount of computation required. Polling also helps to control overfitting. There are many types of polling. But in this paper we used max polling. Fully connected layer, in this step an artificial neural network work as a CNN. This step combine our features into more attributes. These will predict the class level with better accuracy. The error is computed and then occured back propagation. The weights and feature detectors are adjusted to help optimize the performance of the model. This process is continue layer by layer. A sample flowchart for CNN methodologyshown in figure 3.4.2

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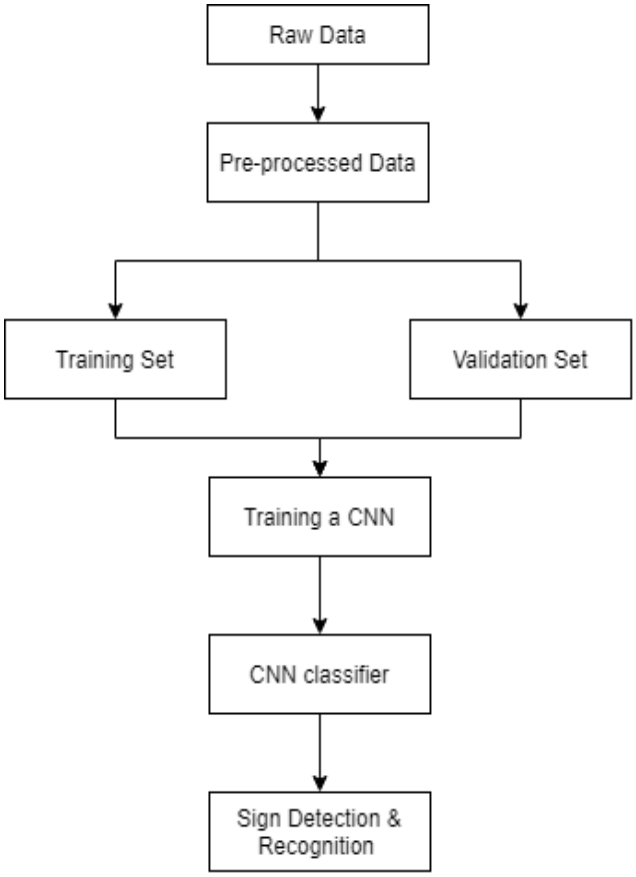

Figure 3.4.2. Flowchart for CNN classification

3.4.2 Support Vector Machin

SVM is a discriminative classifier that is defined by a separating hyperplane. Mainly, SVM is a familiar supervised machine learning algorithm. It is usually used in classification problems. In the SVM model, we can plot each item as a point in n-dimensional space with the value of each feature being the value of a particular coordinate (where n is a number of features). It will be clearly understanding with an example for two classes. We can understand the process of SVM model with the help of figure 3.4.3

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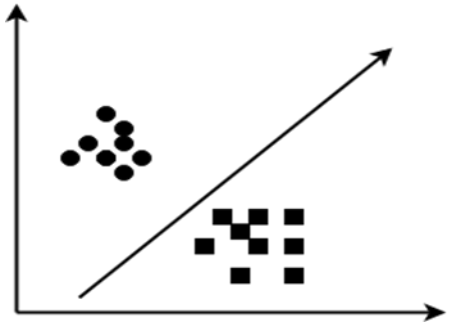

Figure 3.4.3. Spilt data into two classes (SVM)

To understand the work process of SVM we neeed to know the ROI module. This region follow three steps. First one is, color transformation. Which convert the RGB value of each pixel to gray pixel. The second step is to control shape matching over the gray images to find possible sign locations. Finally, it refines the ROI. This module exploits the regularity of traffic signs with their color and shape with high competence.

In this paper, to describe the methodology, the size of the cells and blocks are varied to get different image sizes. We used 9-bin histograms for this methodology. To train the model we rescale the training images to 32x32 pixel images. HOG descriptors to calculate and train SVM classifier. The n resulting support vectors are merged to a single one by multiplying every vector by its weight “a” and adding it with a global vector “v”. Equation 2 for cumputing the suport vector [12].

$$v = \sum_{i}^{n} \alpha_i . v_i \tag{2}$$

Now, we illustrated the whole work process of SVM in figure 3.4.4. Here, we depict all the steps of SVM to reciognize the traffic signs for TSRS.

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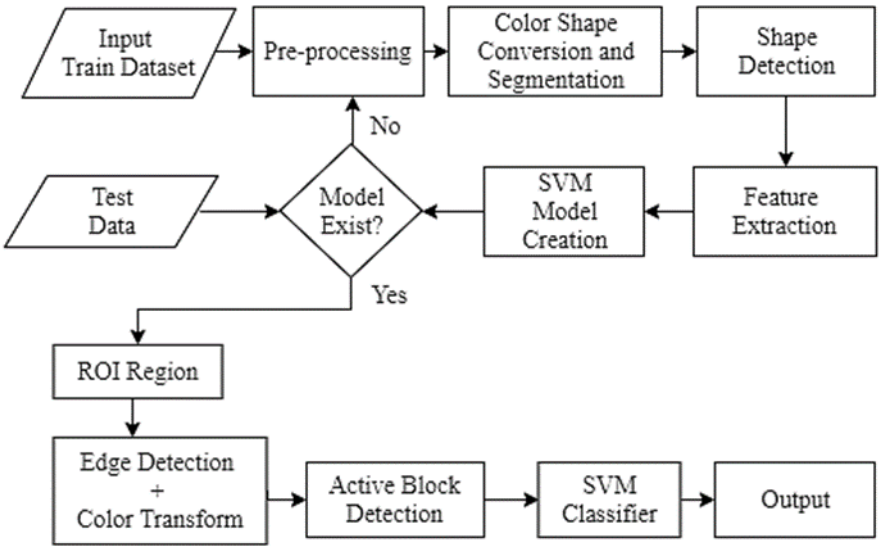

Figure 3.4.4. Flowchart of SVM for Traffic Sign Detection and Recognition

3.5 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:

3.5.1 Hardware/Software Requirements

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

3.5.2 Developing Tools

- Python Environment
- Pycharm
- Google Colab

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CHAPTER 4
EXPERIMENTAL RESULTS AND DISCUSSION

4.1 Experimental Setup

Our Proposed framework investigation procedures are done on a PC with a Core-i3,7100U processor having 2.40GHz Speed, 2 cores, 1 sockets and 4 logical processors. Additionally, the framework had 8GB of RAM and intel(R) HD graphic for video memory. For programming use python environment, pychram free community version and Google colab.

4.2 Experimental Result & Analysis

In this section we are going to discuss about result which was obtained from SVM and CNN. SVM classification for Traffic sign detection and recognition provided 98.33% accuracy (80:20 data split ration), while in CNN method we achieved 99.56% training accuracy and 96.40% validation accuracy. The training accuracy, validation accuracy and loss of CNN model is visualized in figure 4.2.1 and 4.2.2.

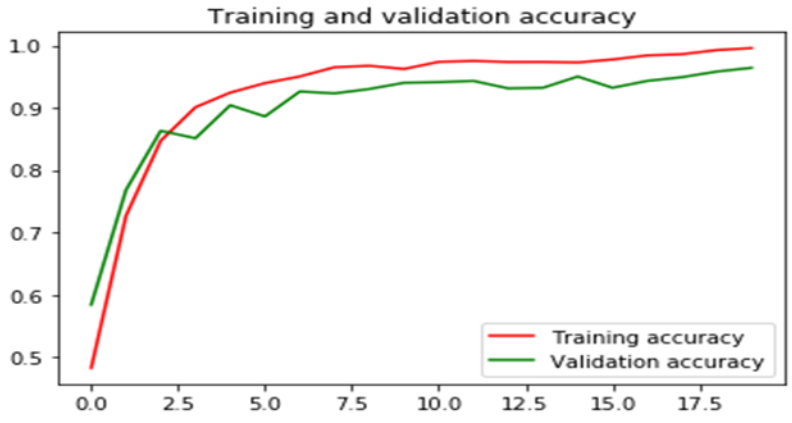

Figure. 4.2.1. Accuracy of Training and validation

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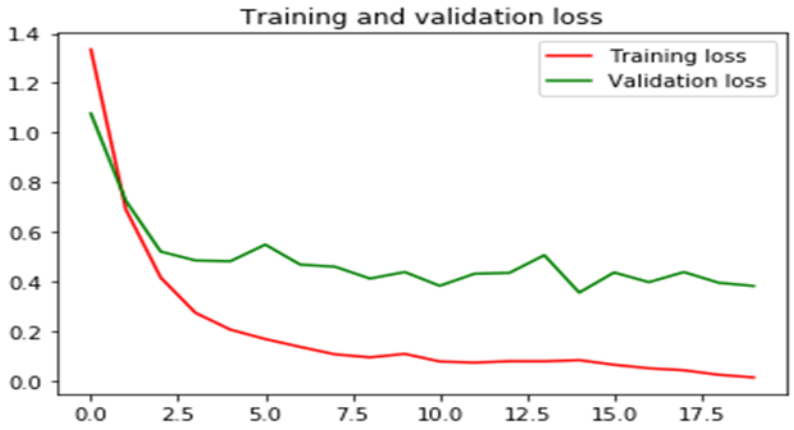

Figure. 4.2.2. Line chart for Training and validation loss

For SVM method we were getting 98.33% accuracy when we split total dataset into 80:20 ration for training and testing purpose. However, we achieved 99.17% accuracy when considered 90:10 ration. Figure 4.2.3 and 4.2.4 for presenting the performance of SVM.

```
Spliting data into training (80%) and test set (20%)...
Training SVM model ...
[10.  8.  2.  9.  2.  6. 11.  2.  9.  8.  4.  2.  5.  0.  3.  7.  2.  0.
  9.  3.  5.  2.  1. 10.  6.  2. 11. 11.  7.  9.  6.  7.  9. 11.  1.  7.
  8.  2.  0.  6.  5. 11. 10.  9.  1.  4.  2.  9.  5. 11.  3.  8.  3.  4.
  4.  5.  8.  3. 10. 11.  9.  1.  5. 10.  2.  3.  3.  6.  5.  4.  8.  3.
  9.  1.  4.  3.  4.  0. 10.  0. 11. 11.  4.  5. 11.  7.  8.  3.  0.  8.
  3.  0.  1.  6.  9.  3.  2. 11.  4. 11.  6.  9.  2.  1.  3.  3. 10.  1.
  9.  0.  1.  7.  1.  3.  5.  5.  7.  5.  9. 10.  4.  9.  8.  4.  3.  6.
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  4.  7.  0.  0. 10.  9.  4. 11.  0.  3.  2.  3.  3.  5.  0.  4.  2. 10.
 10.  7. 11. 11.  5. 11.]
Accuracy: 98.33 %
```

Figure. 4.2.3. Result of SVM for 80:20 ration

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```
Spliting data into training (90%) and test set (10%)...
Training SVM model ...
[ 2.  9.  8.  4.  3.  6.  3.  6.  7.  6.  9.  4. 10.  5. 11.  9.  3.  4.
 10.  5.  7.  4.  3.  2.  6.  1. 10.  4.  2.  2.  0. 10.  4. 11.  9. 10.
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  0.  4.  7.  7.  6.  6.  7.  5.  1. 10.  6.  8.  7.  3.  2.  0.  0.  6.
  0.  4.  7.  8.  7.  7. 10.  6.  0. 10. 11.  7.  6.  9.  4. 11.  0.  2.
  8.  5.  6.  0.  6.  6.  4.  7.  0.  0. 10.  9.  4. 11.  0.  3.  2.  3.
  3.  5.  0.  4.  2. 10. 10.  7. 11. 11.  5. 11.]
Accuracy: 99.17 %
```

Figure 4.2.4: Result of SVM 90:10 ration

After that, we developed a system using SVM to evaluate the results with real time video. The detection part uses image processing techniques that creates contour on each frame and finds all ellipse or circles among those contours. Then, the detection part marked as categorized traffic sign. Some sample results shown in following figures.

Figure 4.2.5. Recognize “Danger” Sign

Figure 4.2.6. Recognize Drive “30 km/h” Sign

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Figure 4.2.7. Recognize “Turn Right” Sign

4.3 Discussion

Figure 4.2.5, 4.2.6, and 4.2.7 to understand the performance of SVM with the help of some real time data. If we implement the full system with CNN, then it will be work well then SVM as we have mentioned their accuracy level. After complete our study we obtained TSRS can be an established and sustainable system. Many researches are going on with traffic issues and self-car driving purpose. We needed an accurate model to implement this system to provide the better solution in every case.

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CHAPTER 5
IMPACT ON SOCIETY, ENVIRONMENT AND SUSTAINBILITY

5.1 Impact on Society

Today it's an era of science and technology. This paper is working with an aim of recognition traffic signs to assist driver to find which traffic sign is ahead. It will be helpful to the driver to maintain traffic rules. Everyday around us so many accidents occurring due to the less knowledge about traffic system. That system will be very helpful as a driver assistant for reducing accident by help driver to recognizing traffic signs. That feature can be also use in autonomous vehicle. So we can see that our proposed system technically has great impact on society.

5.2 Impact on Environment

Proposed system is helpful for environment so many ways, at traditional way traffic system can causes more traffic jam and for that occur sound and air pollutions. But using TSRS, traffic jam can be reducing as well as air and sound pollution will be reduce. Also if any car accident it will be very harmful of environment like people death, tree broken and also harm road environment. Our proposed system can be reducing accident. So our proposed system is very helpful for environment.

5.3 Ethical Aspects

For clarify that issues take an example, let we have an emergency situation, but in front we have stop signs or speed limit sign but at traditional way driver can easily brake rule as well as his interest. But proposed driving assistant can't allow it for an ethical issue for the safety of all. You may be stuck on the traffic on some time or it may be increase your travel time but it will surely provide you a safest path.

5.4 Sustainability Plan

To implement TSRS or implement a driving assistant on vehicle can be costly but using that system if one life can save from uncertain accident then there will be no question about its sustainability, because a life worth than any things. Many developed countries

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implement it. It is bit costly for developed country to implement driver assistant on vehicle. But it can saves vehicle and lives which can be much more worthy.

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CHAPTER 6
CONCLUSION, RECOMMENDATION AND FUTURE WORKS

6.1 Summary of the Study

It has no doubt that there is a lot of research works on. Basically first of all we are proposed two 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 algorithm which known as convolutional neural network (CNN) and support vector machine (SVM). Finally, we find our expected result which accuracy is better than rest of the project related work. Traffic signs 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 area.

6.2 Conclusions

This paper study was to represent an original effective traffic sign detection and recognition approach towards the design of TSRS. As a recent research topic TSRS is getting popular day by day. In this study, it is done using SVM and CNN classification algorithms to decline extensive traffic difficulties. In our experiment, we obtained highest training accuracy from CNN 99.56%, while the test accuracy was 96.40%. We showed the real time evaluation results of SVM, where the system performed 98.33% accurately for 80:20 ration training and test dataset. On the other hand, we getting 99.17% accurately for 90:10 ration training and test dataset. Many research focused on SVM and CNN to solve this specific problem.

6.3 Implication for Further Study

In future, our aim is to increase the number of traffic sign classes with large amount of quality data. As in a machine learning research, to maintain data volume and data quality is most important and time consuming part. To provide a complete system to overcome

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the traffic issues our ambition is to implement a system with distance calculation form car to traffic sign. Also we work with road surface images like lane detection, zebra crossing detection, speed backer detection, road surface hole' detection.

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REFERENCES

[1] Yang, WJ., Luo, CC., Chung, PC., Yang, JF.: Simplified Neural Networks with Smart Detection for Road Traffic Sign Recognition. In: Arai K., Bhatia R. (eds) Advances in Information and Communication. FICC 2019. Lecture Notes in Networks and Systems, vol 69. Springer, Cham (2020)

[2] Dubey, A.R., Shukla, N., Kumar, D.: Detection and Classification of Road Signs Using HOG-SVM Method. In: Elçi A., Sa P., Modi C., Olague G., Sahoo M., Bakshi S. (eds) Smart Computing Paradigms: New Progresses and Challenges. Advances in Intelligent Systems and Computing, vol 766. Springer, Singapore (2020)

[3] Dhar, M. Z., Abedin, T., Biswas, Datta, A.: Traffic sign detection — A new approach and recognition using convolution neural network. 2017 IEEE Region 10 Humanitarian Technology Conference (R10-HTC), Dhaka, pp. 416-419, (2017)

[4] Aashrith, V., Smriti, S.: Traffic Sign Detection and Recognition using a CNN Ensemble. IEEE International Conference on Consumer Electronics (ICCE). 07 March, (2019)

[5] Di, Z., Junqi, Z., Dongdong, Z.: Traffic sign detection based on cascaded convolutional neural networks. In: Conference on Software Engineering, Artificial Intelligence, Networking and Parallel/Distributed Computing (SNPD), (2016)

[6] Sandy, A., Chih-Jung, C., Hsueh-Ming H.: Real-time traffic sign recognition using color segmentation and SVM. In: Conference on Systems, Signals and Image Processing (IWSSIP), (2017)

[7] Jian-He, S., Huei-Yung, L.: A vision system for traffic sign detection and recognition. IEEE 26th In: Symposium on Industrial Electronics (ISIE), (2017)

[8] Zaki, P. S., et al.: Traffic Signs Detection and Recognition System using Deep Learning. In: Conference on Intelligent Computing and Information Systems (ICICIS) (2019)

[9] Jin, Y., Fu, Y., Wang, W., Guo, J., Ren, C., Xiang, X.: Multi-Feature Fusion and Enhancement Single Shot Detector for Traffic Sign Recognition. in IEEE Access, vol. 8, pp. 38931-38940, (2020)

[10] Saadna, Y., Behloul, A.: An overview of traffic sign detection and classification methods. In: J Multimed Info Retr 6, 193–210. https://doi.org/10.1007/s13735-017-0129-8 (2017)

[11] Sheikh , M. A. A., Kole , A., Maity, T.: Traffic sign detection and classification using colour feature and neural network. In: Conference on Intelligent Control Power and Instrumentation (ICICPI), Kolkata, pp. 307-311. (2016)

[12] Fatin, Z., Bogdan, S.: Warning traffic sign recognition using a HOG-based K-d tree. IEEE Intelligent Vehicles Symposium (IV), (2011)

[13] Youpan Hu, Qing He, Xiaobin Zhuang, Haibin Wang, Baopu Li, Zhenfu Wen, Bin Leng, Guan Guan,Dongjie Chen "Algorithm for vision-based vehicle detection and classification", IEEE International Conference on Robotics and Biomimetics (ROBIO),ISBN: 978-1-4799-2744-9,2013

[14] Chiman KwanBryan,ChouAdam,Echavarren,Bence Budavari,Jiang Li,Trac Tran,"Compressive Vehicle Tracking Using Deep Learning", IEEE Ubiquitous Computing, Electronics & Mobile Communication ConferenceAt: New York City,November 2018

[15] R. Girshick, J. Donahue, T. Darrell, and J. Malik, "Rich feature hierarchies for accurate object detection and semantic segmentation", in Proceedings of the IEEE conference on computer vision and pattern recognition, 2014, pp. 580–587

[16] A. Karpathy,G.Todereci S.Shetty, T.Leung, R. Sukthankar, and L. Fei-Fei, "Large-scale video classification with convolutional neural networks", in Proceedings of the IEEE conference on

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Computer Vision and Pattern Recognition, 2014, pp. 1725–1732.

[17] Understanding neural network, available at << https://towardsdatascience.com/understanding-neural-networks-from-neuron-to-rnn-cnn-and-deep-learning-cd88e90e0a90>>, last accessed on May 2, 2020 at 1:33 PM.

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APPENDICES

Appendix is about research reflection. To complete the project, we confronted so numerous issues, to begin with, one was to decide the methodological approach for our work. Another issue was that collection of data; it was a huge challenge for us. But we over come from this challenge and successfully complete our work. The main feature of our application is traffic sign detection and recognition. Using our application driver can easily know the traffic signs meaning and easily take her decision. And this is also reducing accident. Also step up to build autonomous vehicles. Thus, we have a tendency to believe that our "**Traffic Sign Recognition System (TSRS)**" application are going to be terribly positive and effective for users.

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< 1% match (publications)
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< 1% match (publications)
E. Sanz-Madoz, J. Echanobe, O. Mata-Carballeira, I. del Campo, M. V. Martinez. "Reduced Kernel
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< 1% match (Internet from 28-Apr-2020) https://towardsdatascience.com/understanding-neural-networks-from-neuron-to-rnn-cnn-anddeep-learning-cd88e90e0a90?gi=dba395c13f8c

< 1% match (publications)
Md. Abdul Alim Sheikh, Alok Kole, Tanmoy Maity. "Traffic sign detection and classification using colour feature and neural network", 2016 International Conference on Intelligent Control Power and Instrumentation (ICICPI), 2016

< 1% match (publications)
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< 1% match (publications)
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Electrical Information and Communication Technology (EICT), 2019

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https://www.spiedigitallibrary.org/journals/Optical-Engineering/volume-47/issue-03/037402/Robust-technique-for-watermark-embedding-in-a-video-stream-based/10.1117/1.2896539.full

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https://www.mantralabsglobal.com/blog/why-should-businesses-consider-chatbots/

< 1% match (publications)
"Smart Computing Paradigms: New Progresses and Challenges", Springer Science and Business Media LLC, 2020

< 1% match (publications)
Yanmei Jin, Yusheng Fu, Wenqin Wang, Jinhong Guo, Chunhui Ren, Xin Xiang. "Multi-Feature Fusion and Enhancement Single Shot Detector for Traffic Sign Recognition", IEEE Access, 2020

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< 1% match (publications)
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"Information of Authors", 2019 Ninth International Conference on Intelligent Computing and Information Systems (ICICIS), 2019

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< 1% match (publications)
"Intelligent Computing, Networking, and Informatics", Springer Science and Business Media LLC, 2014

< 1% match (publications)
S. Maldonado-Baseon. "Traffic sign shape classification evaluation II: FFT applied to the signature of blobs", IEEE Proceedings Intelligent Vehicles Symposium 2005, 2005

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ABSTRACT . TSRS (Traffic Sign Recognition System) may plays a significant role in selfdriving car, artificial driver assistances, traffic surveillance as well as traffic safety. Traffic sign recognition is necessary to overcome the traffic related difficulties. Thetraffic sign recognition system consists of two parts- localization and recognition. In localization part, where traffic sign region is located

and identified by creating a rectangular area. After that, in recognition part the rectangular box provided the result for which traffic sign is located in that particular region. In this paper, we describe an approach towards traffic signs recognition system. Here, we worked on 12 selected sign to traffic sign detection and recognition purpose. In this intention, we used Support Vector Machine (SVM) and Convolutional Neural Network (CNN) individually to detect and recognize the traffic signs. We obtained 98.33% accuracy for SVM with 80:20 train and test data ratio. On the other hand, the test result was 96.40% accurate for CNN. i CHAPTER 1 INTRODUCTION 1.1 Introduction With the rapid growth of technological development, vehicles have become an essential part of in our routine lives. It makes the road traffic more and more intricate, which leads to more traffic accidents every year. In recent times road accidents are happening regularly in increasing manner across the world. Leading reason of most road accidents is the ignorance or unawareness of the traffic sign. The meaning of traffic sign is any object, device, or mark on the road that object is to carry to road users, or any specified class of road user, restrictions, prohibitions, warnings or information of any explanation. Therefore, it includes not only marks on posts, but also road markings, road studs, traffic signals and other traffic control devices

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to provide smooth car driving. Traffic Sign Detection and Recognition System (TSRS) is an important issue to reduce traffic and increase the sustainability of self-driving car without any incidence. TSRS plays a crucial role in autonomous vehicle, smart driving and smart traffic system. The traffic sign is used in Bangladesh since 1930's and those are inadequate in this current traffic situations. So, we need to underpin TSRS to provide an autonomous vehicle to reduce traffic as well as road accident. An approach assembles with video camera and an active computer with the vehicle is a simple driver assistance system based on frame by frame analysis of the motion frames can be developed and there by generated the alert signals accordingly. So, the driver would be able to take the decision effortlessly. Road sign analysis is one of the significant aspects for automated driver support system. Real time qualitative road sign analysis is the root for any updated transport system. In this paper, we proposed this system to recognize traffic sign with supervised classification algorithms. The outcome of this study can be used for recognizing traffic signs and direction also to slow down or direct driver to another safe route. Figure 1.1.1 Basic block diagram for traffic sign recognition system (TSRS) A simple block diagram to present the overall prospective has depicted in figure 1.1.1. With the help of this diagram, we demonstrated the proposed system towards automated car. In our proposed approach images is captures from vehicle using a video camera. After pre-processing input data classification algorithm was established to detect and recognize the traffic signs. Finally, we introduce a driver alert system to minimize the error of car driving approach. 1.2 Motivation Every year so many people died because of road accident. Many of them occur because of driver were unconscious about traffic signs. In that Cyber Physical World every system is technologically connected. So we decided to Improve traffic system using modern technology. For this, we will do research on Artificial Intelligence (AI) and Machine Learning (ML) field and then we started to search for some ideas. Then we found so many classification methods to classified traffic signs from it using large amounts of images and videos data set. Finally, we have reached on an awesome idea and it's called "Traffic signs recognition system (TSRS) Based on Image processing". These made us interested to do such kind of inquire about based work. Our work is completely related with machine learning strategies. 1.3 Rational of the Study Undoubtedly there are thousands of works done on traffic sign recognition using different classification methods. We work with two different types of methods known as SVM (Support Vector Machine) and CNN (Convolutional Neural Network), we are trying to improve accuracy. We will compere those classification methods and implement a system with SVM or CNN which give best accuracy. Image classified as a three level: One of these is Select training areas another Generate signature file and the final is Classify. If there are many data provided for training and testing it gives more accurate result. Provided image should be collected from valid sources. It will fulfill the gap of traffic sign detection and recognition. It Will be helpful for future researcher to find a solution of TSRS (Traffic Sign Recognition System). 1.4 Research Questions When we were doing that research that was challenging for us. In order to find a realistic, efficient and accurate solution of the problem, the researchers wish to propose following questions to express the feelings and outcomes this problem, ? The Common research question is what classification technique is use to classified? ? ? ? How can we detect the Traffic Sign? Is it possible to improve traffic system using this approach? Is it will be helpful to reduce accident? 1.5 Expected Outcome After development procedure, classified and trained a large amount of datasets we expect that research based project will be helpful to contribute as, ? SVM, CNN based Traffic Sign classification. ? ? ? It will detect Road side sign like as Stop, Turn Left, Speed Limit, etc. It will increase traffic safety system. It will be helpful for driver and autonomous vehicle. ? It will help to decrease accidents and that is our main goal. 1.6 Project Management and Finance In this project we collecting some data from video cropping, and some data collecting from onsite observation. In onsite observation we spend some money to collect data. If we installed our system in any car there will be some cost, like camera cost, device cost, monitor cost, etc. 1.7 Report Layout Chapter one for 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 by the previous worker/researchers in that regarding area. 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 is design to 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 SVM, CNN and others Machine Learning classifier. And within the final area of this chapter, to approve the show as well as to appear the accuracy of the classifier 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 impact on society, environment and sustainability. In our project how to impact on society and environment good or bad discuss about this chapter. Chapter six 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 Terminologies 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 This section for highlights some recent related research works.
Autonomous car is a recent research topic. We found many researches on this field and the working progress is too high. In 2019, Wei-Jong Yang et al. proposed an approach to recognize traffic sign. They worked with shaped based detection algorithms and for classification purpose they choose convolutional neural network. After simulation they got 97% sign recognition accuracy [1]. In this paper [2] author proposed SVM based classification algorithm to recognize traffic sign. Here, they considered 8 types of road signs. For training purpose, they used 600 different images for each signs and for test purpose 120 images was considered. In this paper, they tested individual signs with real data and their accuracy level was 66.6% to 100%. Prashengit Dhar et al. in 2017 proposed a Traffic Sign Recognition (TSR) system. Here, they were used HSV color model and deep CNN for automatic features extraction as a classifier. After this study, they achieved 97% accuracy [3]. In 2019 [4] Aashrith et al. used Convolutional Neural Networks (CNN) to recognize traffic sign. They found 99.18% accuracy on using Belgium Data and German Traffic Sign Benchmark (GTSDB). Whereas they got 99.50% accuracy almost 0.32% improvement at accuracy. In 2016 at paper [5], Di Zang et al. classified their dataset using Support Vector Machine then detection part is done by CNN. Their accuracy was almost 96.50%, and they used GTSDB dataset. In 2017 at paper [6], Ardianto et al. used SVM to classified object and got 91.5% accuracy in detection purpose and they also used GTSDB dataset. They improved it to add a feature called Histogram of Oriented Gradients (HOG) that help to increase its accuracy up to 98%. In 2017 Shi et al., applied SVM to detect which region of image contain a traffic sign [7]. Pavly Salah Zaki and et al. worked on traffic sign detection multi object detection systems. Faster Recurrent Convolutional Neural Networks and Single Shot Multi Box Detector with several feature extractors they used in 2019 to detect traffic sign.
However, they underpin F-RCNN to get best results. Here, they used the GTSDB dataset. The GTSDB holds complete 900 images, where 800 for training and 100 for testing [8]. In 2020, Yanmei Jin and et al. also worked with GTSRB dataset to propose a Single Shot Detector algorithm combine with multi feature fusion and they called it MF-SSD. However, in this time they divided total 900 images into 600 training and 300 as a test data to detect traffic sign [9]. In 2017, Yassmina Saadna and Ali Behloul discussed an approach to detect and recognize traffic sign. Their main goal was to find detection methods for localizing the regions of interest that contain traffic sign. They divided the methods into 3 steps- color based, shape based, and finally learning based methods [10]. In 2016, they proposed an approach to detect and classify the traffic signs. It has 2 main

steps: road sign detection, and classification with recognition. To classify the traffic signs they used neural network and four types of traffic signs: Stop Sign, No Entry Sign, Give Way Sign, and Speed Limit Sign are used. Considered total 300 sets images, and they got 90% and 88% accuracy for detection and recognition purpose [11]. So, traffic sign detection and recognition is necessary to build an autonomas car driving system. 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 [13]. 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 [14], and have been, all things considered, associated for question area, video classification [15], 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 [16]. 2.3 Comparative Analysis and 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. A CNN convolves learned features with input data and uses 2D convolutional layers. This mean that, this type of network is ideal for processing 2D images.A CNN, o Starts with an input image o Applies many different filters to create a feature map o Applies a ReLU function to increases non-linearity o Applies a pooling layer to each feature map o Flattens the pooled images into one long vector o Inputs the vector into a fully connected ANN o Processes the features through the network. the final fully connected layer provide the voting of the classes that we're after o Trains through forward propagation and back propagation for many, many epochs. This repeats until we have a well defined neural network with trained weights and feature detectors. A SVM (support Vector Machine) is a discriminative classifier formally defined by a separating hyperplane. In other word, it's given labeled training data (Supervised learning), the algorithm outputs an optimal hyperplane which categorizes new example. In 2D space this hyperplane is a line dividing a plane in 2 parts where in each class lay in either side. 2. 4 Scope of the problem Using that TSRS system driver can easily recognize and detect traffic signs. It will assist a driver on new roads because at new road driver can't easily find the traffic signs. To form smart driver assistant, autonomous vehicle or build better traffic system TSRS can help. Since 1980's regarding that topics research is conducting till now, in future any researcher can use that research and can elaborate the dataset to get better results. 2.5 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 are many work with this topic, so it is so difficult for us to get more accurate in our result. . CHAPTER 3 RESEARCH METHODOLOGY 3.1 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, skit learn, matplotlib, tensorflow, etc. Google Colab and Pycharm was used for all the training and testing process, Google Colab is a free and open-source dispersion of the Python

programming language for information science and AI applications. Pycharm free community version free for all user. 3.2 Data Collection Procedure 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. Our dataset sample are shown in table 1. Table 1. 12 Traffic Signs with Description. Description Traffic Sign Description Traffic Sign Turn Left Danger Stop 40km/h Only Left 30km/h Only Right Turn Right Road Merges Ahead Pedestrian Speed Breaker Bike 3.3 Statistical Analysis To complete this study a dataset was built from onsite observation collected data. We also collect some random videos and crop traffic sign area to build a real dataset. Then, we categorized its own classes and split the whole data into training and validation dataset. We have total 1200 images to propose SVM and CNN model. We have considered 12 different classes and each class completed with 100 images. Split the whole dataset as training and validation purpose. To generate a model with SVM, 80% data for training and 20% data for testing purpose is considered. Meanwhile, for CNN classification we have divided dataset into two classes train and validation. For training purpose data volume was 1080 images and 120 images for testing purpose, where total 12 different traffic signs were contained. Table 1 to represent the selected 12 traffic signs. Here, we illustrated every traffic sign with sample an image. 3.4 Proposed Methodology We proposed two novel image classification method CNN and SVM. In this section we discuss about CNN and SSM full features. A sample flowchart for our proposed model on CNN and SVM is given in figure 3.4.1. Figure 3.4.1. Flowchart of our model 3.4.1 Convolutional Neural Network The convolutional neural network is a class of deep learning neural network. Convolutional neural network represents a huge breakthrough in image recognition. In this recent era CNN is one of the most popular machine learning algorithms. Many research fields focused on CNN to achieve the highest accurate result. A CNN model constructs with following four layers: • Convolutional layers • Relu function • Polling layers • Fully connected layer Here, Convolutioal operates on two images in 2D format. One as a input image, and other as a filter of the input image, to produce an output image.A convolution of two funcation f and g is defined with following the equation [17] – m (f^{*} f)(i) = Σ. f(i) * f(i − i + m (1)) i=i 2 The rectified linear unit is another step to implement convolutional layer. In this layer applying an activation funcation “relu” onto feature maps to increase non- linearity in the network. On the other hand, Polling progressively decrese the size of the input representation. It makes it possible to detect objects in an image. It helps to decrese the number of parameters and the amount of computation required. Polling also helps to control overfitting. There are many types of polling. But in this paper we used max polling. Fully connected layer, in this step an artificial neural network work as a CNN. This step combine our features into more attributes. These will predict the class level with better accuracy. The error is computed and then occured back propagation. The weights and feature detectors are adjusted to help optimize the performance of the model. This process is continue layer by layer. A sample flowchart for CNN methodologyshown in figure 3.4.2 Figure 3.4.2. Flowchart for CNN classification 3.4.2 Support Vector Machin SVM is a discriminative classifier that is defined by a separating hyperplane. Mainly, SVMis a familiar supervised machine learning algorithm.It is usually used in classification problems. In the SVM model, we can plot each item as a point in n-dimensional space with the value of each feature being the value of a particular coordinate(where n is a number of features). It will be clearly understanding with an example for two classes. We can understand the process of SVM model with the help of figure 3.4.3 Figure 3.4.3. Spilt data into two classes (SVM) To understand the work process of SVM we neeed to know the ROI module. This region follow three steps. First one is, color transformation. Which convert the RGB value of each pixel to gray pixel. The second step is to control shape matching over the gray images to find possible sign locations. Finally, it refines theROI. This module exploits the regularity of traffic signs with their color and shape with high competence. In this paper, to describe the

methodology, the size of the cells and blocks are varied to get different image sizes. We used 9-bin histograms for this methodology. To train the model we rescale the training images to 32x32 pixel images. HOG descriptors to calculate and train SVM classifier. The n resulting support vectors are merged to a single one by multiplying every vector by its weight "a" and adding it with a global vector "v". Equation 2 for cumputing the suport vector [12]. m (2) $v = \sum \alpha i \; . \; vi \; i$ Now, we illustrated the whole work process of SVM in figure 3.4.4. Here, we depict all the steps of
SVM to reciognize the traffic signs for TSRS. Figure 3.4.4. Flowchart of SVM for Traffic Sign Detection and Recognition 3.5 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: 3.5.1 Hardware/Software Requirements ? Operating System (Windows 7 or above) ? Hard Disk (minimum 500 GB)
? Ram (Minimum 4 GB) 3.5.2 Developing Tools ? Python Environment ? Pycharm ? Google
Colab CHAPTER 4 EXPERIMENTAL RESULTS AND DISCUSSION 4.1 Experimental Setup Our Proposed framework investigation procedures are done on a PC with a Corei3,7100U processor having 2.40GHz Speed, 2 cores, 1 sockets and 4 logical processors. Additionally, the framework had 8GB of RAM and intel(R) HD graphic for video memory. For programming use python environment, pychram free community version and Google colab. 4.2 Experimental Result & Analysis In this section we are going to discuss about result which was obtained from SVM and CNN. SVM classification for Traffic sign detection and recognition provided 98.33% accuracy (80:20 data split ration), while in CNN method we achieved 99.56% training accuracy and 96.40% validation accuracy. The training accuracy, validation accuracy and loss of CNN model is visualized in figure 4.2.1 and 4.2.2. Figure. 4.2.1. Accuracy of Training and validation Figure. 4.2.2. Line chart for Training and validation loss For SVM method we were getting 98.33% accuracy when we split total dataset into 80:20 ration for training and testing purpose. However, we achieved 99.17% accuracy when considered 90:10 ration. Figure 4.2.3 and 4.2.4 for presenting the performance of SVM. Figure. 4.2.3. Result of SVM for 80:20 ration Figure 4.2.4: Result of SVM 90:10 ration After that, we developed a system using SVM to evaluate the results with real time video. The detection part uses image processing techniques that creates contour on each frame and finds all ellipse or circles among those contours. Then, the detection part marked as categorized traffic sign. Some sample results shown in following figures. Figure 4.2.5. Recognize "Danger" Sign Figure 4.2.6.
Recognize Drive "30 km/h" Sign Figure 4.2.7. Recognize "Turn Right" Sign 4.3 Discussion Figure 4.2.5, 4.2.6, and 4.2.7 to understand the performance of SVM with the help of some real time data. If we implement the full system with CNN, then it will be work well then SVM as we have mentioned their accuracy level. After complete our study we obtained TSRS can be an established and sustainable system. Many researches are going on with traffic issues and self-car driving purpose. We needed an accurate model to implement this system to provide the better solution in every case. CHAPTER 5 IMPACT ON SOCIETY, ENVIRONMENT AND SUSTAINBILITY 5.1 Impact on Society Today it's an era of science and technology. This paper is working with an aim of recognition traffic signs to assist driver to find which traffic sign is ahead. It will be helpful to the driver to maintain traffic rules. Everyday around us so many accidents occurring due to the less knowledge about traffic system. That system will be very helpful as a driver assistant for reducing accident by help driver to recognizing traffic signs. That feature can be also use in autonomous vehicle. So we can see that our proposed system technically has great impact on society. 5.2 Impact on Environment Proposed system is helpful for environment so many ways, at traditional way traffic system can causes more traffic jam and for that occur sound and air pollutions. But using TSRS, traffic jam can be reducing as well as air and sound pollution will be reduce. Also if any car accident it will be very harmful of environment like people death, tree broken and also harm road environment. Our proposed system can be reducing accident. So our

proposed system is very helpful for environment. 5.3 Ethical Aspects For clarify that issues take an example, let we have an emergency situation, but in front we have stop signs or speed limit sign but at traditional way driver can easily brake rule as well as his interest. But proposed driving assistant can't allow it for an ethical issue for the safety of all. You may be stuck on the traffic on some time or it may be increase your travel time but it will surely provide you a safest path. 5.4 Sustainability Plan To implement TSRS or implement a driving assistant on vehicle can be costly but using that system if one life can save from uncertain accident then there will be no question about its sustainability, because a life worth than any things. Many developed countries implement it. It is bit costly for developed country to implement driver assistant on vehicle. But it can saves vehicle and life's which can be
much more worthy. CHAPTER 6 CONCLUSION, RECOMMENDATION AND FUTURE WORKS
6.1 Summary of the Study It has no doubt that there is a lot of research works on. Basically first of all we are proposed two 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 algorithm which known as convolutional neural network (CNN) and support vector machine (SVM). Finally, we find our expected result which accuracy is better than rest of the project related work. Traffic signs 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. 6.2 Conclusions This paper study was to represent an original effective traffic sign detection and recognition approach towards the design of TSRS. As a recent research topic TSRS is getting popular day by day. In this study, it is done using SVM and CNN classification algorithms to decline extensive traffic difficulties. In our experiment, we obtained highest training accuracy from CNN 99.56%, while the test accuracy was 96.40%. We showed the real time evaluation results of SVM, where the system performed 98.33% accurately for 80:20 ration training and test dataset. On the other hand, we getting 99.17% accurately for 90:10 ration training and test dataset. Many research focused on SVM and CNN to solve this specific problem. 6.3 Implication for Further Study In future, our aim is to increase the number of traffic sign classes with large amount of quality data. As in a machine learning research, to maintain data volume and data quality is most important and time consuming part. To provide a complete system to overcome the traffic issues our ambition is to implement a system with distance calculation form car to traffic sign. Also we work with road surface images like lane detection, zebra crossing detection, speed backer detection, road surface hole detection. REFERENCES [1] Yang, WJ., Luo, CC., Chung, PC., Yang, JF.: Simplified Neural Networks with Smart Detection for Road Traffic Sign Recognition. In: Arai K., Bhatia R.
(eds) Advances in Information and Communication. FICC 2019. Lecture Notes in Networks and Systems, vol 69. Springer, Cham (2020) [2] Dubey, A.R., Shukla, N., Kumar, D.: Detection and Classification of Road Signs Using HOG-SVM Method.In: Elçi A., Sa P., Modi C., Olague G., Sahoo M., Bakshi S. (eds) Smart Computing Paradigms: New Progresses and Challenges. Advances in Intelligent Systems and Computing, vol 766. Springer, Singapore (2020) [3] Dhar, M. Z., Abedin, T., Biswas, Datta, A.: Traffic sign detection — A new approach and recognition using convolution neural network. 2017

IEEE Region 10 Humanitarian Technology Conference (R10-HTC), Dhaka, pp. 416-419, (2017) [4] Aashrith, V., Smriti, S.: Traffic Sign Detection and Recognition using a CNN Ensemble. IEEE International Conference on Consumer Electronics (ICCE). 07 March, (2019) [5] Di, Z., Junqi, Z., Dongdong, Z.: Traffic sign detection based on cascaded convolutional neural networks. In: Conference on Software Engineering, Artificial
Intelligence, Networking and Parallel /Distributed Computing (SNPD), (2016) [6] Sandy, A., Chih-Jung, C., Hsueh-Ming H.: Real-time traffic sign recognition using color segmentation and SVM. In: Conference on Systems, Signals and Image Processing (IWSSIP), (2017) [7] Jian-He, S., Huei-Yung, L.: A vision system for traffic sign detection and recognition. IEEE 26th In: Symposium on Industrial Electronics (ISIE), (2017) [8] Zaki, P. S., et al.: Traffic Signs Detection and Recognition System using Deep Learning.
In: Conference on Intelligent Computing and Information Systems (ICICIS) (2019) [9] Jin, Y., Fu, Y., Wang, W., Guo, J., Ren, C., Xiang, X.: Multi-Feature Fusion and Enhancement Single Shot Detector for Traffic Sign Recognition. in IEEE Access, vol. 8, pp. 38931-38940, (2020) [10] Saadna, Y., Behloul, A.: An overview of traffic sign detection and classification methods. In: J Multimed Info Retr 6, 193–210. https://doi.org/10.1007/ s13735-017-0129 -8 (2017) [11] Sheikh , M. A. A., Kole , A., Maity, T.: Traffic sign detection and classification using colour feature and neural network.
In: Conference on Intelligent Control Power and Instrumentation (ICICPI), Kolkata, pp. 307- 311. (2016) [12] Fatin, Z., Bogdan, S.: Warning traffic sign recognition using a HOG-based K-d tree. IEEE Intelligent Vehicles Symposium (IV), (2011) [13] Youpan Hu,
Qing He, Xiaobin Zhuang, Haibin Wang, Baopu Li, Zhenfu Wen, Bin Leng, Guan Guan,Dongjie Chen "Algorithm for vision-based vehicle detection and classification", IEEE
International Conference on Robotics and Biomimetics (ROBIO), ISBN: 978-1-4799-2744-9,2013 [14] Chiman KwanBryan,ChouAdam,Echavarren,Bence Budavari,Jiang Li,Trac Tran,"Compressive Vehicle Tracking Using Deep Learning", IEEE Ubiquitous Computing, Electronics & Mobile Communication ConferenceAt: New York City,November 2018[15] R. Girshick, J. Donahue, T. Darrell, and J. Malik, "Rich feature hierarchies for accurate object detection and semantic segmentation", in Proceedings of the IEEE conference on computer vision and pattern recognition, 2014, pp. 580–587 [16]A. Karpathy,G. Todereci S .Shetty, T.Leung, R. Sukthankar, and L. Fei-Fei, "Large-scale video classification with convolutional neural networks", in Proceedings of the IEEE conference on Computer Vision and Pattern Recognition, 2014, pp. 1725–1732. [17] Understanding neural network, available at <<
https://towardsdatascience.com/understanding-neural- networks-from-neuron-to-rnncnn-and-deep-learning-cd88e90e0a90>>, last accessed on May 2, 2020 at 1:33 PM.
APPENDICES Appendix is about research reflection. The main feature of our application is traffic sign detection and recognition. Using our application driver can easily know the traffic signs meaning and easily take her decision. And this is also reducing accident. Thus, we have a tendency to believe that our "Traffic Sign

Recognition System (TSRS): SVM and Convolutional Neural Network" application are going to be terribly positive and effective for users. ©Daffodil International University ©Daffodil International University 1 ©Daffodil International University 2 ©Daffodil International University 3 ©Daffodil International University 4 ©Daffodil International University 5 ©Daffodil International University 6 ©Daffodil International University 7 ©Daffodil International University 8 ©Daffodil International University 9 ©Daffodil International University 10 ©Daffodil International University 11 ©Daffodil International University 12 ©Daffodil International University 13 ©Daffodil International University 14 ©Daffodil International University 15 ©Daffodil International University 16 ©Daffodil International University 17 ©Daffodil International University 18 ©Daffodil International University 19 ©Daffodil International University 20 ©Daffodil International University 21 ©Daffodil International University 22 ©Daffodil International University 23 ©Daffodil International University 24 ©Daffodil International University 25 ©Daffodil International University 26 ©Daffodil International University 27 ©Daffodil International University 28 ©Daffodil International University 29

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