PREDICTING TOURIST SPOT BY USING MACHINE LEARNING APPROACH

BY

PRANTA ROY
ID: 181-15-11056

AND

FARJANA YEASMIN
ID: 181-15-11047

AND

MOST AFRIN NAHAR BINTI
ID: 181-15-11341

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

Supervised By

NUSRAT JAHAN
Sr. Lecturer
Department of CSE
Daffodil International University

Co-Supervised By

MR. ABDUS SATTAR
Assistant Professor
Department of CSE
Daffodil International University

DAFFODIL INTERNATIONAL UNIVERSITY

DHAKA, BANGLADESH

4TH JANUARY, 2022

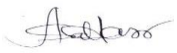
APPROVAL

This Project titled "Predicting Tourist Spot by Using Machine Learning Approach", submitted by Pranta Roy, ID: 181-15-11056, Farjana Yeasmin, ID: 181-15-11047 and Most Afrin Nahar Binti, ID: 181-15-11341 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 4th January, 2022.

BOARD OF EXAMINERS

Chairman

Dr. Sheak Rashed Haider Noori
Associate Professor and Associate Head
Department of Computer Science and Engineering
Faculty of Science & Information Technology
Daffodil International University



Internal Examiner

Abdus Sattar
Assistant Professor
Department of Computer Science and Engineering
Faculty of Science & Information Technology
Daffodil International University

Internal Examiner

Saiful Islam
Senior Lecturer
Department of Computer Science and Engineering
Faculty of Science & Information Technology
Daffodil International University

External Examiner

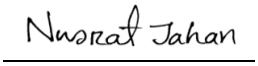
Dr. Dewan Md. Farid
Professor
Department of Computer Science and Engineering
United International University

©Daffodil International University

DECLARATION

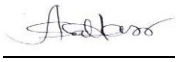
We hereby declare that, this project has been done by us under the supervision of **Nusrat Jahan, Lecturer, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

Supervised by:



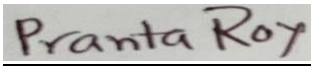
Nusrat Jahan
Sr. Lecturer
Department of CSE
Daffodil International University

Co-Supervised by:

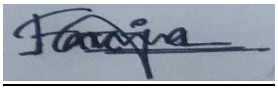


Mr. Abdus Sattar
Assistant Professor
Department of CSE
Daffodil International University

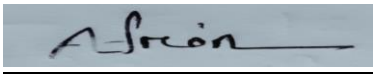
Submitted by:



Pranta Roy
ID: 181-15-11056
Department of CSE
Daffodil International University



Farjana Yeasmin
ID: 181-15-11047
Department of CSE
Daffodil International University



Most Afrin Nahar Binti
ID: 181-15-11341
Department of CSE
Daffodil International University

©Daffodil International University

ACKNOWLEDGEMENT

First of all, we would like to give our robust thanks and gratitude to almighty Allah for the blessings to make it possible to finished the final year thesis successfully.

We are really thankful to **Nusrat Jahan, Sr. lecturer,** Department of Computer science & Engineering, Daffodil International University, Dhaka. She helped us spontaneously in the field of Machine learning based research with her deep knowledge. Finally, we finished our work on 'Image processing'. Her energetic supervision, worthy instruction, unlimited patience helps us to correct at all stage have made it easier to finished this project.

We would like to give heartiest thanks to **Mr. Abdus Sattar, Assistant Professor,** Department of computer science & technology, for his kind help to finish our project and also to other faculty member and the staff of CSE department of Daffodil International University.

At last we give thanks to all the good wishers surrounding us who helped us and inspired us to make the task complete.

Finally, we must acknowledge with due respect the constant support and patients of our parents.

ABSTRACT

Tourism plays significant role for enhancing economic potential worldwide. The natural beauty and historical interests of Bangladesh remarked as a major tourist destination for the international tourists. In this study, we target to propose a Machine learning based application to recognize historical interests and tourist spots from an images. Making use of on-device Neural Engine comes with modern devices makes the application robust and internet free user experience. One of the difficult tasks to collect real images from tourist sites. Our collected images were in different sizes because of using different smartphones. We used following machine learning algorithms– Convolution Neural Network (CNN), Support Vector Machine (SVM), Long Short-Term Memory (LSTM), K-Nearest Neighbor (KNN) and Recurrent Neural Network (RNN). In this proposed framework, tourists can effortlessly detect their targeted places that can boost the tourism sector of Bangladesh. For this regard, Convolutional Neural Network (CNN) achieved best accuracy.

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER 1
INTRODUCTION

1.1 Introduction

Tourism is one of the most remarkable and rising sector in global economy. It has effect on the economic growth of a country. Moreover, this sector provides approximately 1.47 trillion U.S dollars in 2019 worldwide. Developing countries can be benefited greatly from this sector. Apart from gaining foreign currencies, it is also augmenting the economic development for those countries. However, tourism revenue of Bangladesh reached 391 million USD in December 2019.

Natural beauty and charming historical sites of Bangladesh attract a huge number of tourists from all over the world. Hills, waterfalls, rivers, tea gardens, archaeological sites, religious places, forests, coasts and beaches increase the magnificence of Bangladesh. This enormous beauty convince tourists to visit here. As a result, tourism sector contributes 4.4% in total GDP for Bangladesh. In this digital era, people observe many social media post about tour but sometimes there are no details about that beautiful tour or scenario. Sometimes, it is difficult to find out that tourist spot by seeing only the images or photos. It is a problem that have been faced by tourists from home and aboard. Considering this problem, we are proposing a machine learning based application to eradicate this issue and make a safe system for tourists where they can search tourist's places by photos.

Modern technology has helped tourism industry to speed up the travelling process where machine learning techniques and computer vision can provide sophisticated solutions. Researcher from worldwide trying to develop this tourism situation where many machine learning algorithms have constructed to deal with complex task. Travel time prediction, tourist behavior analysis, tourist place recommendation system, travel guide system (app and web based) and tourist spot detection are the key components where researchers have worked on. In general, most of the tourism based research work are associated with image analysis where image processing algorithms have used extensively. In deep neural network, Convolution neural

network (CNN) is a kind of Artificial Neural Network (ANN) which conducted in image processing and recognition. Along with CNN, Long Short Term Memory (LSTM), Recurrent Neural Network (RNN) are used in image classification tasks whereas, popular machine learning classifiers such as KNN, SVM and Random Forest.

In this study, we proposed a machine learning based system to recognize historical interests and tourist spots from an image. Several deep neural network algorithms (CNN, KNN, SVM, RNN and LSTM) have applied to train the model. The photos taken by different smartphones and pre-processed to achieve the more accurate results. The proposed model shows 97% accuracy.

1.2 Objective

We all have some good thoughts about this venture, yet we may not be ready to carry out our thoughts as a whole and goals in the given timeframe.

At present, this is the right time to use technological revolution. Nowadays people can conduct technology everywhere, every step. In our project our main focus is to help the people to find out tourist places without any hassle or wasting any time. We would like to list some historical and renowned tourist places with pictures by using Convolutional Neural Networks. Our target is to build up a platform where people can detect the exact place and get the information about the spot. Our motive is how to identify the different spots.

• Our goal is to help the people to find any tourist spot for their own convenience.

• To build a platform where people can easily help us.

1.3 Motivation

Actually we were thinking of doing something which is exceptional but also helpful for general people. Then we found an idea that we will do research which is based on Machine learning and we decided a topic that is “Tourist Spot Detection by using Machine Learning” for the travel thirsty people. Basically we are willing to help the general people so we decided to do work in

the machine learning field and we started to work on detecting tourist places for the travel lovers. We decided to collect pictures of some historical places and use it (as input by using algorithms and get the output where the place actually is) to get the information when people search tourist spots. And finally we reached on an idea which is “Predicting tourist spots by using machine learning”.

1.4 Expected Outcome

Awaited outcome of this query about research is to make an algorithm or make an entire proficient method that will be beneficial to build the model of the trained dataset.

• It will be helpful to increase the number of travelers.

• It will help to decrease the waste of time and hassle of people.

1.5 Research Question

It was so complicated for us to finish this work and have to face the following questions to clear the outcomes.

• Where do we collect the data?

• Which types of data do we collect?

• What amount of data do we need?

• Can we collect raw image data for machine learning research?

• Is it possible to pre-process the row data using a machine learning approach?

1.6 Report Layout

Chapter 1 represent the presentation to the initiative with objective, motivation, research questions, and anticipated result.

Chapter 2 provides the discussion on what already done in this state before. Then the later section of this second chapter display the scope arisen from their boundary of this field.

Chapter 3 relate the theoretical discussion on this research work. To discuss the theoretical part of research, this part expanded the statistical methods of this work. Besides, this chapter shows the procedural approaches of CNN and machine Learning classifier.

Chapter 4 provides the experimental results, performance evaluation and discussion of result. Some experimental pictures are showed in this chapter to make realize the project.

Chapter 5 described about 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 6 presents summary of the study and future works.

CHAPTER 2

BACKGROUND

2.1 Preliminaries

Bangladesh might remark like a small nation but it has a flourishing history of tourist interests on archaic sites. People from home and abroad have much curiosity about the tourism sector of our country. Whereas, the curiosity of maximum pupils has grown from seeing the attractive pictures of beaches, forests, historic monuments, resorts, picnic spots etc. However, most of them couldn't find the place name and location from seeing some of those images. Sometimes it's not easy to trace more information about those places from images. It's tougher for rural people to identify places from images. With this condition, we will be planning toward resolving all of those matters. For better results, we will be studying other related work about these problems.

2.2 Related Works

Lack of information about destinations suffered tourists while they visiting historical places. To detect historical places in Iran M. Etaati et al., [1] proposed a web based cross platform mobile framework which based on machine learning approach. Firstly, Speeded Robust Feature (SURF), Scale Invariant Feature Transform (SIFT) and Oriented FAST and Rotated BRIEF (ORB) have been used for doing this work. But in high level visual features, they have used Support Vector Machine (SVM) and Random Forest where VGGNet model with 19 layers. They have achieved 95% accuracy by using Random forest algorithm. S Mikhailov et al., [2] have reported an ontology defines tourists' behavior analysis system which based on digital pattern of life concept. For doing this work, they build a dataset about the movement of tourists while working from data lake. They have collected 4000 trips data. They have taken route data from movement dataset for classification. For clustering, they grouped the tourists on the basis on their point of interest reviews. Finally, they used time series model to predict human behavior to predict travel time.

To develop traffic system, traffic managers are interested in understanding travel time. From this point of view M Abdollahi et al., [3] manifested an algorithm to predict travel time. They have

collected 1.5 million Taxi and Limousine Commission trip records from New York City. To boost the feature space, they have applied statistical learning methods, geospatial features analysis and unsupervised learning algorithm (K-Means). Finally, they have trained a deep multilayer perception to predict travel time. However, their proposed method failed to get good accuracy. C. Siripanpornchana et al., [4] proposed a Deep networks concept to predict travel time. They have used Caltrans Performance Measurement System dataset which is one of the most used dataset.

F Goudarzi et al., presented a model to predict travel time. Where they have used Google Maps API for collecting data. They have used several machine learning algorithm like Nearest Neighbor, Windowed Nearest Neighbor, Linear Regression, Artificial Neural Network etc. where a shallow ANN achieve highest accuracy [5]. V Parikh et al., [6] proposed a mobile application where a user can find their desirable tourist place. This application recommended tourist spots, restaurants and hotels by user's interest. To recognize places they have used the CNN algorithm. Their proposed application showed good accuracy. X Su et al., [7] reported a big data architecture for supporting cultural heritage. For cultural item suggestions, they proposed a novel user-centered recommendation technique. An application of the Android devices called "Smart Search Museum" was created to test their system. G LI et al., [8] focused to design a recommendation system for tourist spots. HSS model and SVD++ algorithm have used to design the model. DSSM and CNN are also used to develop the performance of recommendation. For more robustness, they have used IRGAN model.

To detect tourist's activity patterns from Twitter data, F Hu et al., [9] inaugurated a graph based method. They have collected tweets with geo-tags. For building tourist graphs comprising of the tourist attraction edges and vertices, they have adapted a clustering method (DBSCAN). They have also used the Markov Clustering Method and Network Analytical Method for detecting tourist movement patterns. Their work achieved 94% accuracy. N. Nezamuddin and M. Manoj [10] presented an application which assign machine learning techniques for experimental exploration and modelling. They used support vector machine (SVM), Decision Tree (DT), Neural Network (NN), Bayesian Network (BN). They also used Ensemble Learner method, K-means clustering method. They got 93.11% accuracy.

Faizan Ali et al., [11] provided a general way of Virtual reality and Augmented Reality technologies, conviction and base. They used CTM (correlated topic model) that extract the semantic structure on a hierarchical Bayesian analysis. Hien T. Nguyen et al., [12] investigate how mobile technologies are effect on tourism site and also give many information for tourist. They resolved the developing importance of mobile technologies in tourism diligence by reviewing and examining.

To obtain visual image there are three terms: scene recognition, landmark recognition and food image recognition and lexical analysis is fruitful to attain semantic image. Yang Zhang focused here on deep learning method [13]. Smart Tourism Technologies (STTs), a travel related website which is designed by Jahyun Goo and C. Derrick Huang [14] to know the mechanism of the real conduct of STTs in tour plan and travel experience and the ultimate result. This method helps to set the progress of our understanding of STTs in tour planning. They used Bias model and partial least square (PLS) Model. Sun-Yun Kim, Kyung young Lee et al., [15] proposed a strategy which avail a knowledge on tourism report quality on internet by showing exploratory record on destination image structure. This method also helps to attract more tourist through social media platform. They are using an online survey method, it has some limitations. Idir Benouaret, Dominique Lenne et al., [16] have designed a travel time website such as Trip Advisor and your tour for the traveler. They approaches different kind of packages which is constituted with a set of diverse POIs from the website. They used BOBO algorithm and PICK-Bundle algorithm. Angshuman guin et al., [17] invented a time series model that obtain to predicting future travel time by using historical travel time data (ITS data). They used seasonal ARIMA Model (sometimes referred as SARIMA Model). They gather some data which is available in 15 minutes aggregates in Georgia Navigates and from a 7.2 miles segment on I-285 over six months period .

Yen-Chiu Chen et al., [18] worked on tourist spot detection and recognition. Here, Hsinchu City, Taiwan is considered to collect pictures from smartphones and government open dataset. You Only Look Once version 3 is used to build the model and compared machine learning models using same dataset. To optimize tourist spot detection parameters in 2021 Xiaofei Huang and et al., reported a model. They used RBF neural network to predict tourist spot [19]. An online

platform is also proposed by Dongjun Yang [20] in 2021 to identify a tourist spot. Here, as an input considered different types of data: video, image, and text.

2.3 Comparative Analysis and Summary

In our research, we propose a machine learning based application to recognize historical interests and tourist spots from an images. Machine learning algorithms are used to do the work. We have used our own dataset. We have collected our data from some tourist spots in Bangladesh. Where, various mobile phone has used to collect images. Our selected locations were Sundarbans (Khulna), Sompur Mohavihara in Paharpur (Rajshahi), Curzon Hall in Dhaka University (Dhaka), Rayer Bazar Boddho Bhumi (Dhaka) and Shaheed Minar (Dhaka). Data preprocessing is an important factor before starting the work. For this purpose, we resized all of the images and several image augmentation process e.g. Zoom in, zoom out, Rotation, Gray scaling, Salt and Pepper Noise, Gaussian Noise have used to increase the data volume. After preprocessing, we have applied deep learning and machine learning algorithms. Where, VGG19 model was built with machine learning classifiers (SVM and KNN) and deep learning models (CNN, RNN, LSTM) are used. Then, we found our desired response from machine. Jupyter Notebook is used to do the work. In this proposed framework, tourists can effortlessly detect their targeted places that can boost the tourism sector of Bangladesh.

2.4 Scope of the problem

We fixed a goal to generate a better way to solve travel spot detection based problems. Our proposed method works on travelers from home and abroad. They can find their desired spots easily by using our system. We focused on some historical interests and tourist places in Bangladesh. But other researchers from different countries can use this method in future to make a better tourism sector.

2.5 Challenges

The principal challenges of this work is collecting and processing data. As we have collected raw data, we need to visit all the selected spots physically and capture photos. During Covid-19 period, it was not easy for us to collect data. Dealing with the dataset was also hard. After all, training with many layers with different sizes of epoch took a long time in our machine, so getting the final output we waited so long with patience. In Bangladesh, there wasn't similar research work and database available. Achieving highest accuracy, we worked hard and motivated ourselves.

Chapter 3

Research Methodology

3.1 Research Subject and Instrumentation

In recent years, deep learning algorithms, data mining and machine learning algorithms are much popular for any detection and prediction. We have worked for detecting tourists spot by using deep learning algorithms. And our research topic is “Comparative analysis for detecting tourist spot by deep learning approach”. Where we have used various algorithms: Convolution Neural Network (CNN), Support Vector Machine (SVM), Long Short-Term Memory (LSTM), K-Nearest Neighbor (KNN) and Recurrent Neural Network (RNN) on our dataset. Working with a deep learning model needs high configuration pc with GPU and others instrument. We have used python programming language with many packages like matplotlib, numpy, pandas etc. As a data training and testing tool, we have used “Google Colab” which allows everybody to write and perform python code.

3.2 Data Collection Procedure/Dataset Utilized

The main purpose of our work is detect tourist spot from photos. For this reason, we have collected huge necessary and relatable data which can access easily. Firstly, we have selected some tourist places and historical interests in Bangladesh. But it’s not easy to travel one place to another and collect real photos of desired location during the Covid-19 situation. But we don’t lose our concentration and hope. When the infection of Covid-19 had decreased, we started travelling our desire location. However, it’s not possible for us to visit all of our desired destination /with a short time. Finally, we have selected 5 tourist places and historical interest to take photos. For our experiment, we have selected Sundarbans (Khulna), Sompur Mohavihara in Paharpur (Rajshahi), Curzon Hall in Dhaka University (Dhaka), Rayer Bazar Boddho Bhumi (Dhaka) and Shaheed Minar (Dhaka). We have created our own database which has around 846 real photos collected by us from different location and different angle of those location. Where,

various mobile phone has used to collect images. After applying augmentation process, the dataset contains 25214 photos.

Figure3.2.1: Images of tourist spot and historical interests from our dataset

3.3 Statistical Analysis

In total, our dataset has 846 raw images of tourist spots. We have chosen some tourist spots and historical places where, mobile phone cameras have used to take photos from different angle of those locations. Figure… shows that in our dataset how many raw pictures of Sundarbans, Sompur Mohavihara, Curzon Hall, Rayer Bazar Boddho Bhumi and Shaheed Minar were stored in our dataset

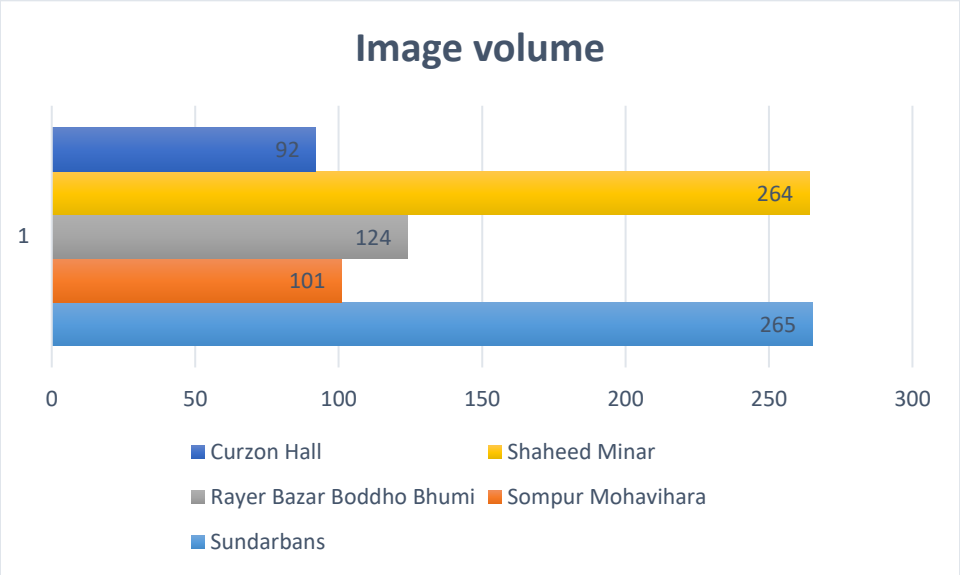


Figure3.3.1: Image Volume

3.4 Proposed Methodology/Applied Mechanism

3.4.1. Data Augmentation

Data Augmentation process plays an effective role while training a model. Several image augmentation process e.g. Zoom in, zoom out, Rotation, Gray scaling, Salt and Pepper Noise, Gaussian Noise have used to increase the data volume.

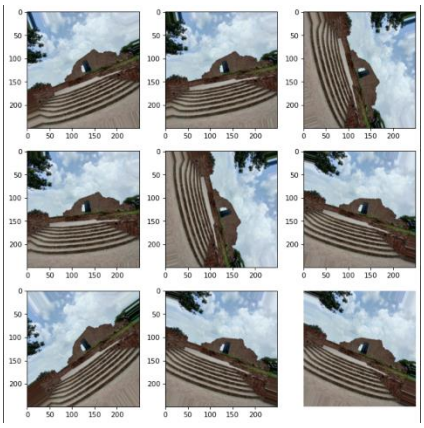


Figure: Rotation

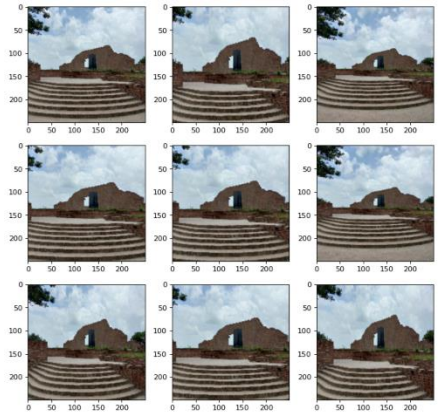


Figure: Zoom in/out

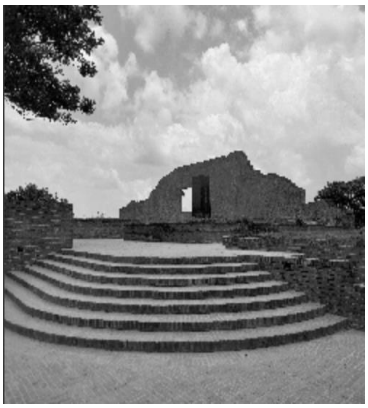


Figure: Grayscale

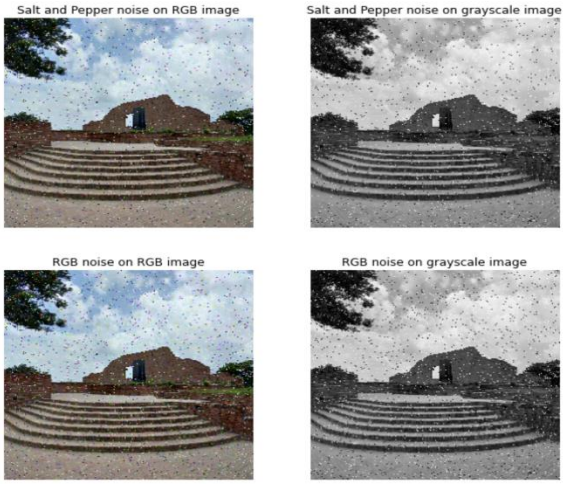


Figure: Salt and Pepper

Figure: Gaussian Noise

After applying data augmentation, the data set reached in total 25214 images. As a result, this large volume of dataset has significance in terms of model training for accurate result.

Tourist Spots	**Number of Collected Images**	**Number of images After Augmentation**
1. Sundarbans	265	7916
2. Sompur Mohavihara	101	2997
3. Rayer Bazar Boddho Bhumi	124	3688
4. Shaheed Minar	264	7885

5. Curzon Hall	92	2728
	Total = 846	Total = 25214

Table3.4.1.1: Data Volume (After and Before Augmentation)

3.4.2 Data Preparation

After augmentation, our dataset reached in total 25204 images. We have resized the dataset with statures and widths. As our model requires a fixed pixel for all photos, we resize all the dataset into 600*600 pixel.

3.4.3 Proposed Methodology

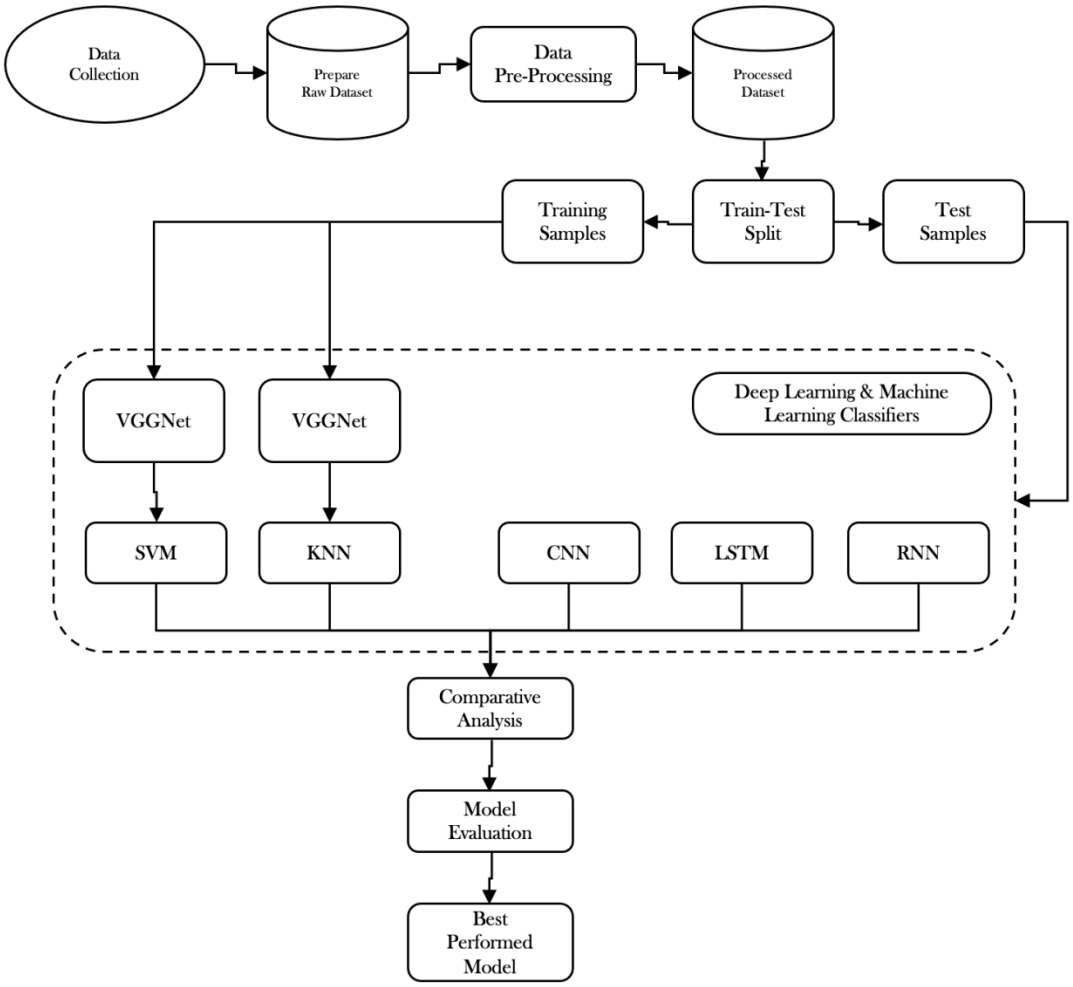


Figure3.4.3.1: Work flow

The architecture of the system introduced is entirely decentralized and based on cross-platform. The suggested framework's architecture is shown in Figure 1. Using the on-device camera modules, the user captures a photo of the tourist spot from any viewpoint.

Most modern modular devices, such as smartphones, tablets, and laptops, include an on-board neural engine intended to effectively run deep learning or machine learning models. The images captured by users are transmitted to the neural engine on the device, which detects the tourist spot and extracts its labels and related information from the database. The result is then shown on the device's screen. The primary advantages of implementing the on-device neural engine is that image processing does not need an internet. Because many tourist spots in Bangladesh still lack access to high-speed internet. Furthermore, the neural engine outperforms the CPU and GPU in terms of Machine Learning and Deep Learning calculations. As a result, the time complexity issue is eliminated.

In addressing image classification problems, CNN has shown to be remarkably efficient. Many image datasets, including the MNIST database, the NORB database, and the CIFAR10 dataset, have seen considerable improvements as a result of research based on CNN. It specializes in detecting local and global structures in image data. In landscape photos containing things such as monuments or hills, which also have visible local and global structures. Local features of an image, like, edges and curves can be integrated to produce more complex features, and eventually the whole scene. When training a complex neural network with many parameters, over-fitting could be a potential problem. Thus, in this study, we suggested a CNN network architecture that is particularly suited for texture-like multi-class image classification and aimed to mitigate the problem of over-fitting.

The architecture of the proposed CNN model is illustrated in Figure 1. The model is consisted of 7 layers. The network receives a normalized tourist location image with a resolution of 600 by 600 pixels as input. A Conv2D layer with a kernel size of 3 X 3 pixels and 16 output channels is the first layer. The second layer, with a kernel size of 2 X 2, is a max pooling layer. Conv2D layer with kernel size of 3 X 3 pixels and 32 output channels and max pooling layer with 2 X 2

kernel size are the third and fourth layers, respectively. The following two layers are densely integrated neuronal layers, each containing 32-5 neurons. [Others architecture reference line like how many layers they are using]. The simplified network architecture also lowered the number of parameters that needed to be trained, reducing the risk of over-fitting.

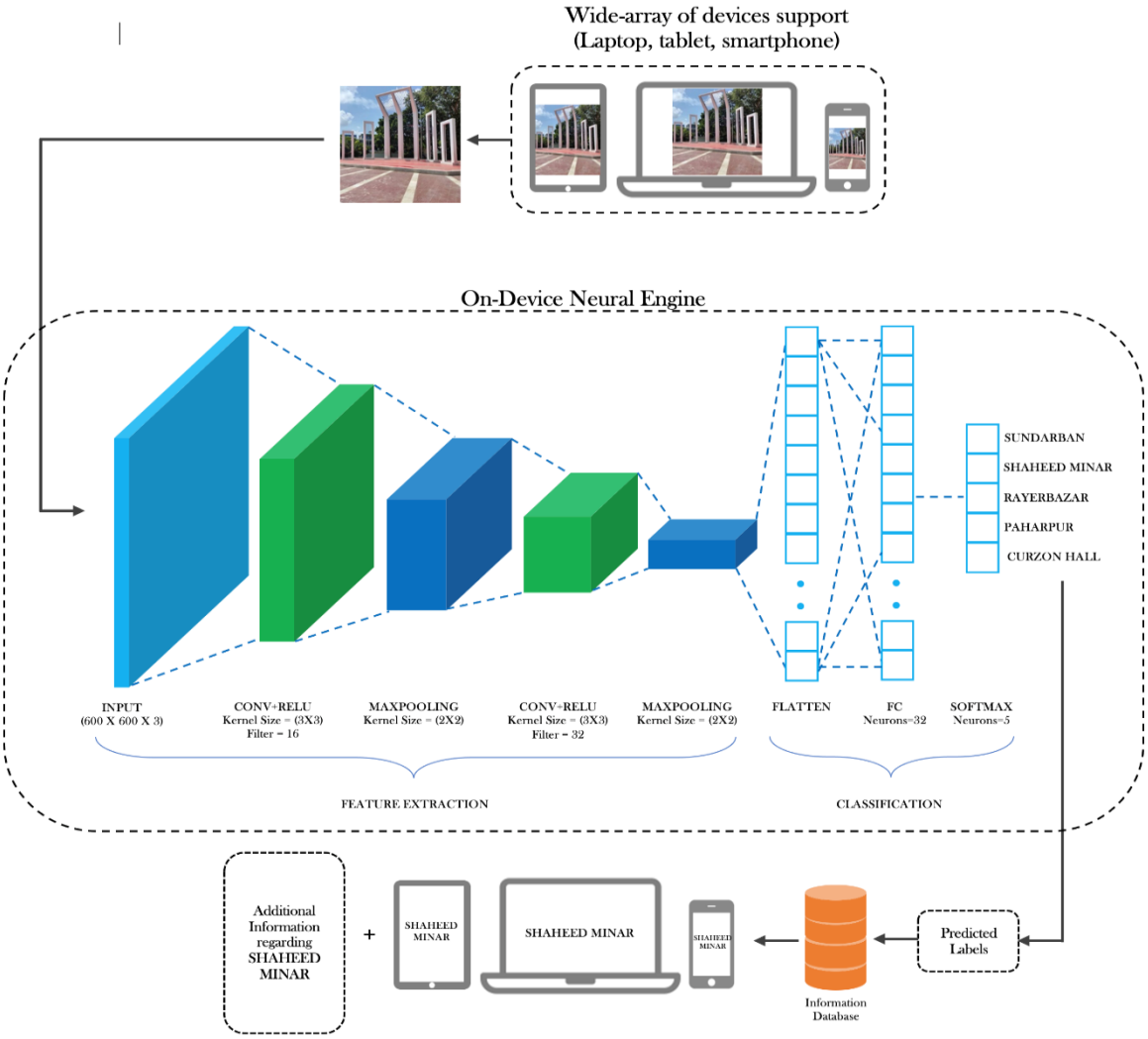


Figure 3.4.3.2: Proposed CNN Architecture

3.4.4 Convolutional Neural Network (CNN):

Convolutional Neural Network (CNN), part of Artificial Neural Network (ANN) used especially in image processing or classification and provide a good frequency accuracy with a short period of time. Convolutional Neural Network (CNN) can also be used in video recognition,

recommended systems, segmentation, NLP (Natural Language Processing), etc. However, Convolutional Neural Network (CNN) can divide into four layers named

- Convolutional Layer,
- ReLU Layer,
- Pooling Layer and
- Fully Connected Layer.

Before going to the layers we need to know some basic things for better understanding like RGB, channels, resolution, etc.

1. **RGB (Red, Green, Blue):** RGB is a color model that activates the basic red, green, blue, color, for producing millions of color combinations. The RGB model is used for colored pictures.

Gray Scale Image:

1. We can say grayscale image black and white image. Here, only black & white colors are used for images or pictures. As like RGB (Red, Green, Blue) model is used for real and colored images, grayscale model is used for black & white images.
2. **Channels:** Image or pictures are a representation of resolutions and resolutions can be defined as the multiplications of height and width. If we represent the colored image we use three channels red, green, blue and if we use the black and white image we'll use 2 channels for image representations. We will present an image with **"Height X Width X Channels"**
3. **Resolutions:** Resolution means the number of total rectangular grids in one image. The higher the grids the higher the resolution of any type of image. Before applying a convolutional neural network, we need a fixed number of resolutions for all images means the same number of rectangular grids. We can represent an image as **Height X Width**.
4. **Filters:** Filters means taking a small part of pictures as matrix representation.

Layers of Convolutional Neural Network (CNN):

The image will be taken as raw materials and divided into two parts train data and test data. Train data requires to use for training the image and testing data used for testing the system or accuracy that our system is working or not. For testing training both need the same process for in convolutional neural network (CNN) including the layers. Let's assume our system is already trained now we want to test our system accuracy.

Convolutional Layer: At first needs to represent the image as "height*width*channels" (figure1).

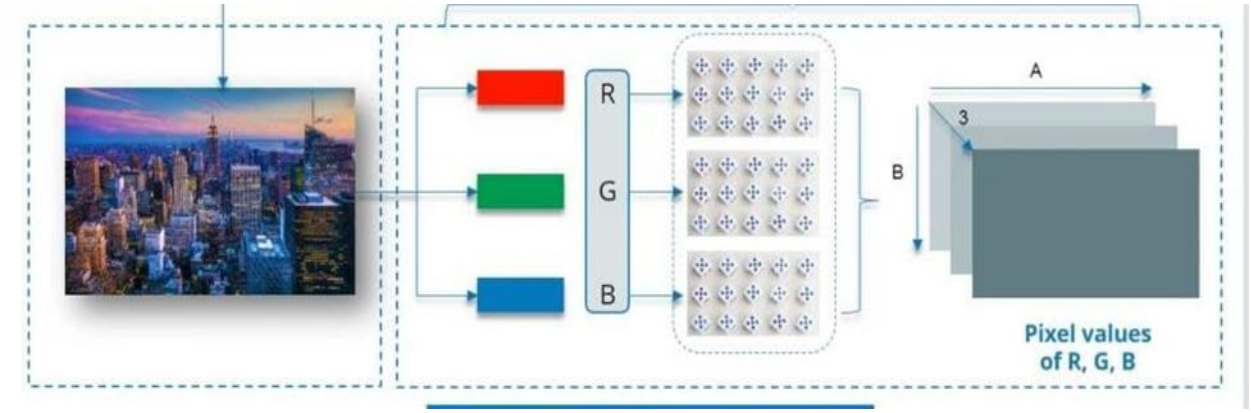


Figure 3.4.4.1: Layers of Convolutional Neural Network (CNN)

Secondly needs to convert the given image into matrix with 0 and 1. Like figure-2 taking 2 images for testing it can be anywhere in the matrix so for detecting the image CNN use some filters.

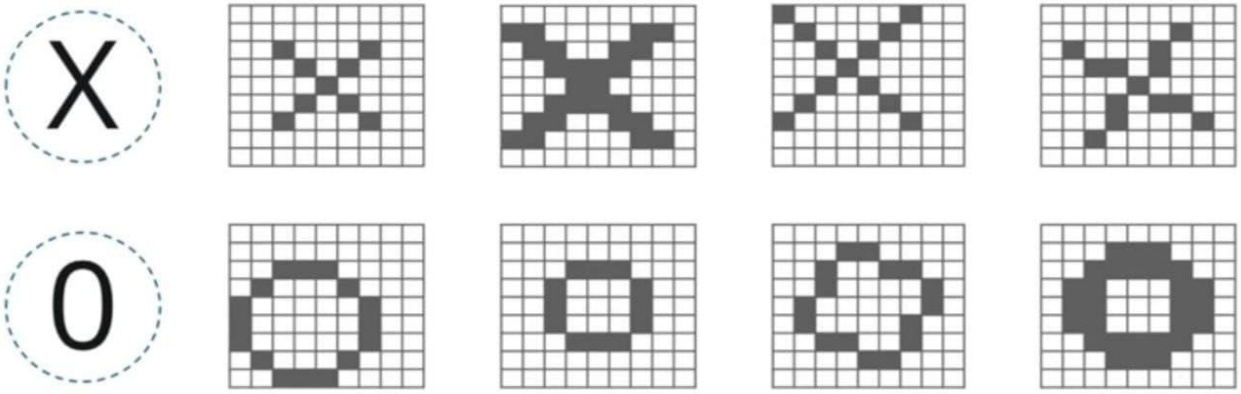


Figure 3.4.4.2:

Divide the image into some small pieces called filters and all the filters will be in same matrix size (figure 3.4.4.3)

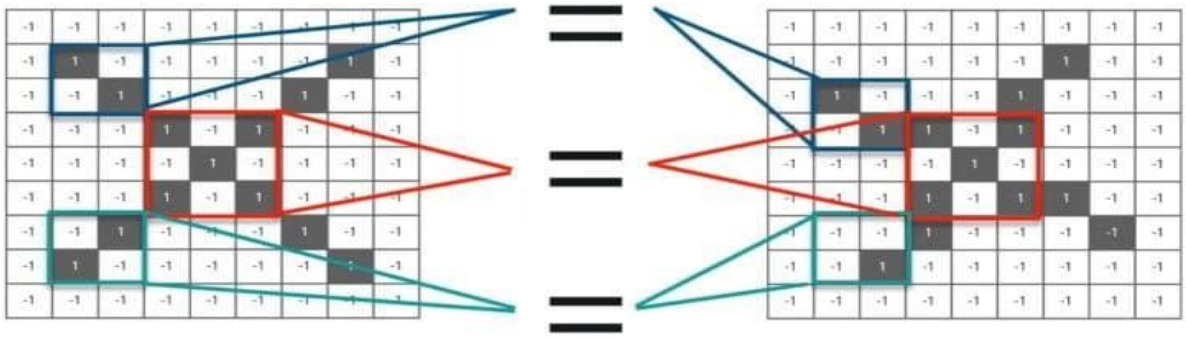


Figure 3.4.4.3:

Here, we consider 3 filters for the whole processing. (Figure 3.4.4.4)

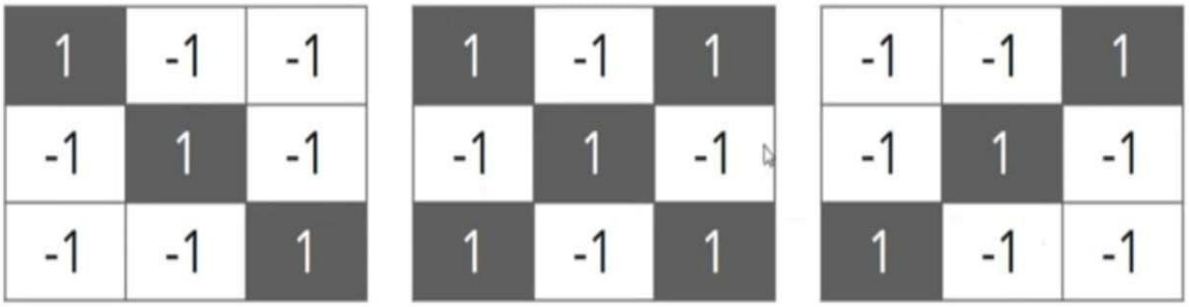


Figure 3.4.4.4

Then plot each feature or filter on the image pixels and multiply them with the corresponding values and add the new values and create a new matrix after calculation (Figure-3.4.4.5)

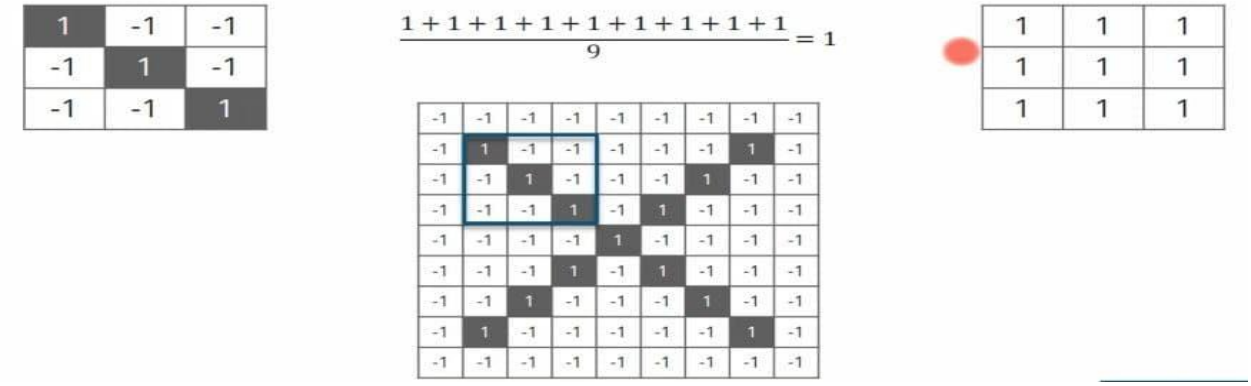


Figure 3.4.4.5

Doing the same for each three filters (Figure 3.4.4.6).

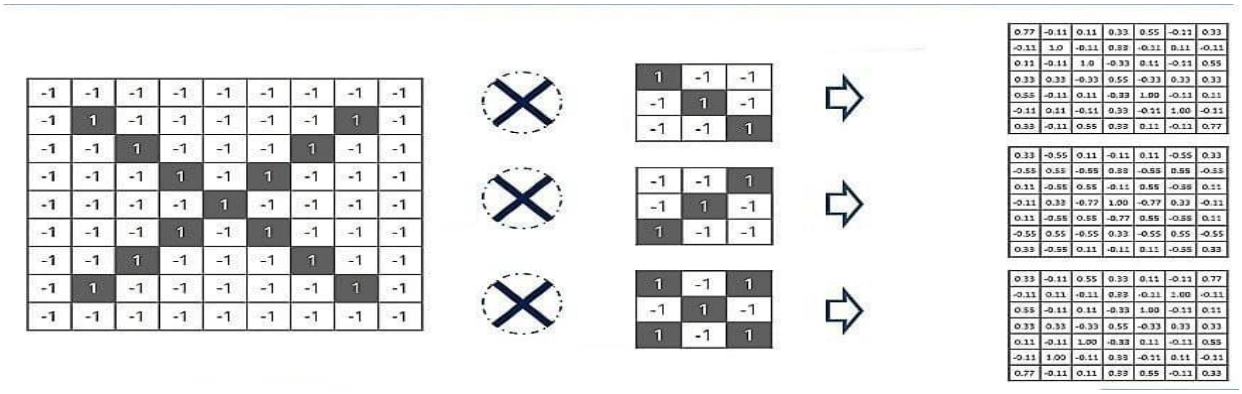


Figure 3.4.4.6

These new three output will be used in ReLU layer.

1. **ReLU (Rectified Linear Unit) Layer:** Use Activation function for replacing the negative values and filtered the image.

   - if value< 0; replace with 0

   - if value > 0; same as value (should be inside the threshold value)

   replaces the negative values (Figure 3.4.4.7)

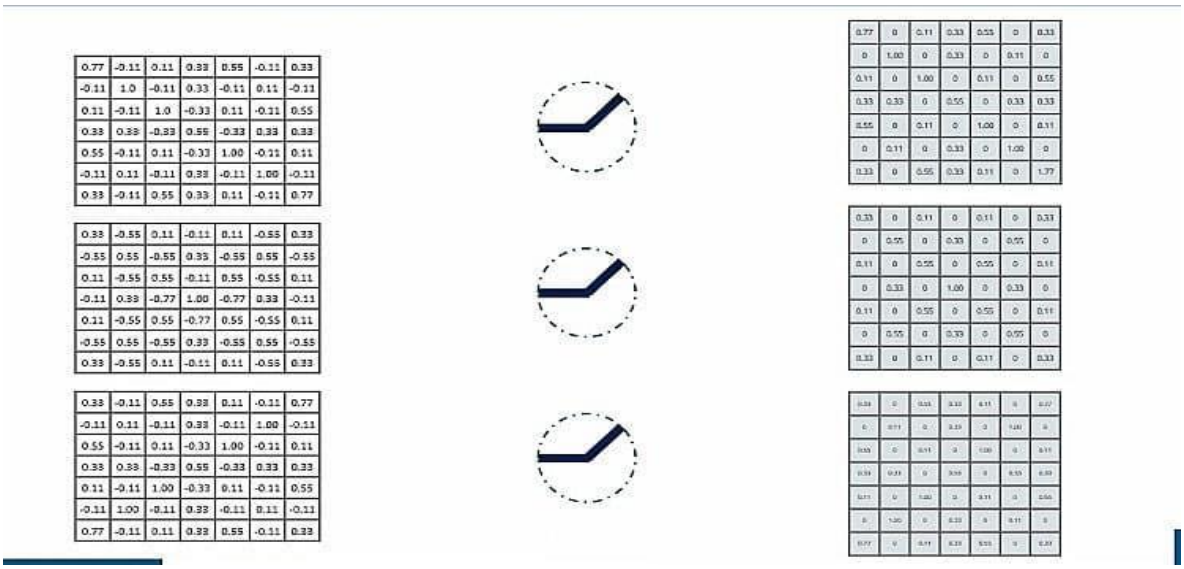


Figure 3.4.4.7

2. **Pooling Layer:** This layer shrinks the matrix size by taking a small size of window, here 2X2 matrix size is used for shorten matrix size that helps us for calculating and reduce processing time (Figure 3.4.4.8)

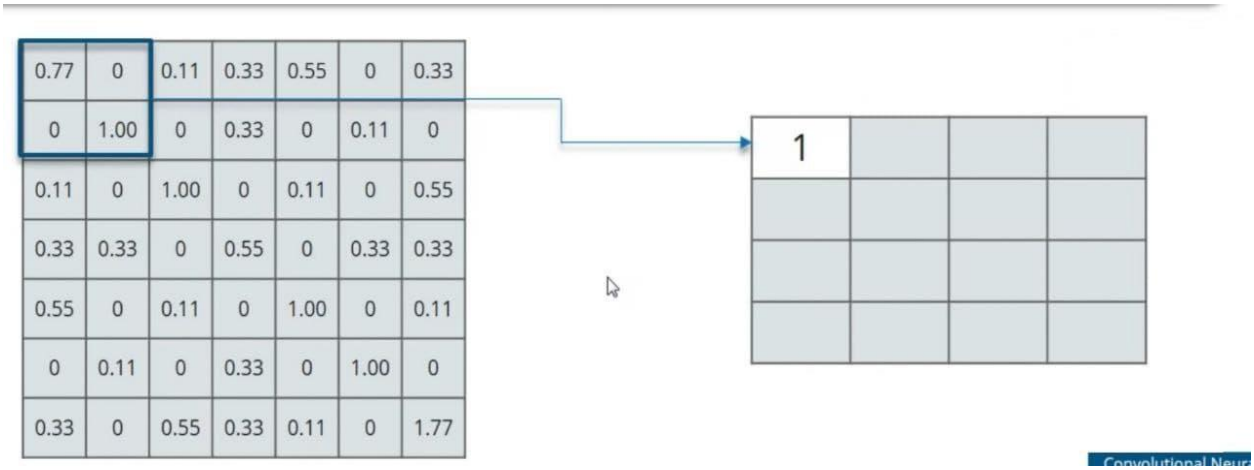
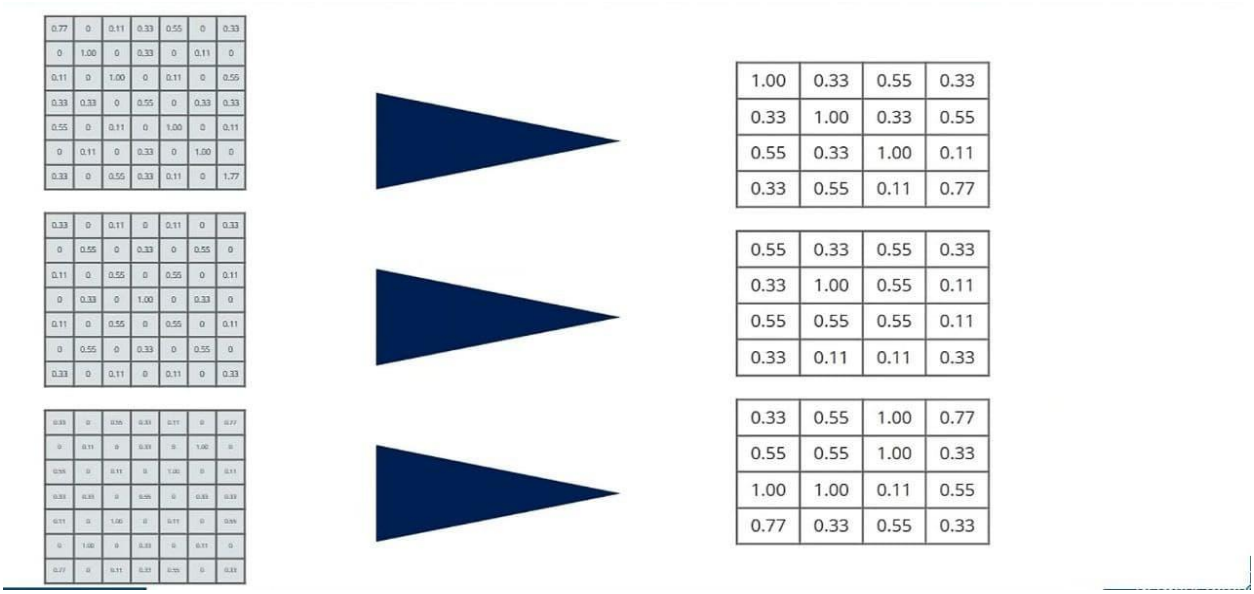


Figure 3.4.4.8

Needs to do the same things for each output (Figure 3.4.4.9)



1.00	0.33	0.55	0.33
0.33	1.00	0.33	0.55
0.55	0.33	1.00	0.11
0.33	0.55	0.11	0.77

0.55	0.33	0.55	0.33
0.33	1.00	0.55	0.11
0.55	0.55	0.55	0.11
0.33	0.11	0.11	0.33

0.33	0.55	1.00	0.77
0.55	0.55	1.00	0.33
1.00	1.00	0.11	0.55
0.77	0.33	0.55	0.33

Figure 3.4.4.9

Now apply the above three layer several times if the matrix size is big for reduces the matrix size. Make the matrix size 2*2 (Figure 3.4.4.10)

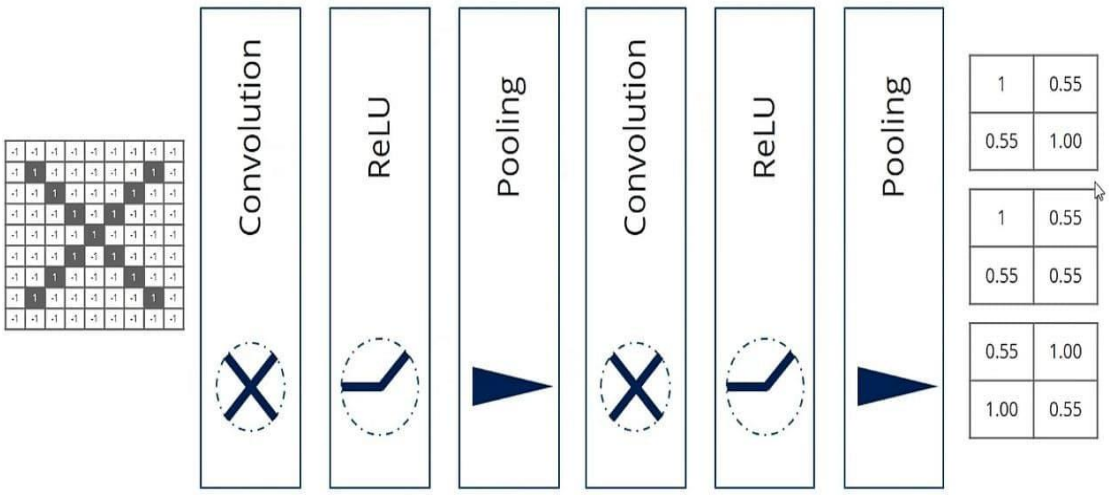


Figure 3.4.4.10

1. **Fully Connected Layer:** Flatten the matrixes of all outputs by creating a list or vector and added the most values. Then divide the sum by train model sum values. Compare with the train file results. The image will be in that class which accuracy is most. Here we use "X" image. So, the accuracy is 0.91% for that class. Other one give .51% accuracy (Figure 3.4.4.11).

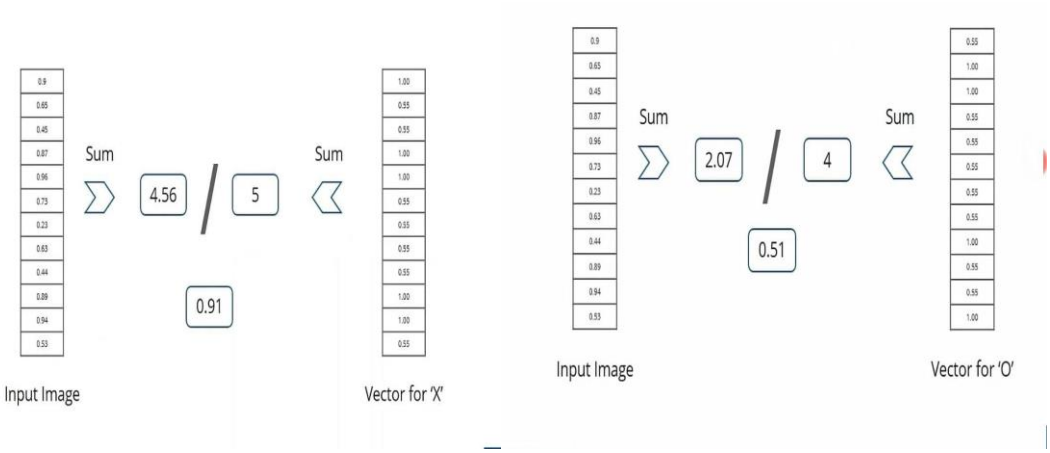


Figure 3.4.4.11

This is how Convolutional Neural Network (CNN) works.

3.4.5 Support-Vector Machines (SVM)

Support-Vector Machines (SVM) is a machine learning algorithm for supervised learning used for classifications and regression analysis. Support-Vector Machines (SVM) is creates a boundary line between different categorical or classified data. Creates the margin based on distance between the data. Chose max marginal distance for best result. If the data is linearly separable then the margin or hyper plane will be linear and easy to create (Figure-3.4.5.1).

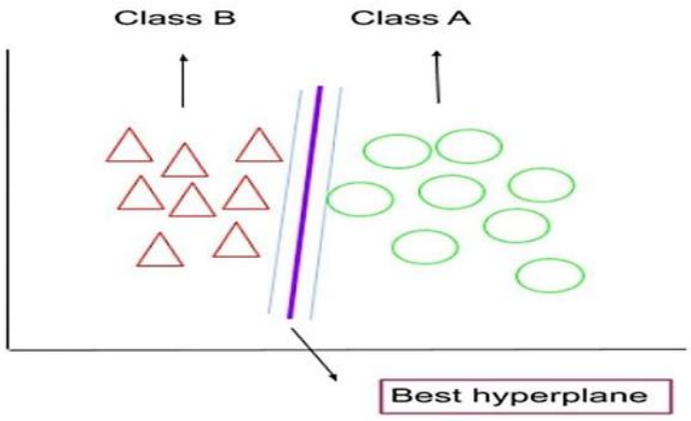


Figure 3.4.5.1

If the data is non- linear the algorithm creates n-dimensional hyper plane for creating the boundary (Figure 3.4.5.2).

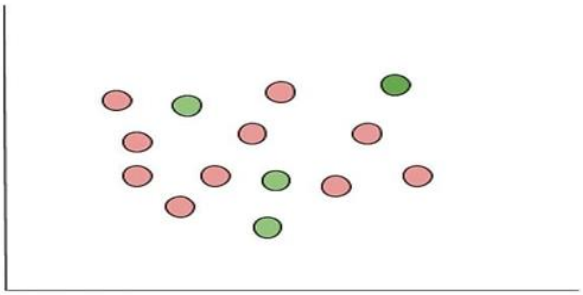


Figure 3.4.5.2

3.4.6 KNN (K Nearest Neighbor)

K Nearest Neighbor is a simple algorithm that stores all the available cases and classifies the new data or case based on a similarity measure.

K in KNN is a parameter that refers to the number of nearest neighbors to include in the majority of the voting process [if k=1, then the testing data are go on the same label as a closest example

in the training sets] [similarly if K=3, the labels of the 3 closes classes are the check and the most common label assign to the testing data].

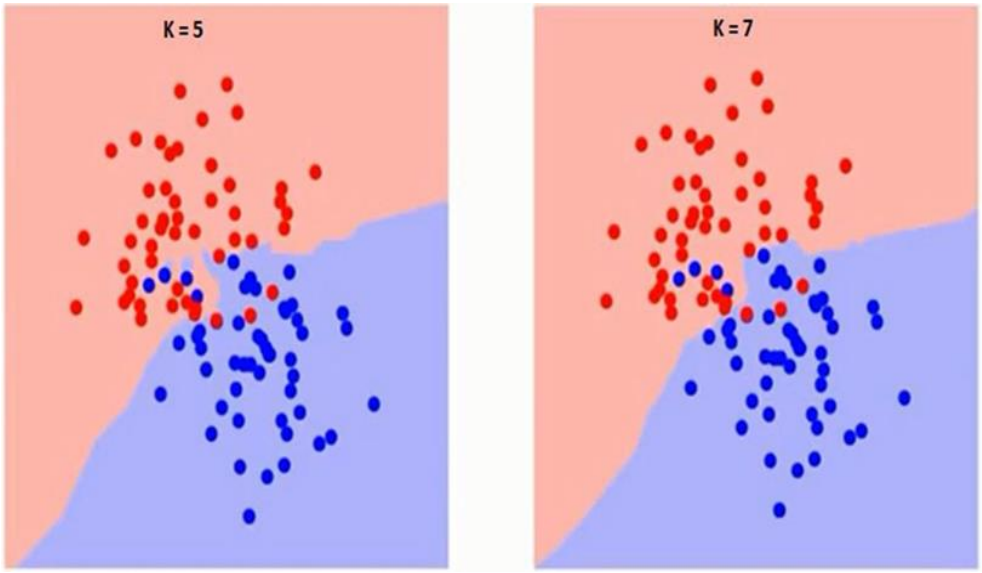


Figure 3.4.6.1: K Nearest Neighbor

Application of KNN algorithm is concept search or searching semantically similar documents and classifying documents containing similar documents. So as we know the data on internet has increasing exponentially every single seconds. There's billion and billion documents on internet. Each document contains multiple concepts that could be a potential concept. We will be talking about an enormous amount of dataset and samples. So what we need, we need to find out the concept from the enormous dataset and samples. So for this purpose we will be using KNN algorithm.

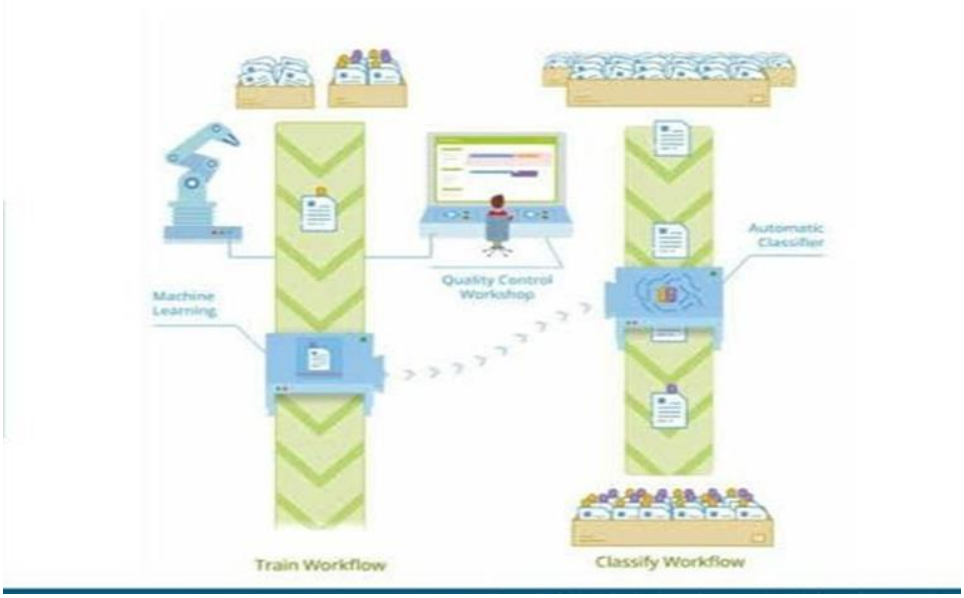


Figure 3.4.6.2: Applications of KNN

Figure 3.4.6.3: KNN (step by step)

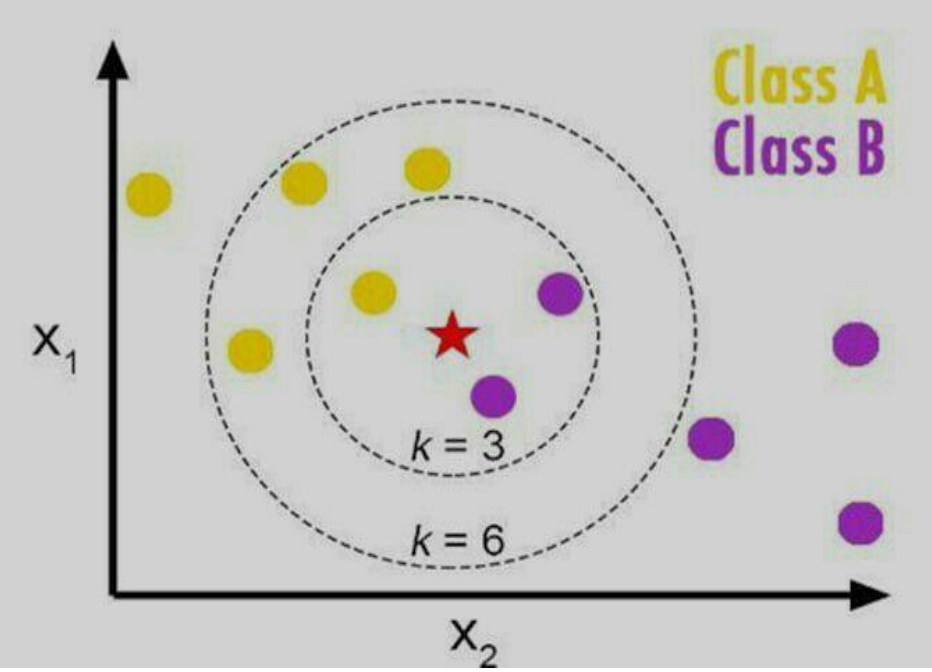


Figure 3.4.6.4: KNN work procedure

Let's start by plotting yellow and pink on the given diagram. So this yellow points are belonging to class A and pinks are belonging to Class B. Now we get a star as a new point and task is to predict whether this new point it belongs to class A or class B. To start the prediction, the very first thing that you have to do select the value of K, number of the k nearest neighbor that we want to select.

3.4.7 RNN (Recurrent Neural Network)

Recurrent Neural Network (RNN) works very well with sequence of data as input. Such as NLP (Natural Language Processing), suppose we have some sentence we need to find out it is positive or negative like this, also time series data, weather forecasting, etc. Google complete our sentences automatically this is also another example of recurrent neutral network. At first convert the image value into vectors and combine with the previous information, predict the next sequence of work as an output (Figure3.4.7.1).

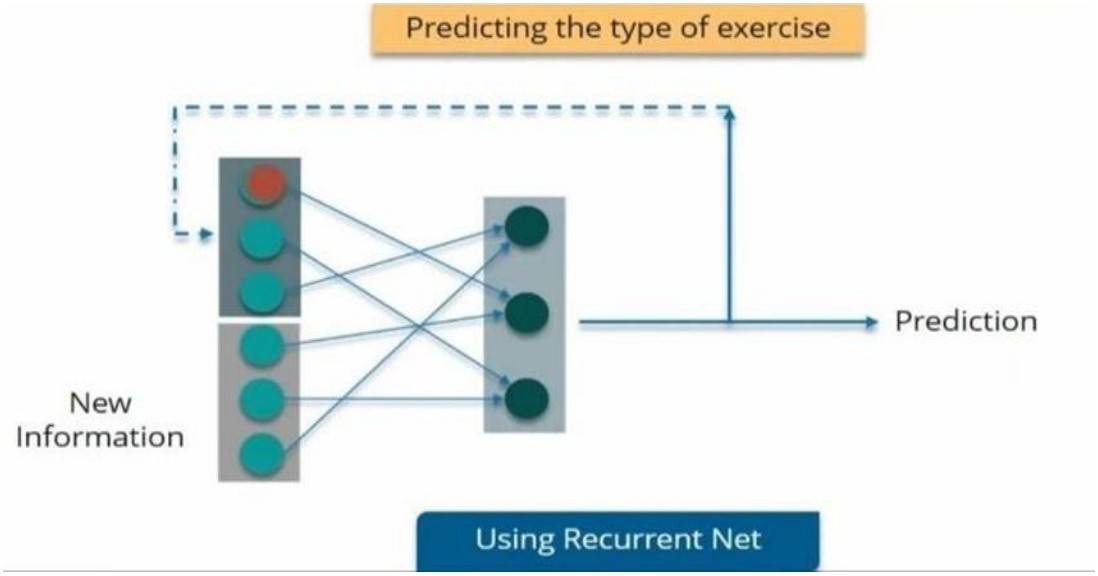


Figure 3.4.7.1: RNN Model

3.4.8 Long Short Term Memory Networks (LSTMs)

Long Short Term Memory Networks (LSTMs) is a species type of Recurrent Neural network (RNN). However, RNN has a short term dependency memory means it erase the previous data by updating and only remember immediate data. That's why we need Long Short Term Memory Networks (LSTMs) because it has a long term memory so that it can remember the previous data, able to use those for further predictions. It can predict data from a long passage and apply it very easily. Long Short Term Memory Networks (LSTMs) is also used for sequence of data for future predictions.

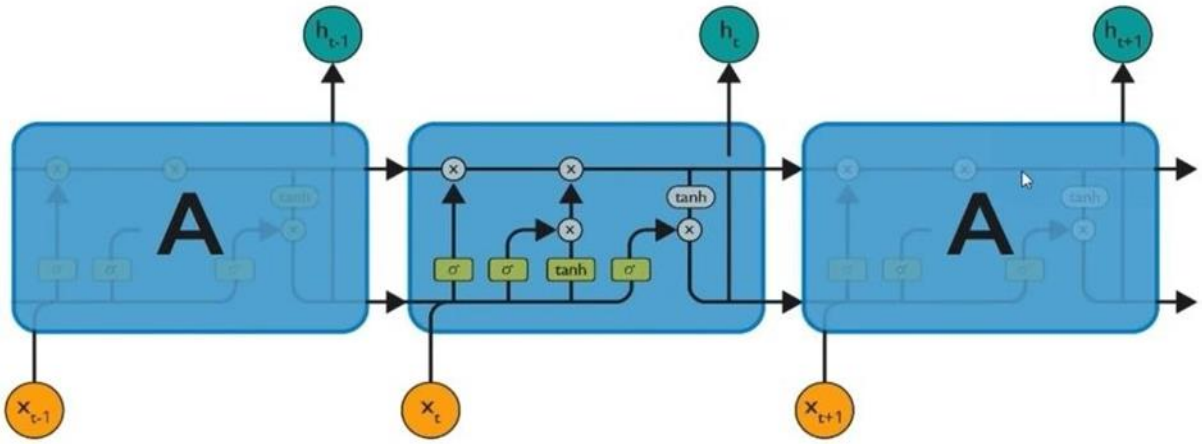


Figure 3.4.8.1: Structure of Long Short Term Memory Networks (LSTMs)

3.5 Implementation Requirements

Working with a deep learning model needs high configuration pc with GPU and others instrument. After completing all of the major tasks, we have identified a list of requirement used for developing this model.

The essential things are:

Hardware/Software Requirements

- Operating System (Windows 10)
- Ram (Minimum 4 GB)
- Hard Disk (Minimum 500 GB)

Developing tools:

- Jupiter Notebook
- Python Environment

Chapter 4

Experimental Results and Discussion

4.1 Experimental Setup

In this study, we have prepared a large volume of image data. Working with a large data set needs a better experimental setup. We have used high configuration pc with GPU. While training machine learning models, it takes many time for completing an epoch. Windows 10 operating system used there. Minimum 4 GB RAM size pc is essential for training a machine learning model otherwise it will not work properly. Ours pc has 500 GB of hard disk and minimum 4 GB of RAM. We have used up gradated version of Jupiter Notebook. Python programming language has used to develop and training the machine learning model.

4.2 Experimental Results & Analysis

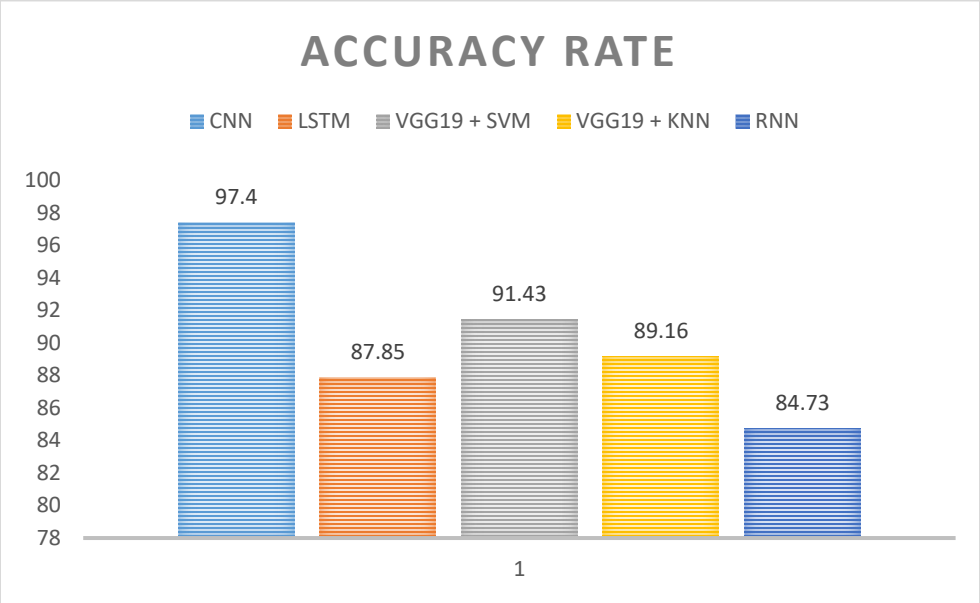
This section discusses over the findings that have been obtained. The performance of classifier models in classifying the tourist spots images dataset was measured using a variety of assessment metrics. The image classifiers were designed and tested using key metrics including Accuracy, Precision, Recall, and F1-Score. The key metrics were formulated as shown in the equations below: where Accuracy measures a classifier's overall efficiency. Precision measures the degree to which data labels coincide with the classifier's positive labels. The efficiency of a classifier in identifying positive labels is measured by Recall. The weighted average of Precision and Recall is the F1-score.

Accuracy: Accuracy narrates the models performance across all the classes. It measures how the algorithm classifies a dataset appropriately.

$$\text{Accuracy} = \frac{(\text{True Positive} + \text{True Negative})}{(\text{True Positive} + \text{True Negative} + \text{False Positive} + \text{False Negative})}$$

We have run 5 different deep learning and machine learning algorithms. Figure 4.1 shows the accuracy of those algorithms where CNN has achieved 97.4% of accuracy, LSTM has

achieved 87.85%, VGG19 + SVM has achieved 91.43%, VGG + KNN has achieved 89.16% and



RNN has achieved 84.73%.

Figure 4.2.1: Accuracy rate of different algorithms

Precision: Precision measures the degree to which data labels coincide with the classifier's positive labels. In data recovery.

$$\text{Precision} = \frac{\text{True Positive}}{\text{True Positive + False Positive}}$$

Recall: The efficiency of a classifier in identifying positive labels is measured by Recall. It measures the number of appropriate positive prediction made out of all positive prediction.

$$\text{Recall} = \frac{\text{True Positive}}{\text{True Positive+False Negative}}$$

F1-score = The weighted average of Precision and Recall is the F1-score.

$$F1 - score = \frac{2 \times (Recall \times Precision)}{Recall + Precision}$$

The performance results of using VGG19 model to build machine learning classifiers (SVM and KNN) and deep learning models (CNN, RNN, LSTM) were reported in the Figure 4.2. The five methods were implemented in Jupiter Notebook. These results used a train-test split of 80-20 ratio to evaluate the classifiers.

Methods	Accuracy	Precision	Recall	F1-Measure
CNN	97.40	96.95	97.91	97.43
LSTM	87.35	92.26	83.49	87.87
VGG19 + SVM	91.43	95.94	88.51	92.22
VGG19 + KNN	89.16	94.81	85.78	90.30
RNN	84.73	79.31	89.99	84.65

Figure 4.2.2: The performance of different algorithm using VGG19 model

Figure 4.3 shows the classification result comparison of different algorithms. Where, four key factors: Accuracy, Precision, Recall, F1-Score have compared with CNN, LSTM, VGG19 + SVM, VGG19 + KNN, RNN algorithms.

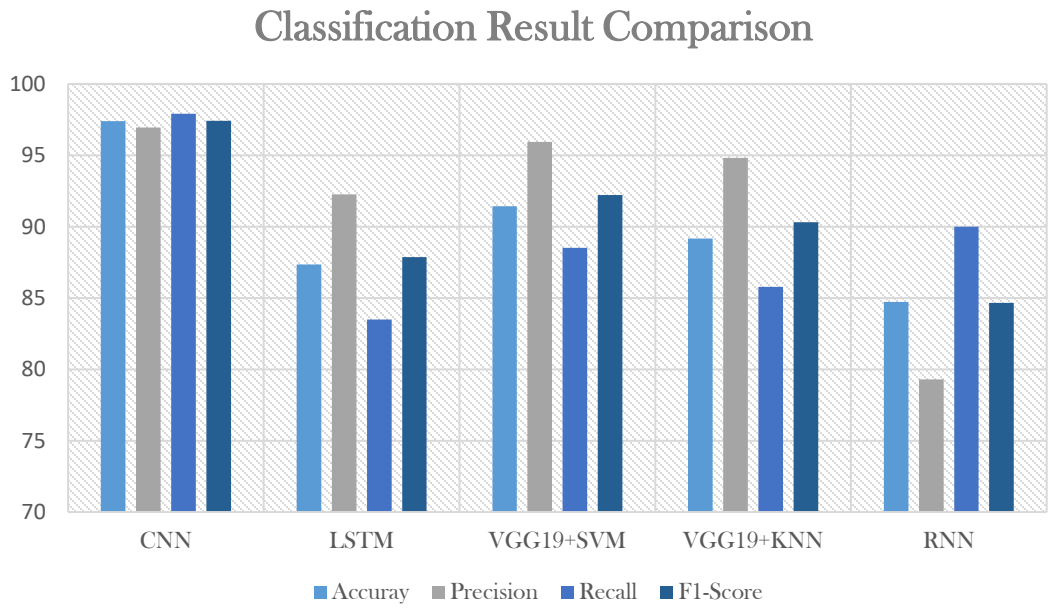


Figure 4.2.3: Classification result comparison

Confusion matrix plays a vital role for measuring performance in deep and machine learning classification. It is one of the best technique for abbreviating the performance of classification. We can get better idea about the type of errors our system makes and the right things also by calculating confusion matrix.

Figure 4.4 shows the Confusion Matrix of Convolution Neural Network (CNN) which is using in our model.

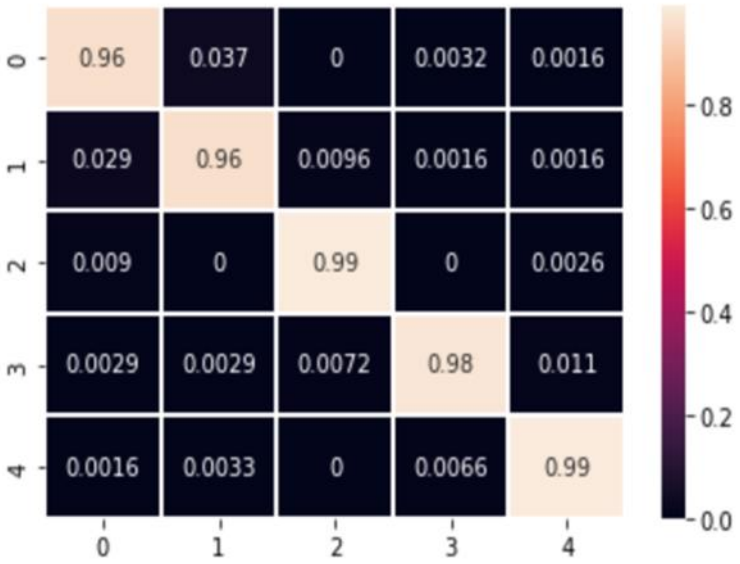


Figure 4.2.4: Confusion Matrix of Convolution Neural Network (CNN)

4.3 Discussion

This section reviews the experimental setup of our work, the performances of algorithms, accuracy, precision, recall, F1-score and ROC curve. We have also discussed about the equation

of evolution model and their functionality. Working with machine learning model needs high configuration of pc with GPU. We have discussed here about the Experimental setup of our work. In this work, Convolution Neural Network (CNN) shows the highest accuracy of 97.4%. As well as it shows the Precision of 96.95%, Recall of 97.91%, F1-Measure of 97.43%. Our final finding says that Convolution Neural Network shows the best result of accuracy in our model.

CHAPTER 5

Impact on Society, Environment and Sustainability

Tour is the action of entertainment, pleasure, attraction, etc. Its impact can be social, economic, cultural, environmental. Same as our research work has some impact on society, along with the economic and environmental situation. Tourist places can change our mental & physical health, behavior, family relationship behavior, etc. Tourism & tourist places can have the dominant power to change our lifestyle [3]

5.1 Impact on Society

Our main motive is to uncover the tourist places for native people to enhance tourism. Tourist places & tourism flourish our social kinship, increase mental health and growth. Psychologically proven environmental changes amplify one's thinking level, are friendly to think out of the box, introduce new ideas, etc. Territory put all these together. It helps to think simple and fill our mind with peace therefore our social kinship uplift. By ameliorating kinship that impairments conflict among people also increases the communication level. Since people visit a good number of places they are able to gather knowledge about other people's livelihood, culture, language, etc that increase social bonding and bits of knowledge. New culture & language knowledge can help to compare our livelihood, culture, language, and how much better position we're in lately. Anyone will agree, mental peace is the greatest peace in the world, we can get that from the territory. Along with the social impact, a good number of economic impacts are present there too. By providing food, water, shelter native people are getting an opportunity for earnings. It increases our country's earnings and foreign visitors get support & services that achieve dignified places towards the other countries.

5.2 Impact on Environment

As we mentioned before, Tourist places are only for the betterment of tour-loving people. Therefore, the environmental impact will be also associated with them. For territorial purposes,

native people, government, and opportunists are doing guardianship of that places, nature, and wild animals. Opportunists preserve the area, natural resources, and history. Natural resources protect us from natural disasters like cyclones, typhoons, floods, river erosion, earthquakes, etc. Sundarbans saves us from a lot of storms it's called a biological protective shield. Since last year Sundarbans has been fending us from "Amphan". Sundarbans covers 6,000km of Bangladesh & UNESCO declared as a World Heritage site that helps us economically and socially. As tourists places have a good number of advantages it has some disadvantages too like sometimes people destroy natural resources, murder wild animal, often people died because of wild animals, etc.

5.3 Ethical Aspects

If we consider tourist places ethical aspects it can be economical, social, environmental, life-related anything as it's related with tourism, tourists. Since tourist places are beneficial for those who love nature and want to refresh themselves. Ethical aspects can be,

- **Income distribution:** Tourist places are a good source of income as all people need food and shelter if they come from other places. They can make this as an earning resources
- **Services & facilities:** Services and facilities define the place's efficiency because impoverished facilities decrease the number of tourists.
- **Welfare of the wild animals:** Unique & unknown animals can be an excellent attraction for tourists. The government and the opportunists will take good care of them.
- **Environmental & life threaten:** Sometimes tourists face unwanted issues like accidents, dehydration, snatching, etc which causes death often. For tourists' services some of the natural resources are destroyed which is unethical.

5.4 Sustainability Plan

1. We are going to work for all over our county as well as all the tourist places. After that we want to work on the all territory places in the world.

2. We want to build an application for this which can predict the places from images

CHAPTER 6

CONCLUSION, RECOMMENDATION AND FUTURE WORKS

6.1 Summary of the Study

There is a lot of research work on our topic but we thought of doing something different on this project. We planned to collect a huge amount of data from different historical places to do better work but we have not been able to do this since the Covid-19 situation. We collected data from some of the historical places and we preprocessed the dataset for training and testing. Although we had to struggle so many times to collect the data because of the pandemic situation, we were able to collect a very limited amount of data. We used different algorithms to get a good result and good accuracy. Finally, we succeeded in this work and got good accuracy by using the Convolutional Neural Network (CNN). We assure that this project work will be of great use to the tourists and travelers. Nowadays there are lots of people who are too interested to travel and we hope that this approach will be very helpful for the traveler which is our main goal.

6.2 Conclusion

Nowadays Technology makes our life more blessed and easier day by day. We can search anything that we want at any time or solve our problem within a second by using technology. We have tried to build the easiest pathway for the traveler and tourist by this project. This work will surely make the traveler feel comfortable. For the tourists and travelers, it will be very useful. They can enjoy their vacation without facing any hassle. People could spend their weekend or any type of occasion like family picnic, mini tour in their nearest place.

So, we prospect that this project will be a turning point for tourists and travelers.

6.3 Implication for Further study

Despite the fact that increasing the number of travelers or people being attracted to travel, we want to develop our work a step further so that travel becomes easier and more convenient for tourists.

In the future, we want to collect data from many more places that we could not because of the epidemic. We used a few algorithms (Convolutional Neural Network, K Nearest Neighbors, RNN, LSTMs, (SVM). Later if possible we implement more algorithms to get better result.

REFFERENCES

1. M. Etaati, B. Majidi, M. T. Manzuri.: Cross Platform Web-based Smart Tourism Using Deep Monument Mining. 4th International Conference on Pattern Recognition and Image Analysis (IPRIA), pp. 190-194, (2019)
2. S. Mikhailov, A. Kashevnik, A. Smirnov.: Tourist Behaviour Analysis Based on Digital Pattern of Life. 7th International Conference on Control, Decision and Information Technologies (CoDIT), pp. 622-627, (2020)
3. M Abdollahi, T Khalegi, K Yang.: An integrated feature learning approach using deep learning for travel time prediction. Expert Systems with Applications, Vol. 139, (2020)
4. C. Siripanpornchana, S. Panichpapiboon, P. Chaovalit.: Travel-time prediction with deep learning. IEEE Region 10 Conference (TENCON), pp. 1859-1862, (2016)
5. F. Goudarzi.: Travel Time Prediction: Comparison of Machine Learning Algorithms in a Case Study. IEEE 20th International Conference on High Performance Computing and Communications. IEEE 16th International Conference on Smart City; IEEE 4th International Conference on Data Science and Systems (HPCC/SmartCity/DSS), pp. 1404-1407, (2018)
6. V. Parikh, M. Keskar, D. Dharia, P. Gotmare.: A Tourist Place Recommendation and Recognition System. Second International Conference on Inventive Communication and Computational Technologies (ICICCT), Coimbatore, India, pp. 218-222, (2018)
7. X. Su, G. Sperlì, V. Moscato, A. Picariello, C. Esposito, C. Choi.: An Edge Intelligence Empowered Recommender System Enabling Cultural Heritage Applications. IEEE Transactions on Industrial Informatics, vol. 15, no. 7, pp. 4266-4275, (2019)
8. G Li, J Hua, T Yuan, J Wu, Z Jiang, H Zhang, T Li.: Novel Recommendation System for Tourist Spots Based on Hierarchical Sampling Statistics and SVD++. Mathematical Problems in Engineering, (2019)
9. F Hu., Z Li., C Yang, Y Jiang.: A graph-based approach to detecting tourist movement patterns using social media data. Cartography and Geographic Information Science, (2018)
10. Koushik, A. N., Manoj, M., Nezamuddin, N.: Machine learning applications in activity-travel behaviour research: a Review. Transport Reviews, pp. 288-311, (2020)
11. Loureiro, S. M. C., Guerreiro, J., Ali, F.: 20 years of research on virtual reality and augmented reality in tourism context:A text-mining approach. Tourism Management, (2020)
12. Guerreiro, C., Cambria, E., Nguyen, H. T.: New Avenues in Mobile Tourism. 2020 International Joint Conference on Neural Networks (IJCNN), pp. 1-8, (2020)
13. Sheng, F., Zhang, Y., Shi, C., Qiu, M., Yao, S.: Xi'an tourism destination image analysis via deep learning. Journal of Ambient Intelligence and Humanized Computing, (2020)
14. C. D. Huang, J. Goo, K. Nam, C. W. Yoo.: Smart tourism tech- nologies in travel planning: The role of exploration and exploitation. Information & Management, vol. 54, no. 6, pp. 757 – 770, (2017)
15. Kim, S.-E., Lee, K. Y., Shin, S. I., Yang, S.-B.: Effects of tourism information quality in social media on

destination image formation: The case of Sina Weibo. Information & Management, vol. 54, pp. 687–702, (2017)

16. Benouaret, I., Lenne, D.: A Package Recommendation Framework for Trip Planning Activities. 10th ACM Conference on Recommender Systems – RecSys, (2016).
17. Guin, A.: Travel Time Prediction Using a Seasonal Autoregressive Integrated Moving Average Time Series Model. IEEE Intelligent Transportation Systems Conference, (2006)
18. Chen Y-C, Yu K-M, Kao T-H, Hsieh H-L.: Deep learning based real-time tourist spots detection and recognition mechanism. Science Progress, (2021)
19. Huang, X., Jagota, V., Espinoza-Munoz, E.: Tourist hot spots prediction model based on optimized neural network algorithm. Int J Syst Assur Eng Manag, (2021)
20. Yang, D.: Online sports tourism platform based on FPGA and machine learning. Microprocessors and Microsystems, vol. 80, (2021)

Turnitin Originality Report

Processed on: 02-Dec-2021 12:30 +06
ID: 1718201084
Word Count: 7290
Submitted: 1

Tourist Spot By Nusrat Jahan

Similarity Index	Similarity by Source
18%	Internet Sources: 17% Publications: 10% Student Papers: 8%

2% match (Internet from 07-Apr-2021)
http://dspace.daffodilvarsity.edu.bd:8080/bitstream/handle/123456789/5207/162-15-7914%20%2825_%29.pdf?isAllowed=y&sequence=1

1% match (Internet from 06-Aug-2020)
http://dspace.daffodilvarsity.edu.bd:8080/bitstream/handle/123456789/4095/P15433%20%2829_%29_.pdf?isAllowed=y&sequence=1

1% match (Internet from 28-Jul-2021)
https://www.survivalistpals.com/machine-learning-full-course-learn-machine-learning-10-hours-machine-learning-tutorial-edureka/

1% match (student papers from 26-Apr-2019)
Submitted to CSU, San Jose State University on 2019-04-26

1% match (Internet from 09-Apr-2021)
http://doctorpenguin.com/categories.html

1% match (Internet from 10-Oct-2020)
https://www.springerprofessional.de/empirical-evaluation-of-deep-learning-based-travel-time-predicti/17095156

1% match (publications)
Sergei Mikhailov, Alexey Kashevnik, Alexander Smirnov, "Tourist Behaviour Analysis Based on Digital Pattern of Life", 2020 7th International Conference on Control, Decision and Information Technologies (CoDIT), 2020

< 1% match (Internet from 07-Apr-2021)
http://dspace.daffodilvarsity.edu.bd:8080/bitstream/handle/123456789/5149/162-15-7878%20%2818_%29.pdf?isAllowed=y&sequence=1

< 1% match (Internet from 07-Apr-2021)
http://dspace.daffodilvarsity.edu.bd:8080/bitstream/handle/123456789/5158/152-15-6060%20%2817_%29.pdf?isAllowed=y&sequence=1

< 1% match ()
Paul, Aditya Jyoti, Ghose, Smaranjit, Aggarwal, Kanishka, Nethaji, Niketha, Pal, Shivam, Purkayastha, Arnab Dutta. "Machine Learning Advances aiding Recognition and Classification of Indian Monuments and Landmarks", 2021

< 1% match (Internet from 19-Jul-2020)
https://arxiv.org/pdf/2003.04978.pdf

< 1% match (Internet from 24-Nov-2018)
https://www.mdpi.com/2071-1050/10/11/4197/htm

< 1% match (Internet from 14-Feb-2021)
https://www.mdpi.com/2071-1050/12/1/320/htm

< 1% match (Internet from 29-Oct-2021)
https://www.mdpi.com/2306-5729/5/2/44/htm

< 1% match (Internet from 09-Jun-2021)
https://davidroelleke.com/data-science-full-course-learn-data-science-in-10-hours-data-science-for-beginners-edureka/

< 1% match (Internet from 24-Feb-2021)
http://eprints.gla.ac.uk/227632/2/227632.pdf

< 1% match (Internet from 28-Jun-2020)
https://tel.archives-ouvertes.fr/tel-02500640/document

< 1% match (Internet from 25-Nov-2021)
https://namanmehra1207.medium.com/?source=post_internal_links---------5----------

< 1% match (Internet from 02-Feb-2021)
https://istar.iscte-iul.pt/is-publications/