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Flag recognition system

Student Id : 2039271
Student Name : Aman Oli
Supervisor : Prakash Gautam
Cohort/Batch : 4

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Declaration Sheet

Award Title: ***BSc(Hons) Computer Science***

Declaration Sheet

(Presented in partial fulfillment of the assessment requirements for the above award.)

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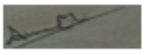
Signature:  Date: 6/5/2021

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Acknowledgement

I must acknowledge the support and guidance of few respected individuals that helped me in completion of my project. They deserve my heartfelt gratitude. During this project I got to learn about so many things and had so much of experience. I am also grateful to my College/University for organizing this Final Year Project module.

It would have been very much difficult for me to complete this project on my own without the support of few individuals. I would like to thank everyone who have helped me on this project directly or indirectly. But I would like to thank my supervisor Mr. Prakash Gautam for guiding and motivating me throughout this project. He would find the flaws and give very effective feedbacks which helped in making this project more effective.

Abstract
This project focus on National Flag Detection Using Convolutional Neural Network. This is an image processing work with the help of Convolutional neural network, in this project we solve an image classification problem, where our goal will be to tell which class the input image belongs to. The way we are going to achieve it is by training an artificial neural network on few thousand images of national flags and make the NN(Neural Network) learn to predict which class the image belongs to. Finally, we achieve our goal for detection of national using Artificial Neural Network when corresponding national flag is provided.

To develop this project, the most fundamental part is we need to prepare dataset of National Flag. For this we need you to download all the required training and test dataset into our working directory. It took a while as there are more than 4,000 images.

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1. Introduction

1.1. Project Briefing

This project helps people to predict flag images of different countries. This is a web-based application that users can access through the internet and get instant result to the images of flags of different images.

Image Classification has been an interesting issue for a long time. It is mind-boggling applications in everyday life has been the motive for consistent research in present context. Last couple of years lot of works have been done regarding image processing and image detection. The world we live in currently is depending on data. Every major research needs to be fed with lots of data to get best results. Images are also a set of data. An exceptional type of application but related to our daily life is to detect images. For an example, when we see world around us that is also an information gathered from a lot of pictures processed at an enormous speed. With time, the advancement in Computer Vision with Deep Learning have been refined, mostly by one unique algorithm i.e., a Convolution Neural Network.

This project will be using deep learning. It is a supervised model as it is being trained through giving a proper dataset and have made many repeated the learning process multiple times when it does not work as planned.

We know that technology is getting better every day. One of the gifts in this rapid development of technologies has been the utilization of AI(Artificial Intelligence) in many sectors. In, particular Neural Networks helps a lot in Image classification.

My topic for my Final Year Project is Country Flag Recognition. This project requires Artificial Intelligence to function. Flag Recognition is also a part of Image Classification. To teach an algorithm how to recognize images, I will utilize Convolution Neural Network (CNN).

Image Classification has been widely used in many sectors of our surrounding such as in our mobile phones for facial recognition, it is also used in medical fields for detection of cancer and other disease. Image Classification can also be used in my topic i.e., Flag recognition. Flags are national symbols. Every country has a specific flag as their symbol. When attending some international conference, it can be essential to know which countries are participating in the conference by detecting their national flag. Similarly, if we talk about the team identification using their national flag in World Cup it is going to be very easier using flag detection.

We know that our national flags are a meaningful source of a county and it always has a very good story behind it. Every individual should research about national flag and its meaning. But there are some problems of our young generation. Now a day's young generation is so lazy and unconscious that they want to stay online but they do not want to know about the nationality and national flag. So, I want to make country flag recognition. So that young people can save their valuable time without browsing, they know about the name of the national flag of all countries of world.

Lot of people do not recognize flags of many countries. That is too much common today. Even educated people are very confused with flags of many countries. And there are flags between countries that seems so similar just distinguished with a few patterns. So sometimes identifying flags is difficult. So, sometimes it may occur that someone have to recognize any national flags displayed on Television, or in some general meeting etc. so this project gives a defined idea of all the national flags. So, I am going to make an application that helps people recognizing national flags easily. I will use neural networks to create this application i.e., Convolution Neural Networks

1.1.1. Classification System

For a classification system with Python, datasets are required. With the datasets acquired that contains images of flags of different nations, the keras framework can be used. Keras framework is widely used for image classification tasks. It offers different type of image augmentation features. It supports almost all the models of neural network i.e., fully connected, convolutional, pooling, recurrent, embedding, etc. For this project I will use Convolution Neural Network

1.1.1.1. Why Convolution Neural Network (CNN)?

A Convolution Neural Network (CNN) is a deep neural network (NN) inspired by visual cortex of a human brain. (Saha, 2018) CNN is considered to be the most powerful algorithm for image classification. It stands apart from the traditional style of Machine Learning(ML). CNN is mostly used in images and also used on any 2D or 3D array of data. The concept behind CNN is that a local understanding of an image is reasonably accurate but recently CNN has been used for many other classification purposes other than image classification. (Chan, 2020)

1.1.1.2. Image Preprocessing

For this project, the first work is to collect a good dataset. After collecting the dataset that contains images of flags of different nations the images must be preprocessed before feeding it to the neural network just like converting all the images into same image format, converting the image into one standard size, etc.

1.1.1.3. Aims

- Provide as accurate result as possible to the users.
- Build a user-friendly web-based application.
- Save user predicted images into database.

1.1.1.4. Objectives

- Understanding Convolutional Neural Network(CNN) algorithm.
- Plan suitable solutions to the problems during the project.
- Provide a web-based application with image classification system.

1.2. Artefacts

The Artefacts of the system are:

- This system is web-based application built using Django framework which generates
- Suitable result of the flags image input.
- It is a user-based system. User should create accounts to login. The image input by the user is stored in database.
- Detection of image is done by CNN algorithm.
- Input is taken by uploading photo and output is generated with help of neural networks in text automatically. Flag recognition recognizes the national Flag input given.

Functional Decomposition Diagram

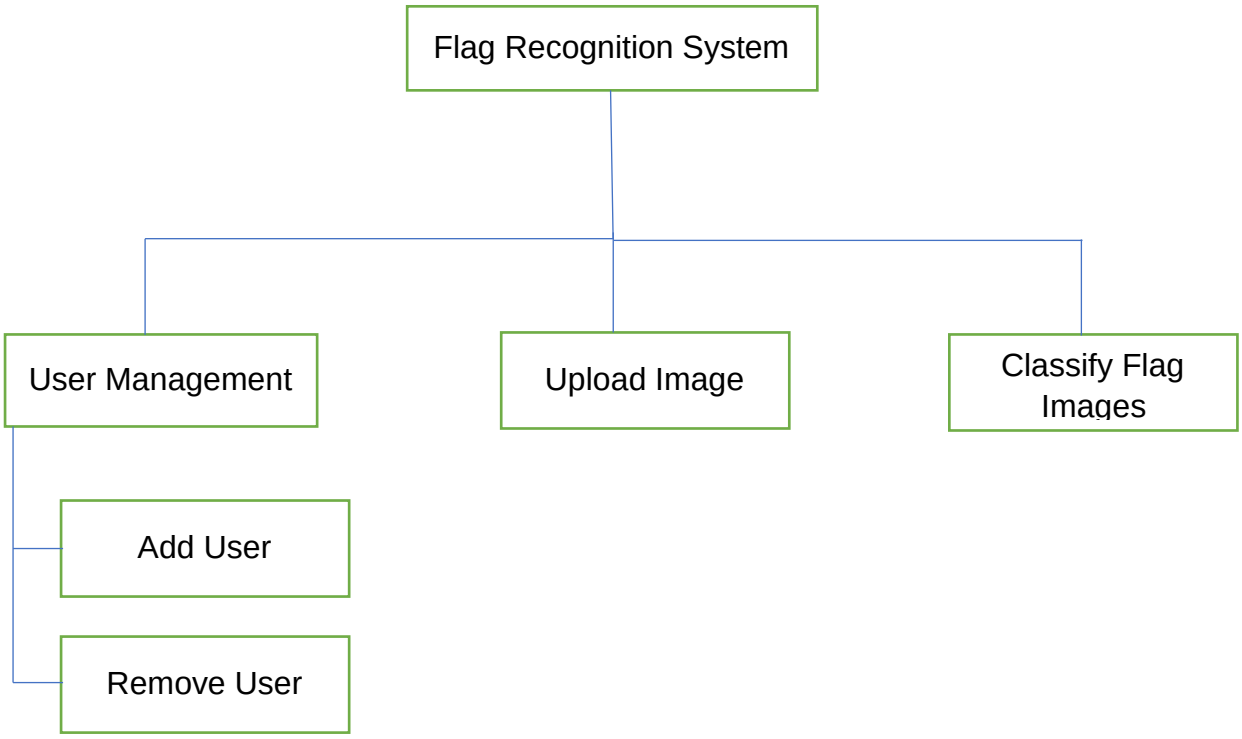


Figure 1: FDD diagram

Flag Recognition is an image classification system that is able to recognize the images of flags of different nations. This project uses deep learning algorithm. It contains datasets that are images of different countries collected from the internet and preprocessed. The concept of this project is very simple. The user inputs an image of flag of any nation and the model must be able to predict it with a satisfactory level of accuracy. This project uses the Convolutional Neural Network(CNN) algorithm for image classification because of its high accuracy. We use the keras library as it is designed for enabling fast experiment with the deep neural networks and focuses on being user friendly. The system will be built using the python Django framework.

This project is simple and does not have any extra features. After deploying the model at first the user should signup an account in order to use the system. After creating an account, the user can log into the system via their account. Then they are redirected towards the homepage. Then the user can upload their images to the system. After uploading the image to the system, it gives an appropriate result stating the country name of the flag input.

1.3. Academic Questions

- What are most appropriate techniques, tools and technologies to implement in this project?
- What needs to be done to make such a system to make it robust, secure and resilient?
- Which algorithm will be the best for developing the project successfully?

1.4. Scope and limitations

The scopes of this project are:

- It can classify many flags just at an instance.
- Projects like this can be used in many sectors like health care.
- It also can be helpful for searching through images like google search by image

Limitations of this project are that it can only predict images of limited classes for now. There are some future works left. Users can only upload images within the local storage and cannot upload images through the URL. The image should have a majority of flag image within it then only the model predicts the flag very accurately. This system cannot predict flags image in real time.

1.5 Further Details

Computer vision
Image Classification is one of the most well known task in the field of computer vision. It allows for the classification of a given image as belonging to one of a set of predefined categories. It works by imitating human perception of vision using different algorithms. (Zhang, 2020)

Supervised Learning
Flag Recognition System using deep learning is based on supervised learning. The training, testing and validation sets of dataset are preprocessed and fed to the model. The output are already known but taught to the model and the learning process is repeated until the model is perfect at classifying it.

2. Literature Review

The literature review focuses on analyzing the techniques that can be used in Flag recognition system from different approaches i.e., traditional to modern approach. It is an important and interesting topic. So, it makes this project little more fun as there is a lot to discover. As flag recognition system has fewer research papers and it is also a part of image recognition system, in this review all the available techniques that can be used for image classification will be analyzed. All the sources that are used for this review are taken from trusted official research paper provider such as IEEE.

2.1. Evaluation

Used in multiple fields, Image Classification is where the built system can analyze and identify the class under which the image falls under or it can also calculate the probability of the image falling into the respective classes. Image classification is most used is in health care where the system inputs an image and produces output classification for identifying if the disease is present or not. (K. Balaji, 2019)

To make this Image Classification system an algorithm is needed to make the system learn about the images and their classes. For this there are many algorithms like CNN, SVM etc. for this project I am choosing the Convolutional Neural Network algorithm. One of the major advantages of using CNN is that it is able to reduce the computation as the number of parameters can be reduced as it has the feature of parameters sharing and dimensionality reduction.

2.2. Convolutional Neural Network

CNN is a neural network algorithm so let us have a little basics about neural networks. Neural Networks are the core of deep learning algorithms. This algorithm tries to copy the human brain and the processing style. The human brain receives, processes and outputs the given information likewise in neural networks this is represented as the layers i.e., input, hidden and the output layers. To complete training the neural network forward propagation and backward propagation are done.

In forward propagation the images are fed into the input layer which is the first layer in the CNN architecture in numeric form. Then the neurons in the hidden layers perform certain mathematical operations and then the output layer gives the final output. The Backward propagation comes in action after the training is done. After the output is received the backward propagation compares the output values with the real values to test the model and then updates the parameters if necessary and repeats the process again. Now let us understand the basic layers and functions of the CNN algorithm. The word “convolutional” defines numerical activity of two functions which creates another function that indicates at which range the first functions coordinate if their graphs are contrasted and one another.
The convolution between two functions in one dimension is termed as:

$$g(x) = f(x) \odot h(x) = \int_{-\infty}^{\infty} f(s)h(x-s)ds$$

here two functions are f(x) and g(x), and s is dummy variable of integration which takes 0 or 1.

The convolution between two functions in two dimensions is termed as:

$$g(x,y) = f(x,y) \odot h(x,y) = \int \int_{-\infty}^{\infty} f(s,t)h(x-s,y-t)ds\,dt$$

In generally, convolution operation is denoted by asterisk *.
CNNs are more similar to traditional ANNs. Input is received by each neuron and performs an operation. Neurons in a layer of CNN are simply associated with a little locale area rather than the entirety of the neurons in a completely associated way. CNN is feed-forward ANN which have network design between neurons. CNNs are mostly used in the area of pattern recognition within images. CNN layers are included neurons composed into three dimensions, height and width of input and the depth.

The convolutional layer is the first layer. It extracts the features of the images and the mathematical operation of convolution is performed between the image and the filter of size (S x S). The filter slides over that input image. The dot product is taken between the filter and the image in respect to the size of the filter image (S x S). The output is also called as feature map which is fed into other layers to know other features of the input image.

The convolutional layer is followed by the pooling layer. This layer decreases the size of the convolved feature map. It reduces the overall computational cost. There are three types of pooling layers i.e., max pooling, average pooling, sum pooling. The max pooling calculates the max value from the feature map, whereas the average pooling calculates the average value, and the Sum pooling calculates the sum of the feature

map. This layer acts as the bridge between convolutional layer and the fully connected layer. The images are flattened and fed into the fully connected layer. The flattened vector undergoes few more mathematical functions. In this layer the prediction begins.

The Dropout function is used when all the features are connected to the fully connected layer and overfitting is seen. Overfitting occurs when the model only learns about the training sets and predicts all the images in the training sets very accurately and lacks the power to predict the real-life images. This can happen due to many reasons such as bad datasets, bad hyper parameters, etc. to reduce the overfitting we can use the Dropout layer. This layer drops few layers from the neural network. For example, passing 0.4 in dropout layer means that 40% of hidden layers are dropped randomly.

Activation functions are one of the most important parameters to be used in CNN. This layer adds non-linearity to the model. There are many activation functions such as Sigmoid, Softmax, ReLU, etc. In binary classes Sigmoid function is used whereas in multiclass Softmax is always preferred.

2.3. Initial Research on similar topics

2.3.1. CamFind

CamFind is one of the famous apps found for mobile devices to find objects using image capture through camera. It allows user to identify objects items just by taking picture of an object with their smart phones and provides a range of information including related images, price comparison and also web results. CamFind is a lightweight yet powerful application. It has huge number of positive reviews and also has more than 5,000,000+ installs in present context. (CamFind, 2019)

2.3.2. Google Lens

Google lens is an application that uses image classification, object detection to recognize the image shown. This application is very vast as it can identify almost everything. It can scan and translate texts in real time. It can also identify image of objects such as chair, tables and also clothes that caught your eyes, but you have no clue about. It gives you the web result related to it and also can search related images just like that. Not only that much google lens also can identify places so that you could have information from picture of any place, and it can identify pets and animals effectively. Google also have another similar system to this i.e., Google search by image which extracts every detail of the image, learns the image and provides us with web result accordingly to the picture input. Google lens has been a revolutionary application in technology field. It has been loved by the users and has over 1,000,000,000+ installs currently which is a big number. (Google, 2020)

2.3.3. Amazon Rekognition

Amazon Rekognition is an image recognition service from amazon. This system allows user to detect faces in images, objects, scene etc. it is based on deep learning technology that is developed by scientists working for amazon to analyze billions of photos. It uses deep neural networks to detect and also label thousands of objects and scenes in the image provided. (Amazon, 2020)

2.3.4. Automatic Flag Recognition Using Texture Based Color Analysis and Gradient Features

In order to imitate the human perception of vision they have used the HSV (Hue, Saturation, View) model rather than the RGB (Red, Green, Blue) model. Here, MSD have been used for feature extraction. SVM trained on the new feature set got them 2.08% and 7.57% increase for their training and testing sets. Their dataset consisted of 224 countries or classes. SVM is used for learning the algorithms that analyze data used for classifications. SVM is able to solve all the linear and nonlinear problem and work with many practical problems. It separates the data into different classes. (W. Le, 2019). They found out that the color bin size of 180 got them the best result with the training and testing set of 97.12% and 60.01% respectively. They have also stated that the machine learning models are still based on whole lot of pixel intensity values, which are much influenced by the actual object property as by lighting conditions and viewpoint. Their dataset contained of 224classes and many of the flags have same color combination plus within a class there is a great variation in color shade and texture. This might cause a little confusion to the model. They approach this project as a problem of object identification rather than a problem of object retrieval. (Jetley, 2019).

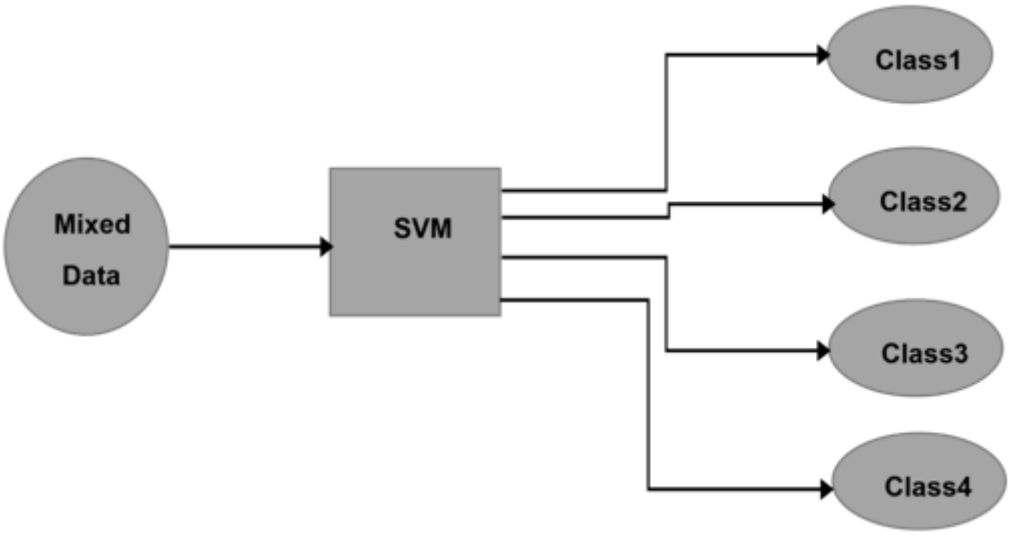


Figure 2: SVM classifier

2.3.5. Computer Aided Identification of Flags Using Color Features

In this research Flag is recognized using color features. Since the color pattern might be very similar between many of the flags, recognizing it can be a little difficult when number of images are increased. In this research the authors have proposed KNN approach as shown in the figure below. (Lodh, 2016)

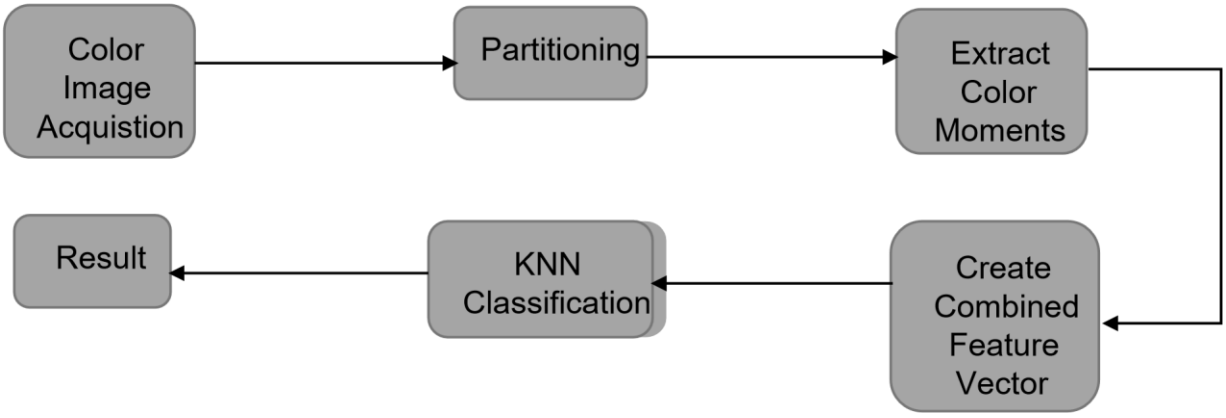


Figure 3: KNN classification

Firstly, to remove the computational overloads they resized to standard dimensions as a part of preprocessing process. Also, if any image has white background the white part is removed so that only the flag portion is visible. (Lodh, 2016)

In the next step an image with dimension (M rows by N columns) is vertically divided into H cells V cells such that the dimension of each cell is m / n given by

$$m = \frac{M}{h}, n = \frac{N}{V}$$

The value of H and V are based on the experimented results. Here, the color information is divided each cell into three channels i.e., RGB. The mean and the standard deviation are determined for each channel, and all six statistical characteristics are added together to make a cell information.

$$C_i = \{\mu(R), \sigma(R), \mu(G), \sigma(G), \mu(B), \sigma(B)\}$$

An entire flag is represented by a collection of all such cells,

$$I = \mathrm{i} = 1\mathrm{H} * \mathrm{V}C_i$$

Each flag contains color feature of 6HV elements. Here they have used k-NN algorithm for its simplicity, reliability, and speed. (Lodh, 2016)

2.3.6. National Flag Detection Using Convolutional Neural Network

In this report the authors have made National Flag Detection using CNN (Convolutional Neural Network). They have used python language as coding language. Their report shows that they were able to get 96.6% of accuracy. According to them getting quality of datasets is a major challenge in doing such a project. (Sumaiya Sultana, 2018)

Country Name	**Accuracy**
Bangladesh	95%
India	97.67%
Australia	97%
Nepal	93.89%
Malaysia	97.72%
New Zeeland	96%
Japan	95.88%
Bhutan	94.03%
Maldives	98%
Afghanistan	96.8%
Ireland	97.2%
Sri Lanka	95.5%
Macro average	**96.6%**

This was the accuracy they were to achieve. In this report inception-v3 of TensorFlow have been used and they have implemented transfer learning to identify the nationality of SAARC countries based on the dataset and they got 96.6% of accuracy. (Sumaiya Sultana, 2018) Many of other people have done similar project using SVM too. But they state that using SVM get them low level of accuracy.

2.3.7.A Convolutional NEURAL Network Approach for Semaphore Flag Signaling Recognition

In this paper Semaphore flag signaling (SFS) recognition has been made using CNN. CNN algorithm has been used for this project. CNN can capture translational invariance with a smaller number of parameters. This can be accomplished with repetition of weights over frequency and time. The use of CNN is the substitution method apart from using a deep neural network. (Samudre, 2019). In addition, they got better performance with MINST dataset. The enhanced CNN offers a specific wavelet to various light, angles, scenes, and group of people. For SFS CNN is often used as it has advantages for better adaptability, simple structure and less training parameters. Therefore, it is faster to train. RELU activation function has been used as substitute to the sigmoid activation function as using RELU function helped in increase in the accuracy. The structure of CNN does make it a good option for parallel implementation in GPU. The result shows that their approach gained 99.95% of accuracy. (Zhao, 2016)

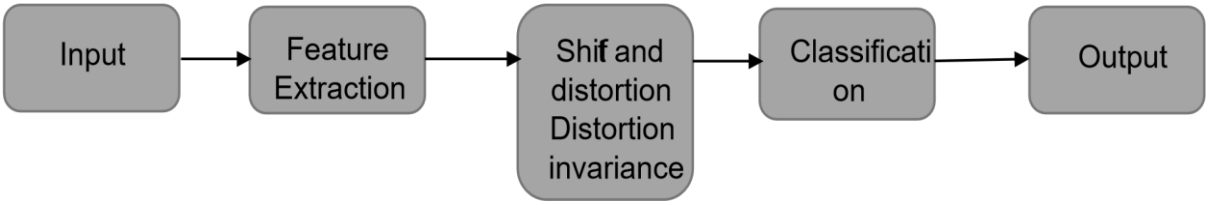


Figure 4: CNN classification method

The framework of Convolutional Neural Network is shown below:

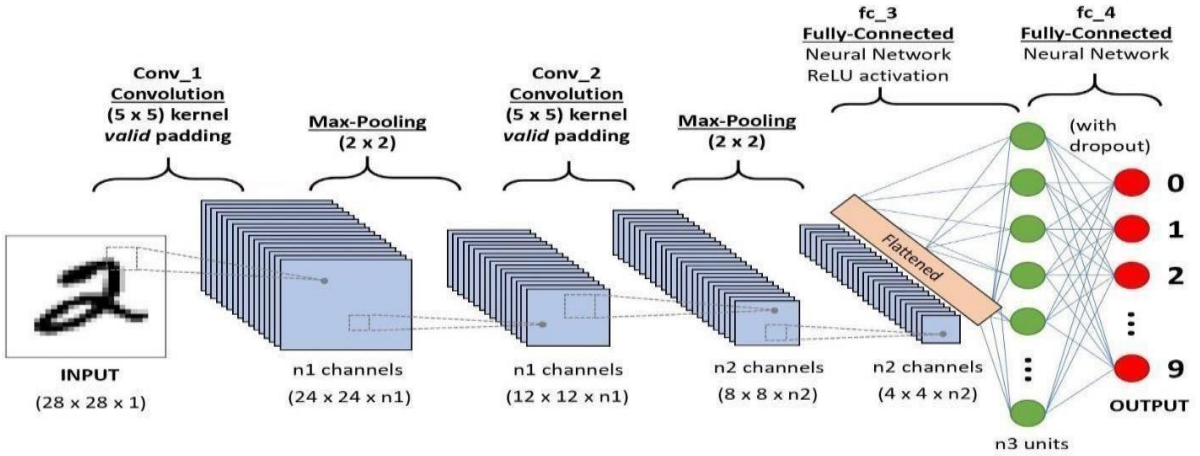


Figure 5: The framework of CNN system

Convolutional layer

$$x_{jl} = f(\sum_{i \in M} x_{il-1} * W_{ijl} + b_{jl})$$

Here, x_{jl} represents the j-th feature map of the L layer, f(.) represents the activation function and W represents convolutional kernel. The convolutional operation is * and bias is b. Now, for the formula for subsampling is:

$$x_{jl} = f(\beta_{jl} down(x_{jl-1}) + b_{jl})$$

Here, down(.) represents the subsampling function. The size of the output image is 1 by n times of input image. β as the weighted coefficients, and b for the bias.

2.3.8. The Recognition of Semaphore Letter Code Using Haar Wavelet and Euclidean Function

This research paper proposes an image processing algorithm for correcting the movement of letter code of the semaphore based on the image obtained by using the letter of the semaphore using the webcam. They have applied the wavelet feature extraction, Digital image processing and Euclidean distance function for examining the best rate of recognition of distance variation and the variation decimation for sending the semaphore letter code through the webcam. Wavelet can be defined as a short or a small wave. The Wavelet reshaping converts signal into a Wavelet sequence.

Shortwave is a fundamental mechanism located at various times. Among all Haar wavelet is the simplest. The basic function of Haar Wavelets is the transformation coefficient low and high pass filter. The Euclidean distance is one of the maximum used metrics for calculating similarities between two vectors. As higher the value of similarities between two vectors the smaller the value of the Euclidean distance gets. Here, Matlab is used as a semaphore letter programming code. The preprocessing step is commenced by turning a RGB (Red, Green, Blue) image into HSV (Hue, Saturation, View) image. Now, the next process will be to resize according to the default image size.

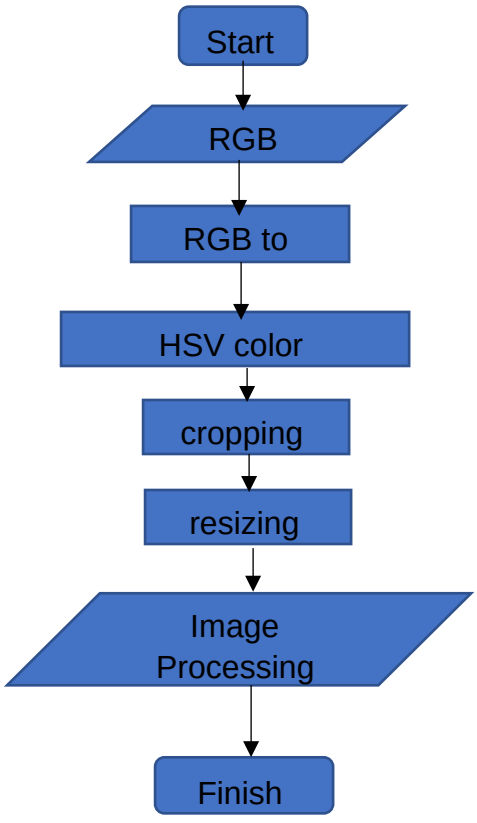


Figure 6: image preprocessing flowchart

image preprocessing flowchart in this report, the % of semaphore letter recognition rates
on the decimation variation of the overall distance is shown below

Decimation	(% of the recognition rate)
1st	95.4%
2nd	94.6%
3rd	94.2%

2.3.9. Detection of fire using image processing techniques with LUV color space.

The vision-based fire detection system is recently being more popular as to the traditional way which included sensors. The color in the fire is a simple technique for identifying the fire on the image. Also, color of the fire also varies like orange, red, white, blue to yellow. There are many non-fire objects that are similar to fire color. For increasing accuracy edge detection, background segmentation, smoke existence, growth in fire, motion detection etc. are some of the techniques combined by many researchers and implemented by them to distinguish the image with fire and other fire like non fire images inside a video. This system is centered on the flame color detection that are combined with other many features such as area and motion of the frame. In this research paper LUV hybrid transforms and color space is implemented. The fire pixel has a higher red component in it. In RGB model the (R Intensity is greater than G Intensity and G Intensity is greater than B Intensity) and (R Intensity is greater than R Threshold). In HSV model S > (225=R) * S Threshold/R Threshold. Normally there are three ways for motion detection and that are Frame Subtraction, Background Registration, Moving Pixel Detection. Here, the system reads the captured video and extracts every frames. Every frame is examined for the existence of fire. The fire pixel is identified with the feature of LUV color spades and hybrid transforms. Most researchers use HSV, RGB and YCbCr color space for identifying the flame region but according to them LUV color space alongside hybrid transforms is better to use for good results. (Pritam, 2017)

2.3.10. Object Detection in Videos by High Quality Object Linking

Object detection in videos is a tough task because of its degraded image quality. According to them their research outperforms the static image detector. Their method gives a better result by 8.8% for fast moving objects over the static image detector. Detecting objects have significantly improved due to progress in deep convolutional neural networks (CNN's). But still object detection in videos remains a challenge because of the motion blur and video defocus. Fast R-CNN has been adapted for each cuboid proposal to detect short tubelets. In addition, they also extended the standard non maximum suppression (NMS) with a tubelet overlap measurement that stops tubelets from breaking which may occur in frame-wise NMS. They modified the region proposal network (RPN) method in the Faster R-CNN and introduced the cuboid proposal network (CPN). Comparing their results with other methods using the same ResNet-101 network their method gave performance which confirms that their linking strategy is more effective. In the runtime their method took 0.35s per-frame for testing which is close to 0.30s by the static baseline. (Tang, 2020)

2.3.11. Automatic Color Recognition Technology of UAV based on Machine Vision

In this paper image acquired by UAV from different color models and its influence on the color recognition, principle and conversion method are discussed below. The most common used color spades models are RGB, HSI and HSV color model. The change in these models brings difference in accuracy of the system. The RGB is most commonly used model in image processing. The HSI is good for huge color differences and the HSV tends to imitate the human eye. In this paper they have used the HSV color model. As the original images captured by the cameras are in RGB model now it should be converted into the HSV. They have used the canny operator for this project although there are many operators such as LOG, Sobel, etc. The canny operator is an optimization operator with filtering, enhancement, and detection functions. Therefore, Canny operator will be used for this project. According to them their system is able to identify the color of the signals even in a complex background. (Liu, 2019)

3. Analysis

There are many ways of image classification. In the reviews above flag recognition have been implemented with different approaches. In this research I learned about many new models and algorithms. I also learned about the hybrid models and many algorithms. Overall, I got a decent knowledge about image classification through different approaches.

There are many ways of image classifications such as SVM, CNN, fuzzy classification and others. In the above-mentioned research papers SVM, CNN, fuzzy classifications, transfer learning etc. have been implemented. Every algorithm has given satisfactory outputs in the following reviews. In the first review flag recognition have been commenced using texture-based analysis and color gradients. They have used SVM as it tends to give more accuracy with low computational power. (Gandhi, 2018). They also used HSV rather than RGB although RGB is used in most cameras, digital screens, digital images etc. but HSV directly corelates with the human perceptual differentiation between colors. (Loesdau, 2014). In the next research flag recognition has been done with color features. They have used KNN algorithm for this project. According to the authors they have used KNN algorithm as when flags numbers are at large scale the colors and layout tends to be similar making it difficult to recognize. For preprocessing they have cropped all images to standard dimensions and removed all white background it if there is any, this helps in faster training process. In the next research CNN has been used. CNN is one of the most used algorithms in the field of image classification. They have used inception-v3 model of tensorflow. They have used transfer learning model for recognize the images of SAARC countries. They state that they got more accuracy with transfer learning than SVM. Transfer learning is a good approach for saving time, better performance and not requiring a lot of data. It is usually used for projects requiring a huge amount of data. Data are reused as a starting point for a model on a second task. In the next research paper Semaphore flag signal have been recognized CNN. They acquired a slight better performance using the MINST dataset. According to the authors in project like this CNN
is often required as it is easier to train and has strong adaptability. In the next report Haar Wavelet and Euclidean function have been implemented.

By doing this report I learned about so many new models and algorithms. I learned about color models. RGB color model is most used color models that you find in every camera, smartphones, etc. but while making a system we are trying to recognize an object by imitating the human sight processing this is where HSV color model is best as it imitates the human vision system. I also learned about different edge detection operators such as Roberts, Sobel, LOG, Canny etc.

4. Project Methodology

4.1. Justification of chosen methodology

Agile Software Development process defines users, established vision, and works iteratively on solutions to problems, opportunities. It is concerned with actors such as user, development team and product owners. The major principles for agile project management are:

1. Customer collaboration over contract negotiation.
2. Satisfying customer with through early and continuous delivery.
3. Responding to change over following a plan.
4. Making effective communication.

The Agile methodology includes a framework called Scrum. Scrum is one of the most used models currently. Scrum is a cost saving development methodology. Scrum is not as easy to learn as other methodologies but is highly beneficial for projects. Scrum is a good methodology for every kind of projects(small or large projects). Scrum is also a lightweight to use. Scrum has an incremental approach. Scrum would be best methodology to choose for my project as scrum is an incremental based framework. It divides a project into many sub projects, so it helps to get a clear vision to the project manager. Now scrum is not only used for group projects bur can also be used for personal projects. Scrum methodology has many advantages such as if any error occurs then it can be fixed from repeating the backward phase unlike waterfall model where there is only one direction process. It is also a cost saving method. As I can plan all sprint and can manage time according to the sprint this model would be very suitable for my project. (Scrum, 2020)

1. Meeting: In the initial stage, we proposed idea about our project. We had explained to our supervisor how it works and how can it have built in specific time.
2. Analysis: Different researched paper and similar projects are reviewed. Custom dataset has been made as it was difficult to find a good dataset. Feedback by our supervisor.
3. Design: Here firstly we prepare wireframes and finalize how our system looks. Then we also decide the algorithms and libraries for our project. In this project CNN algorithm have been used with the keras library.
4. Develop: In this phase, the actual task will start. Prototype are created by coding in python language. This system is based on AI. The model has been created in google colab as it executes the code faster using the gpu.
5. Test: Testing is conducted on Google Colab. The model takes image as input and gives predicts the class as output.
6. Deploy: This project is web application. Django is framework based on python language. We have deployed our model through Django in web application.
7. Review: Feedback of supervisor is a must. This stage is again repeated as per feedback of supervisor until he accepts our project.

4.2. Tools and Techniques

4.2.1. Software requirements

Python: Python is a high-level , general-purpose programming language which is versatile in nature. Python can be used in various fields such as web development, Artificial Intelligence, etc. Some major advantages and why python was chosen for this project are:

Python supports wide varieties of libraries that helps in numerous fields.
Python is also great for integration. It is perfect for application using multiple programming language.

Python is scalable as it is flexible even at a small project and equally efficient in a larger project.

Django: Django is a Model View Template (MVT) framework which utilizes a robust Object-Relational-Mapping layer. This ORM layer makes relating databases and data in it efficient and also allows python code to do the table definitions and translation of that code into the required query language, and CRUD operations.

Notepad: Notepad is a simple text editor that you use to write on. It is the lightest weight text editor anyone can find. Smaller programs can also be written through notepad.

Draw.io For creating flowcharts, method diagrams, UML, ER diagrams etc., Draw.io is free online diagram creator app. Draw.io supports almost all the diagrams needed. Many large-scale industries also rely on Draw.io for making diagrams for their plans.

Visual Studio Code: Visual Studio is a Microsoft built Integrated Development Environment (IDE) used for the development of computer programs, websites, web-apps, etc. It supports extensions to almost anything a user need. It is one of the most used editors currently.

4.2.2. Hardware requirements

Laptop/Computer It is a hardware and software combined tool used for all kinds of technical developments.

RAM For this project RAM must be at least 4GB as many google tabs are needed for research.

Hard Disk Hard Disk for this project is recommended around 256GB for storing dataset images and also other applications as well.

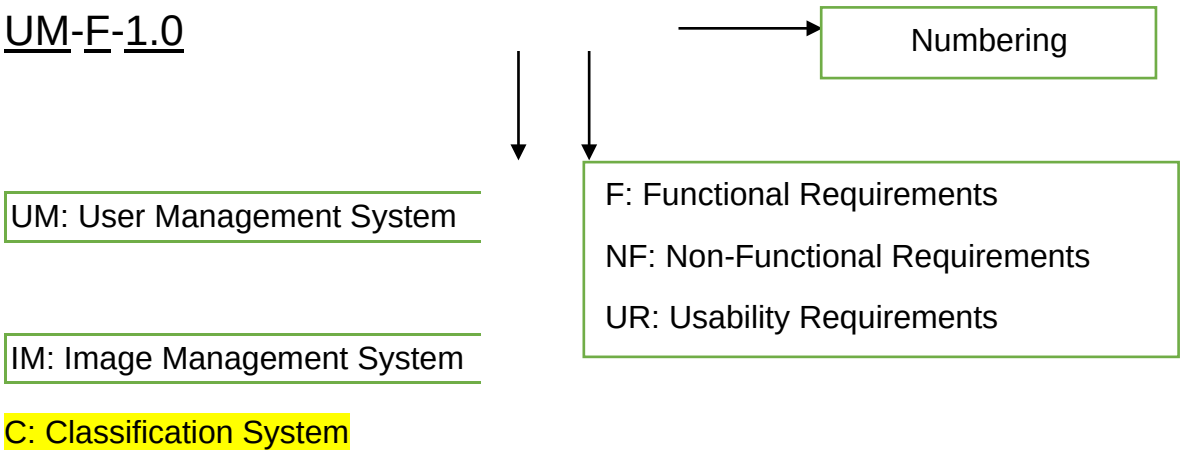
4.2.3. Challenges

The main challenges associated with the research are given below-

- Getting good quality datasets with needed attributes.
- Preprocessing of the datasets for the effective analysis.
- Corresponding exploratory data analysis to visualize the nature of the datasets.
- Choosing a proper programming platform and corresponding libraries.
- Incorporating GPU computing along with CPU computing to reduce time complexity.
- Choosing proper initial hyper parameters and tweaking them while programming.
- Finding the optimal number of convolutional layers in CNN implementation.
- Getting enough data to train the neural network properly.
- To choose the correct activation functions in both hidden and output layers.
- To avoid over fitting in Convolutional Neural Network.

5. Artefact Design

5.1. SRS Table



Requirement_ID	Requirement Specification	Moscow
UM-F-1	System must allow user to Sign up.	Must
UM-NF-1.1	User must fill-up the Sign-up form.	Must
UM-NF-1.2	User must submit Sign up form.	Must
UM-UR-1.3	After Signup system should add user into the database.	Should
UM-F-2	System must allow user to Log in.	Must
UM-NF-2.1	User must fill Log in form.	Must
UM-NF-2.2	User must submit Log in form.	Must
UM-UR-2.3	User should enter registered email and password to get access.	Should
UM-UR-2.4	System should allow user to reset password in case of forget password.	Should

UM-F-3 UM-NF-3.1	System must allow user to logout of the system. User must be able to logout of the system.	Must Must
C-F-4 C-NF-4.1 C-NF-4.2	System must allow user to classify the Flag image. User must give an input image of a Country Flag. System should provide result in same page.	Must Must Should
IM-F-5 IM-NF-5.1	System must allow user to add an image.	Must Must
	User must be able to add and delete image.	

5.2. Wireframes

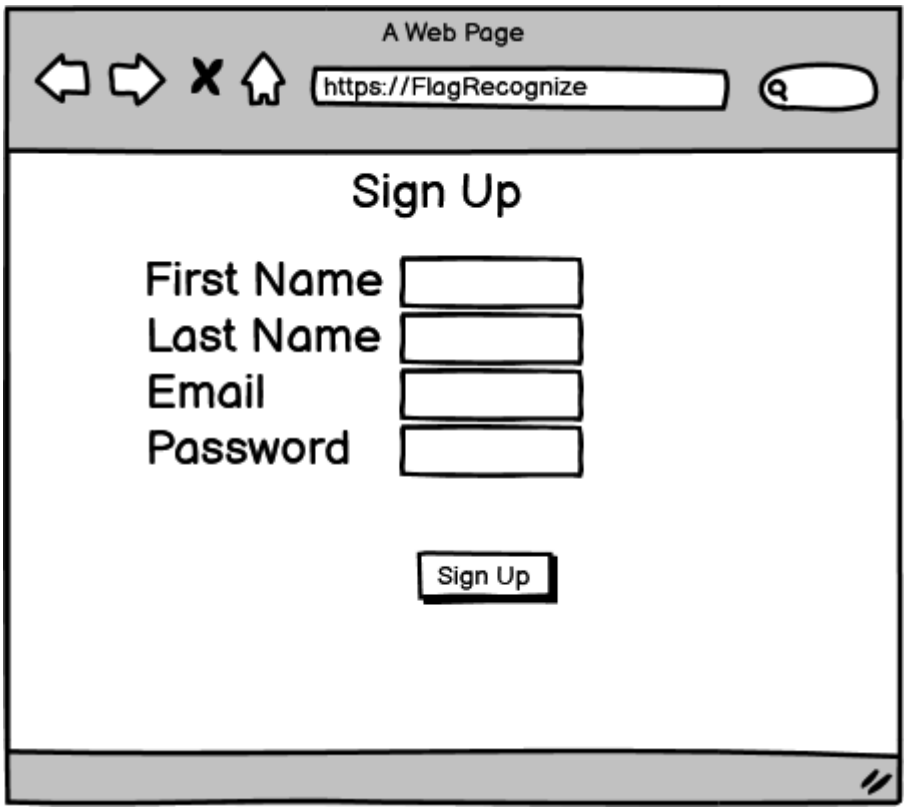


Figure 7: Wireframe of SignUp

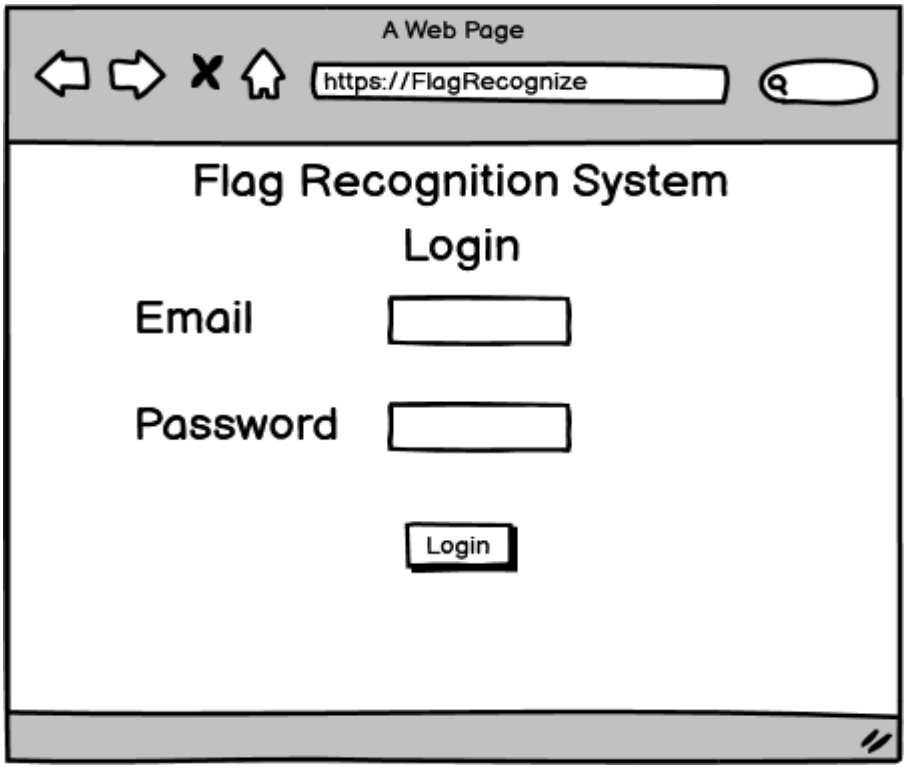


Figure 8: Wireframe of login

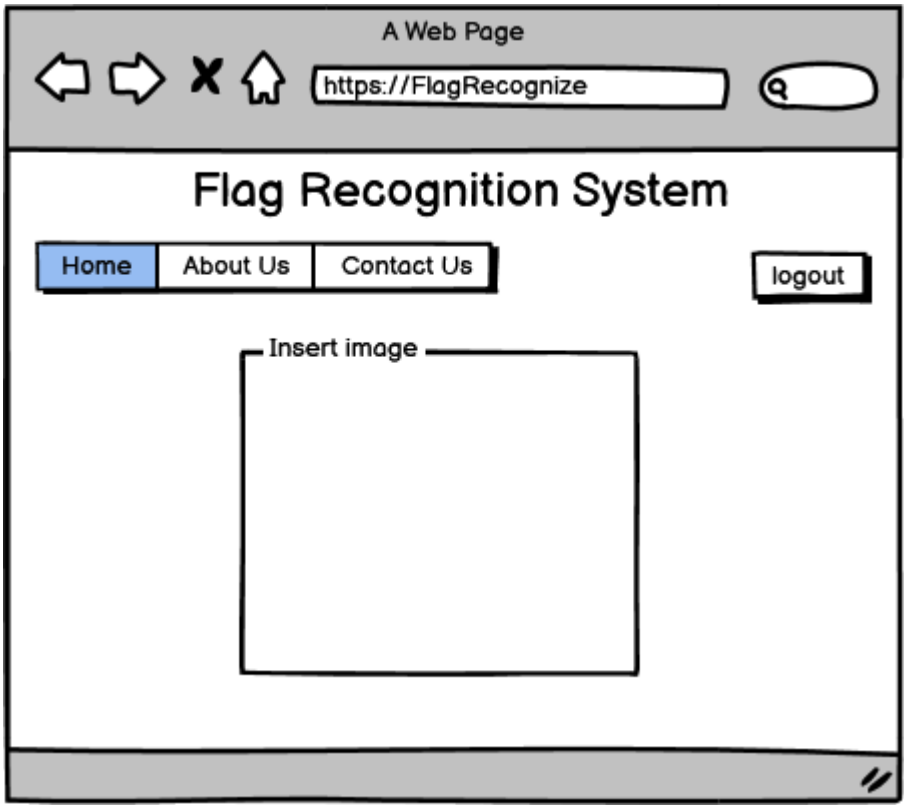


Figure 9: Wireframe of Homepage

5.3. Use Case Diagram

5.3.1. User Management System

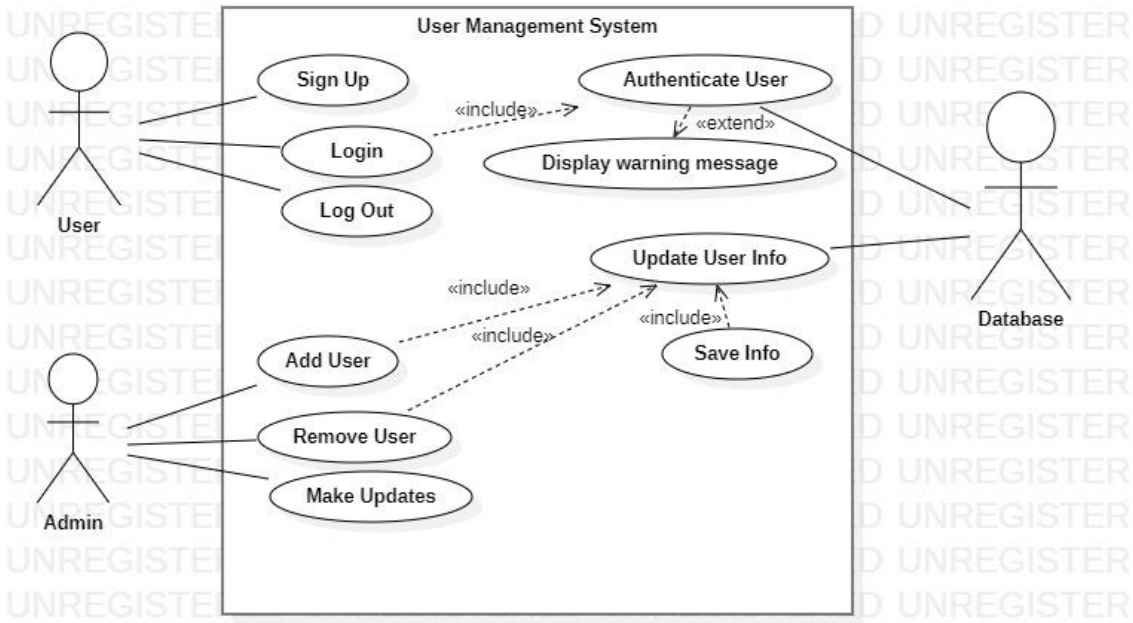


Figure 10: Use Case Diagram of user management

5.4. Class Diagram of the System

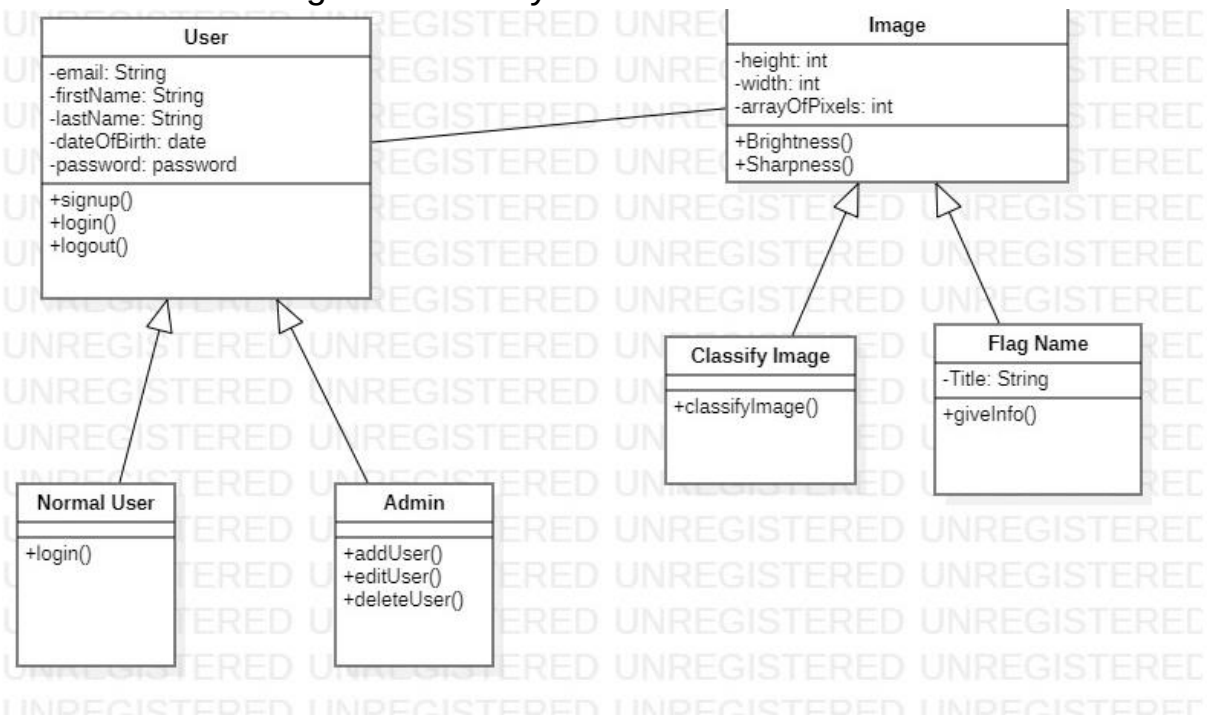


Figure 11: Class Diagram of the system

5.5. Activity Diagram

5.5.1. Activity Diagram of login and signup

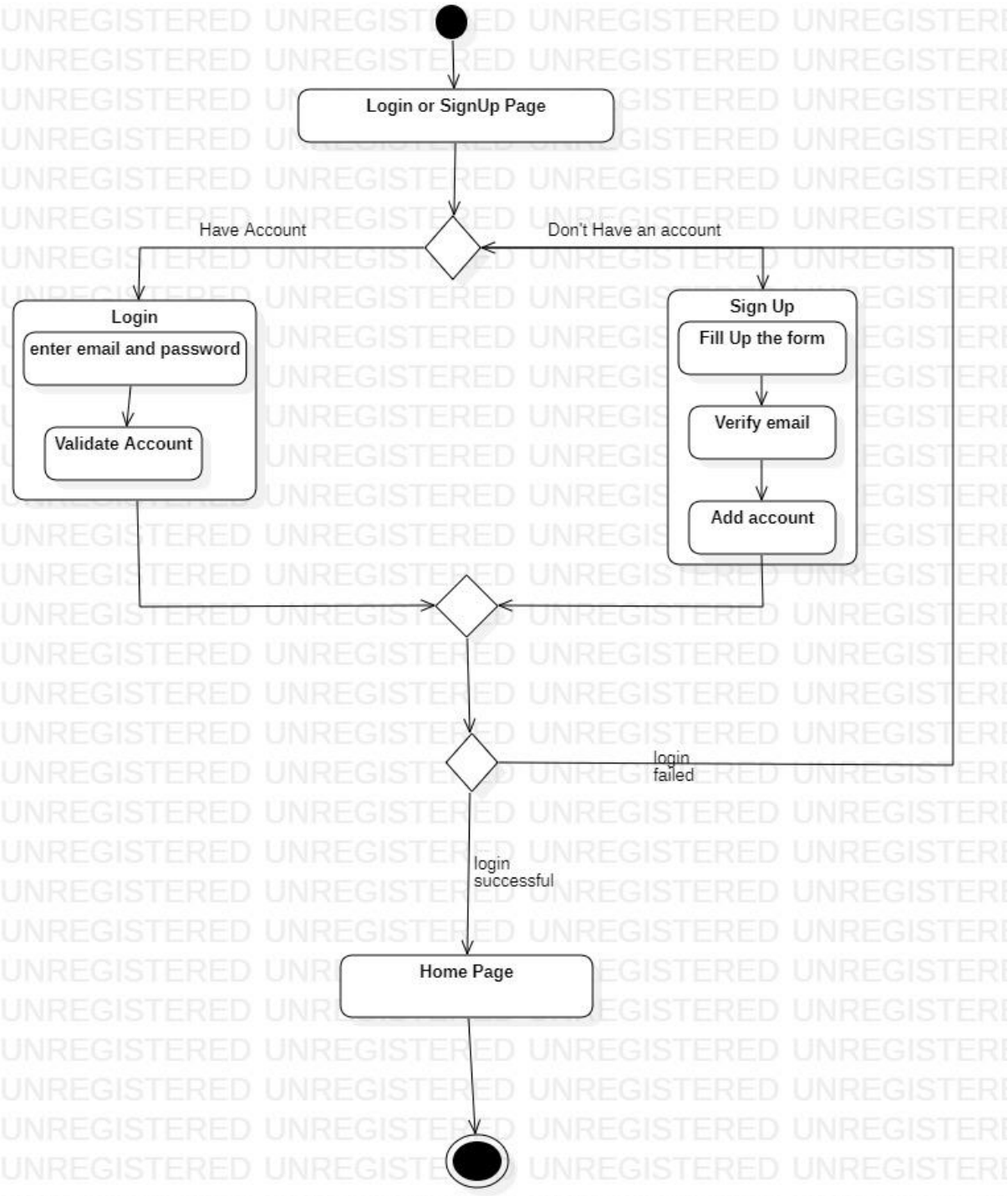


Figure 12: Activity Diagram of login and signup

5.6. Sequence Diagram

5.6.1. Sequence Diagram of Signup

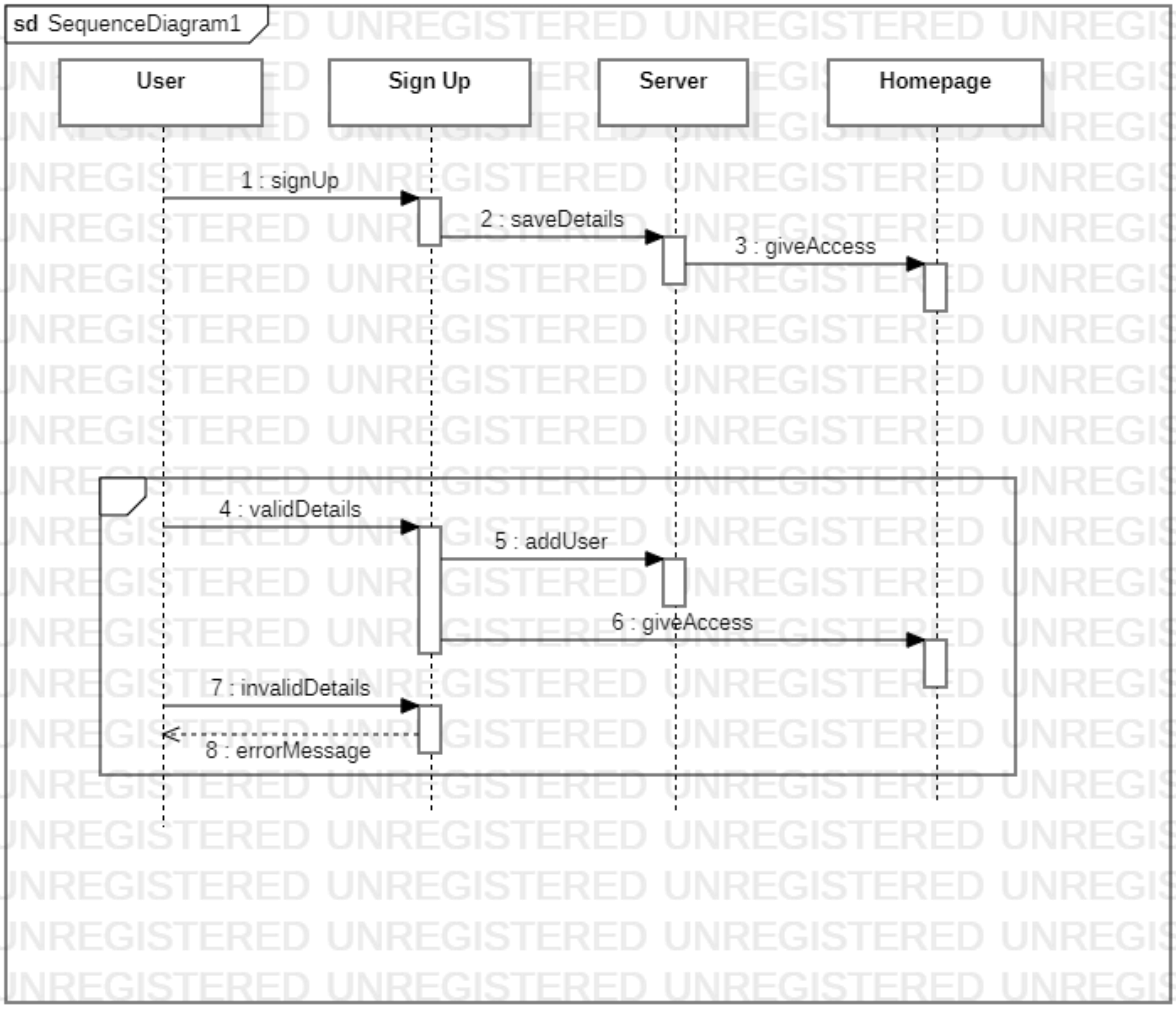


Figure 13: Sequence Diagram of Signup

5.6.2. Sequence Diagram of login

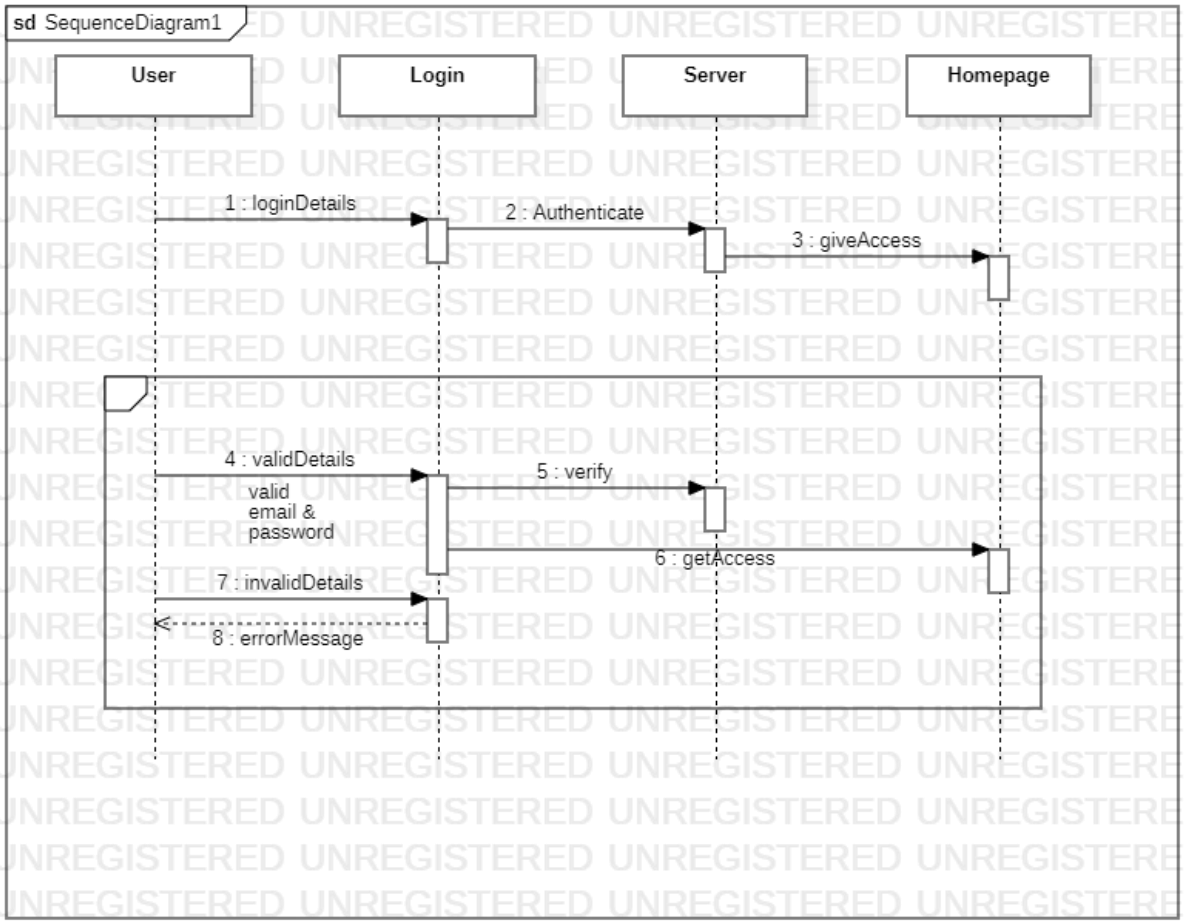


Figure 14: Sequence Diagram of login

5.7. State Transition Diagram

5.7.1. State Transition Diagram for signup

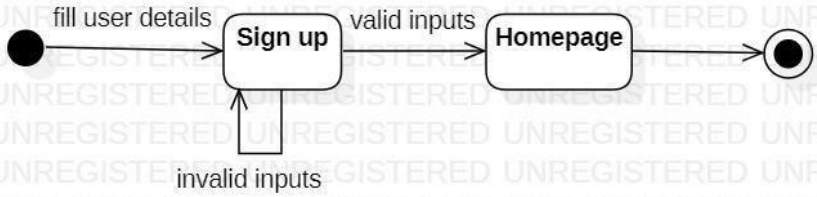


Figure 15: State Transition Diagram for signup

5.7.2. State Transition Diagram for login

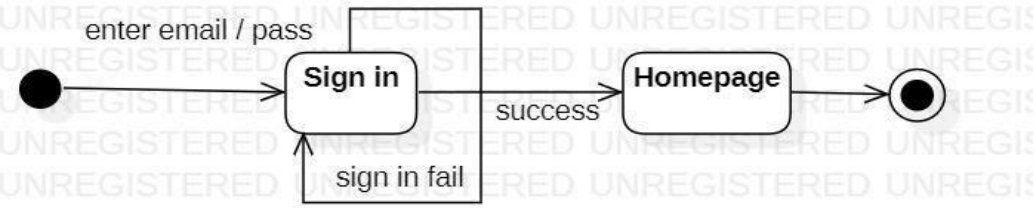


Figure 16: State Transition Diagram for login

5.8. Entity-Relationship Diagram

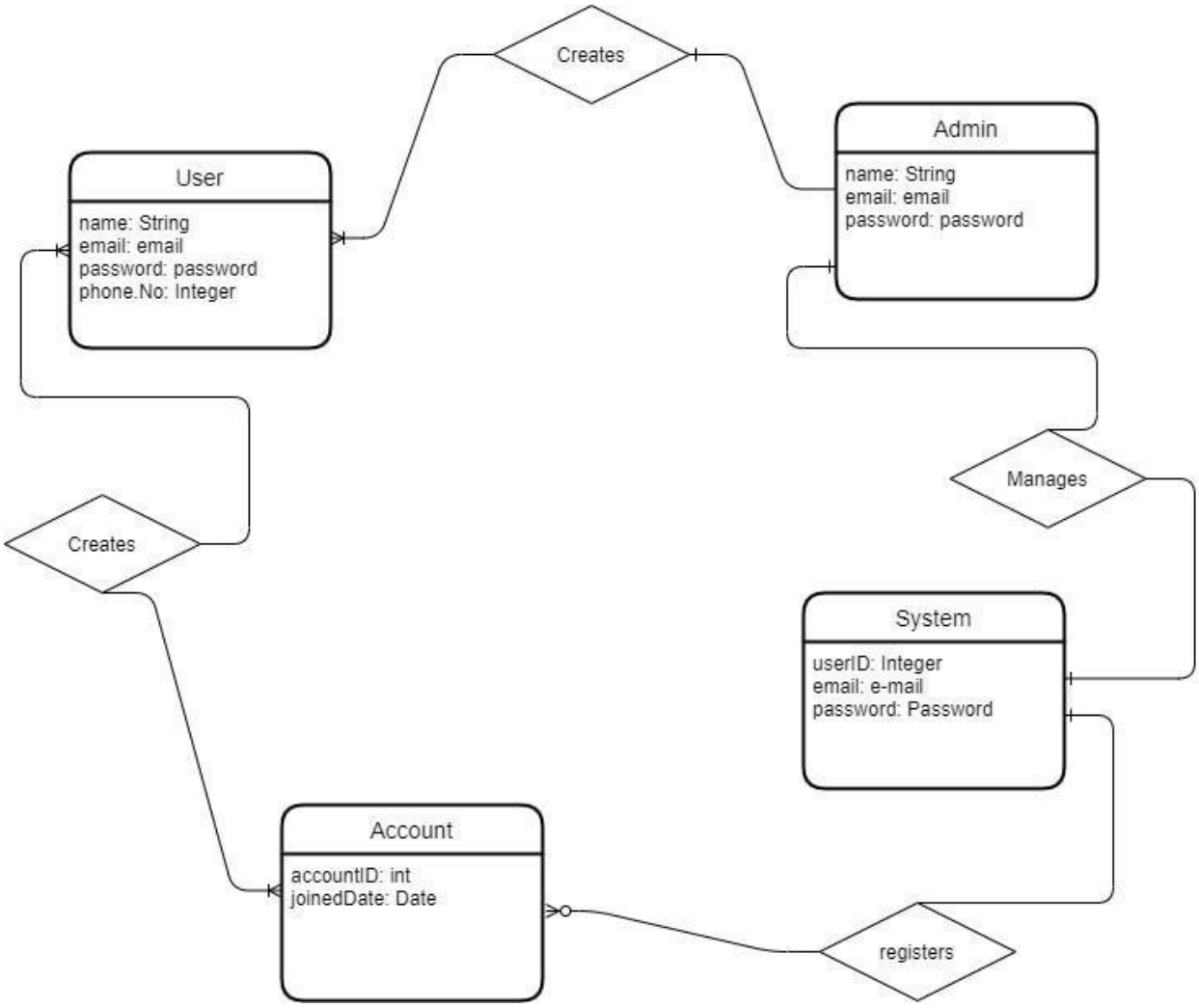


Figure 17: ERD

5.9. Testing

ID	Title	Step	Data	Result
T01		Go to login page	Username:”” Password:””	“Invalid username and password”
T02	Login admin	Enter username & password	Username: “admin” Password:“”	Invalid password
T03	Login admin	Enter username & password	Username: Password: “admin”	Invalid username
T04	Login admin	Enter username & password	Username: “admin” Password: “admin”	Login Successful
T05	Logout admin	Admin must be logged in Click on the logout button		Redirected to login page
T06	Admin password reset	Click “Reset” password Enter old password Click apply	Old Password: “” New Password: “1admin”	Invalid Password
T07	Admin password reset	Click “Reset” password Enter old password Click apply	Old Password: “admin” New Password: “”	Invalid Password
T08	Admin password reset	Click “Reset” password Enter old password Click apply	Old Password: “1admin” New Password: “2admin”	Invalid Password
T09	Admin password reset	Click “Reset” password Enter old password Click apply	Old Password: “admin” New Password: “1admin	Password changed successfully
T10	List Users	1.Admin must be logged in. 2.User Lists should be visible		List of users being displayed.

T11	Create User	1.Admin must be logged in 2.Click “Create User”. 3.Fill the form and Submit	Name: User User Email: email@email.com Password: User	User is created successfully.
T13	Edit User	1.Admin must be logged in 2.Click on edit 3.Edit data 4.Apply changes		User data edited successfully.
T14	Delete User	1.Admin must be logged in 2.Click on edit 3.Edit data 4.Apply changes		User removed successfully.
T15	Homepage	Go to URL		The homepage is viewed as long as the user is logged in.
T16	Admin Profile	1.Admin must be logged in.		Admin dashboard is in view by default.
T17	Registration for clients	1.Go to URL. 2.Click “Sign Up” 3.Fill up the form	Name: “” Email: “” Password: “admin”	Error!!! Missing username and email.
T18	Registration for clients	1.Go to URL. 2.Click “Sign Up” 3.Fill up the form	Name: “admin” Email: “” Password: “”	Error!!! Missing username and email.
T19	Registration for clients	1.Go to URL. 2.Click “Sign Up” 3.Fill up the form	Name: “” Email: “admin@email.com” Password: “admin”	Invalid, Username missing

T20	Registration for clients	1.Go to URL. 2.Click “Sign Up” 3.Fill up the form	Name: “admin” Email: “admin@email.com” Password: “admin”	User registered successfully.
T21	Login for clients	Enter username and password	Username: “” Password: “”	Invalid username or password
T22	Login for clients	Enter username and password	Username: “admin” Password: “”	Invalid username or password
T23	Login for clients	Enter username and password	Username: “” Password: “admin”	Invalid username or password
T24	Login for clients	Enter username and password	Username: “admin” Password: “admin”	Redirected to dashboard.
T25	Logout for Clients	1.Clients must be logged in. 2.Click logout		Redirected to login page.

5.10. Artificial Intelligence

The system utilizes Artificial Intelligence to perform the classification tasks. For this image classification task CNN(Convolutional Neural Network) has been used. This system is simple image classification system are system made possible through python.

Basically, in this system the following are the steps:

- Choose a dataset.
- Create dataset for Training and Testing.
- Start with an input image
- Apply different filters to create a feature map
- Applying pooling layer to each feature map
- Flattening the pooled images not one long vector.
- Inputting the vector into fully connected artificial neural network.

5.10.1. Dataset

The dataset contains multiple images of flags of different countries. The impure images have been removed manually. The datasets are images collected from google and then all the images are resized to size of 224x224 and converted into .jpg format. The dataset contains 4000 images and have 10classes. Each class contains 400 images for training.

Loading these datasets is done by flow_from_directory method of keras. This method is useful in loading multiple images inside multiple folders. This method also allows in data augmentation by importing the data augment elements from ImageDataGeneraton.

```
train_generator = train_datagen.flow_from_directory(train_dir,
                                                    target_size =(img_width, img_height),
                                                    batch_size = batch_size, class_mode ='categorical')

val_generator = test_datagen.flow_from_directory(
    val_dir,
    target_size =(img_width, img_height),
    batch_size = batch_size, class_mode ='categorical')
```

```
Found 4000 images belonging to 10 classes.
Found 400 images belonging to 10 classes.
```

Figure 18: Reading Datasets

The RGB values are in the range between 0-255 and this is not ideal for a neural network. So, we will set the value between 0-1.

```
from keras.preprocessing.image import ImageDataGenerator

train_datagen = ImageDataGenerator(rescale = 1. / 255,)

test_datagen = ImageDataGenerator(rescale = 1. / 255)
```

Figure 19: Rescaling

Now, we create a model on which we train our dataset.

```
model1 = Sequential()
model1.add(Conv2D(32, (3, 3), input_shape = (32,32,3)))
model1.add(Activation('relu'))
model1.add(MaxPooling2D(pool_size =(2, 2)))

model1.add(Flatten())
model1.add(Dense(64))
model1.add(Activation('relu'))
model1.add(Dense(10))
model1.add(Activation('softmax'))

monitor = tf.keras.callbacks.EarlyStopping(monitor='val_loss',
                                           min_delta=0, patience=5,
                                           verbose=1, mode='auto',
                                           restore_best_weights=True)
```

Figure 20: Creating Sequential model and using early stopping

Here, we use the Sequential model as we use stack of layers. When building a new Sequential architecture, it is useful to incrementally stack layers with add() and print model summaries. For instance, this enables you to monitor how a stack of Conv2D and MaxPooling2D layers is down sampling image feature maps. Conv2D parameter is the numbers of filters that convolutional layers will learn from. Here we are learning a total of 32 filters and then we use Max Pooling to reduce the spatial dimensions of the output volume. The activation layer applies the rectified linear unit activation function. Flatten layers are used when you got a multidimensional output, and you want to make it linear to pass it onto a Dense layer. Here, SoftMax activation function have been used as we have multiclass output.

Here, we list the number of classes.

```
train_generator.class_indices
```

```
{'Afganistan': 0,
 'America': 1,
 'Argentina': 2,
 'Bangladesh': 3,
 'Bhutan': 4,
 'India': 5,
 'Maldives': 6,
 'Nepal': 7,
 'Pakistan': 8,
 'SriLanka': 9}
```

Figure 21: Class indices

Now, training the dataset into this model gave showed signs of overfitting which can be seen in the graph below:

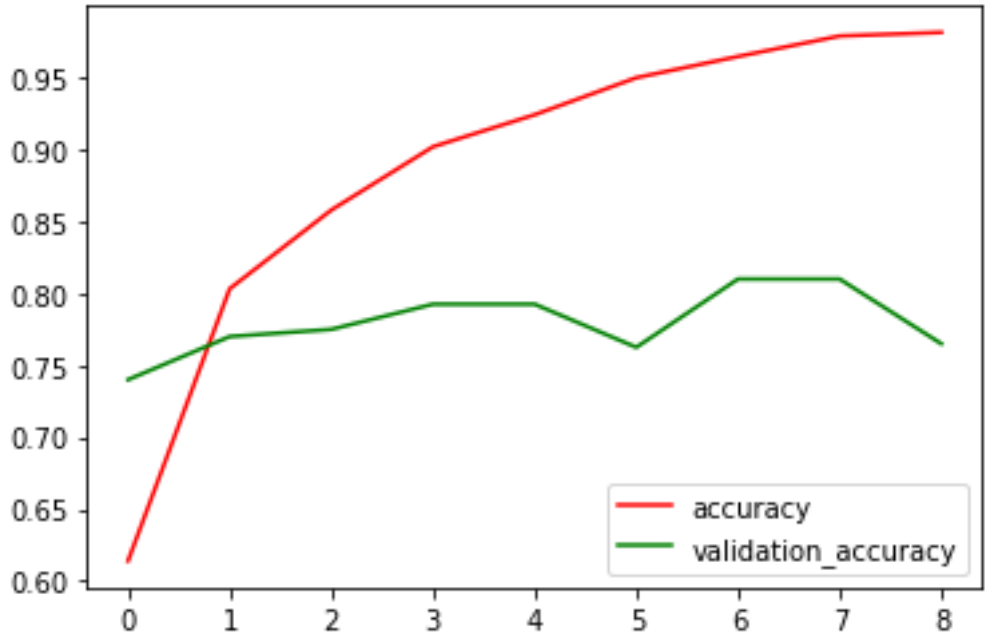


Figure 22: ROC curve

Here, the training accuracy seems to be reaching near 100% which is not a good sign and also the testing accuracy is not increasing in a smooth manner. The gap between the training and testing data seems to be noticeable which is a clear sign of overfitting and is also not classifying real life image accurately.

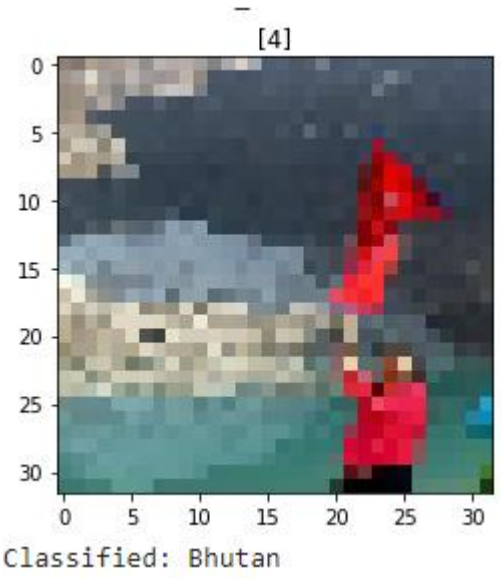


Figure 23: Prediction

Here, we can see that the model predicts flag of Nepal as flag of Bhutan as the model is unable to predict any real-life images and has only learned about the training sets.

So, now we know that out model is facing overfitting so to reduce it we could use Data Augmentation and also use the Dropout layer.

```
train_aug = ImageDataGenerator(
    shear_range = 0.2,
    rotation_range = 90,
    brightness_range=[0.3,0.9],
    zoom_range = 0.2,
    horizontal_flip = True,
    vertical_flip = True
)
```

Figure 24: Using Data Augmentation

Here, we use ImageDataGenerator for data augmentation. Here we have used few arguments from the ImageDataGenerator function. Let us visualize the Augmented images.

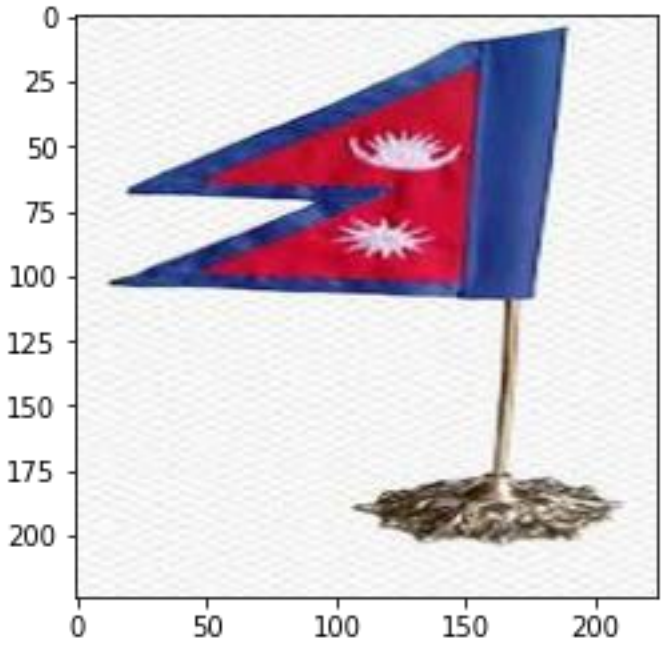


Figure 25: Random training image

After applying augmentation

Figure 26: After data augmentation

Here, we use the dataset from the training directory and use the image augmentation which we have defined in training_directory. We also use the shuffle argument so that the dataset will be trained randomly instead of being trained serially. We have set the class_mode to categorical as we deal with multiclass.

```
training_datagen = ImageDataGenerator(
    rescale = 1./255,
    zoom_range = 0.8,
    shear_range=0.2,
    horizontal_flip = True,
    )

validation_datagen = ImageDataGenerator(
    rescale=1./255
)
```

```
model2 = Sequential()
model2.add(Conv2D(16, (3, 3), input_shape = (32,32,3)))
model2.add(Activation('relu'))
model2.add(MaxPooling2D(pool_size =(2, 2)))

model2.add(Conv2D(32, (3, 3)))
model2.add(Activation('relu'))
model2.add(MaxPooling2D(pool_size =(2, 2)))

model2.add(Conv2D(64, (3, 3)))
model2.add(Activation('relu'))
model2.add(MaxPooling2D(pool_size =(2, 2)))

model2.add(Flatten())
model2.add(Dense(128))
model2.add(Activation('relu'))
model2.add(Dropout(0.2))
model2.add(Dense(10))
model2.add(Activation('softmax'))

monitor = tf.keras.callbacks.EarlyStopping(monitor='val loss', min d
```

Here, we build our model for training. We have added dropout layer as it also helps in removing overfitting. Here we have set the dropout layer to 0.2 which means 20%. This removes 20% of hidden layers randomly during training. We have also increased the number of layers here. The activation function is SoftMax as we have more than 2 classes.

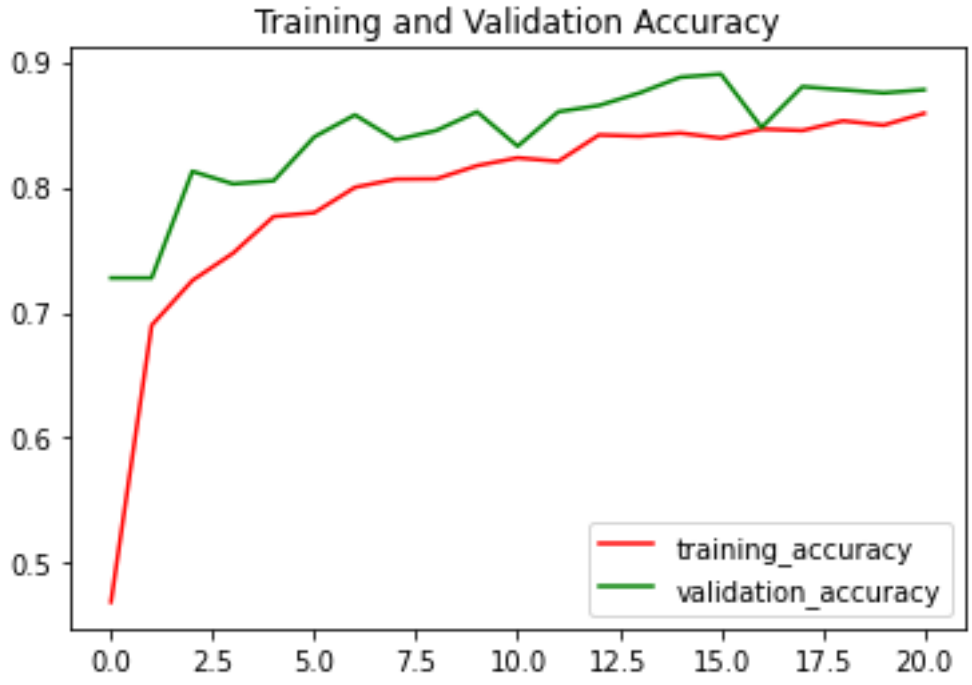


Figure 27: Training and validation accuracy

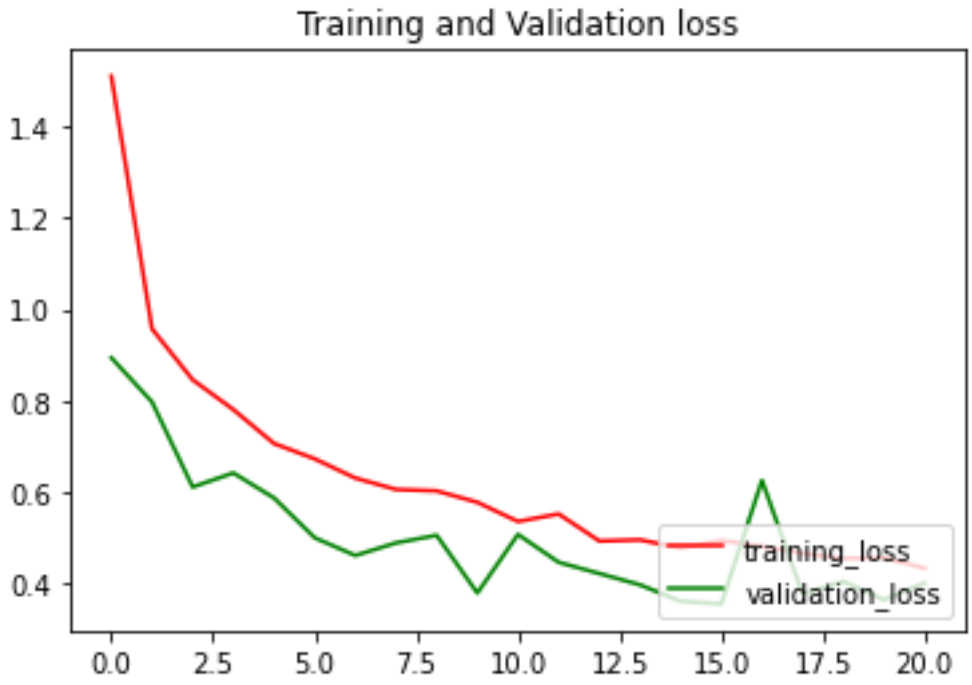
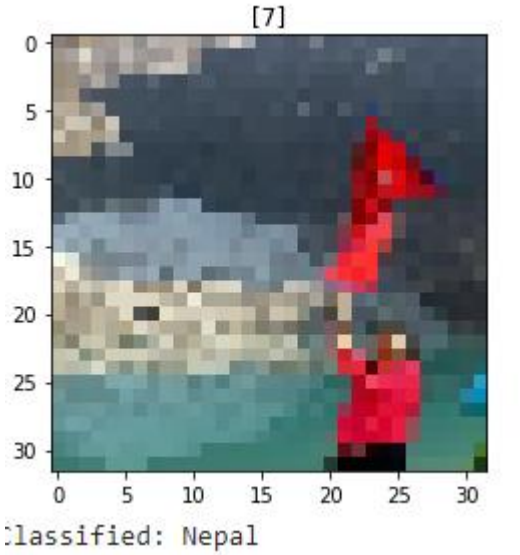


Figure 28: Training and validation loss

```
Training Accuracy  : 85.93%     Training loss  : 0.428621
Validation Accuracy: 89.00%     Validation loss: 0.354763
```

After applying the dropout layer and using Data Augmentation the gap between the training and testing sets have reduced by a huge margin.



```
[[32  0  0  4  0  1  1  0  0  2]
 [ 2 36  0  0  2  0  0  0  0  0]
 [ 0  3 29  0  3  1  0  0  2  2]
 [ 0  0  2 33  0  1  1  1  0  2]
 [ 0  0  1  0 38  0  0  0  0  1]
 [ 3  1  0  0  0 33  0  0  1  2]
 [ 0  0  0  0  0  1 33  0  0  0]
 [ 5  3  3  2  1  0  0 25  0  1]
 [ 3  0  2  0  0  1  0  0 32  2]
 [ 0  1  1  0  1  0  0  0  0 37]]
```

	precision	recall	f1-score	support
Afganistan (Class 0)	0.71	0.80	0.75	40
America (Class 1)	0.82	0.90	0.86	40
Argentina (Class 2)	0.76	0.72	0.74	40
Bangladesh (Class 3)	0.85	0.82	0.84	40
Bhutan (Class 4)	0.84	0.95	0.89	40
India (Class 5)	0.87	0.82	0.85	40
Maldives (Class 6)	0.94	0.97	0.96	34
Nepal (Class 7)	0.96	0.62	0.76	40
Pakistan (Class 8)	0.91	0.80	0.85	40
Srilanka (Class 9)	0.76	0.93	0.83	40
accuracy			0.83	394
macro avg	0.84	0.83	0.83	394
weighted avg	0.84	0.83	0.83	394

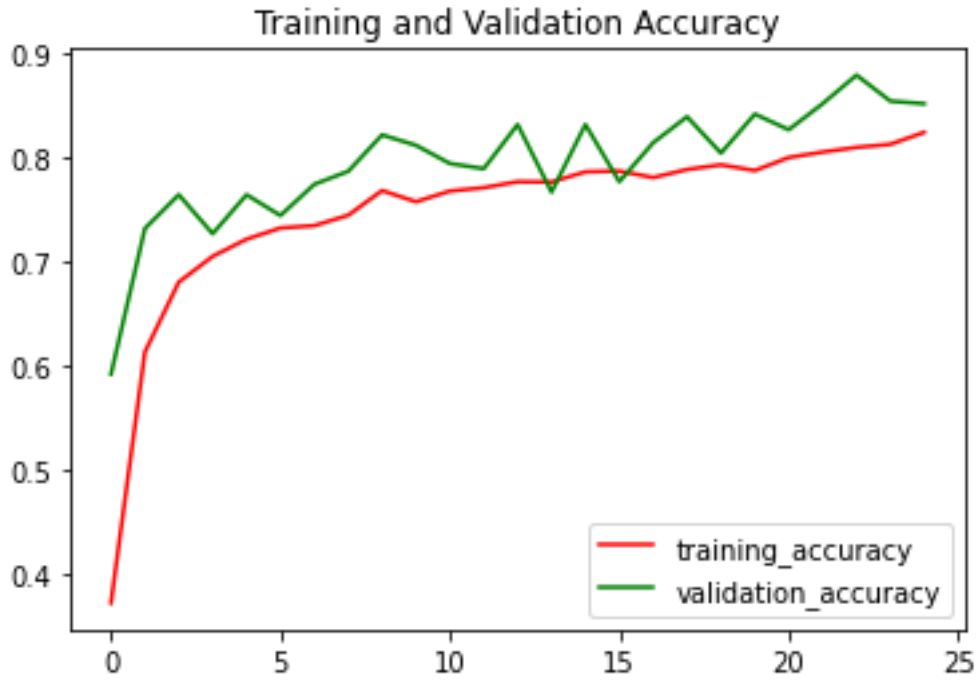
Figure 29: Confusion matrix

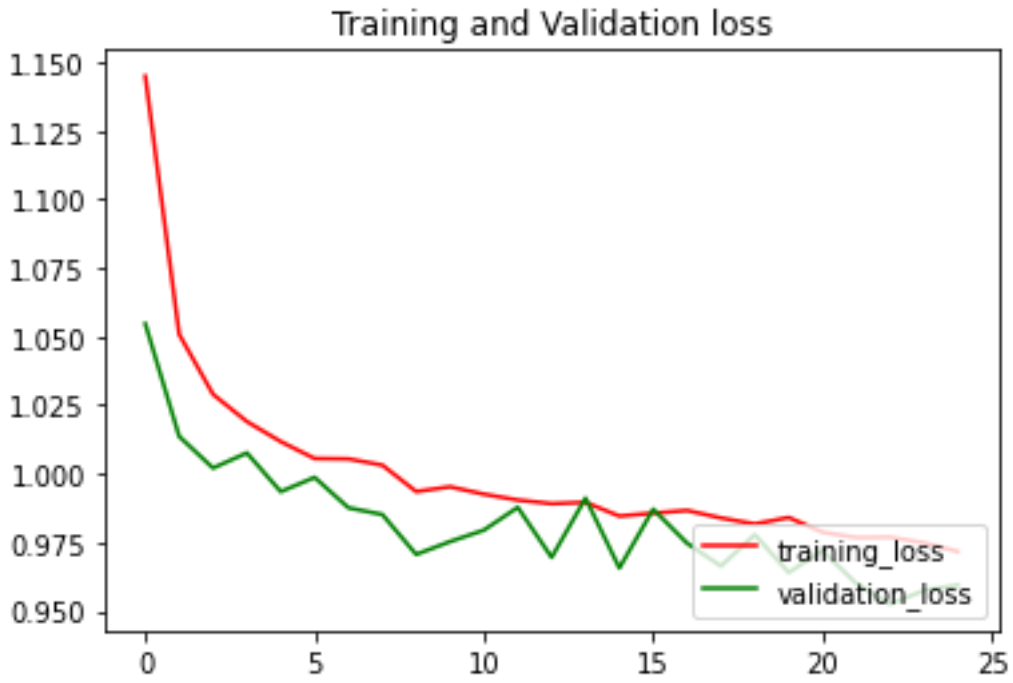
Now the model is more capable of classifying real life images.

Now, we have got a good model and ready to deploy. But we will still use other methods as well just to see what they act like in our dataset. Firstly, we change the parameters of our sequential model by adding kernel_regularizer which is often used in SVM tasks.

```
svm = Sequential()
svm.add(Conv2D(16, (3, 3), input_shape = (32,32,3)))
svm.add(Activation('relu'))
svm.add(MaxPooling2D(pool_size =(2, 2)))

svm.add(Conv2D(32, (3, 3)))
svm.add(Activation('relu'))
svm.add(MaxPooling2D(pool_size =(2, 2)))

svm.add(Conv2D(64, (3, 3)))
svm.add(Activation('relu'))
svm.add(MaxPooling2D(pool_size =(2, 2)))

svm.add(Flatten())
svm.add(Dense(128))
svm.add(Activation('relu'))
svm.add(Dense(10, kernel_regularizer=tf.keras.regularizers.l2(0.01),activation='softmax'))

monitor = tf.keras.callbacks.EarlyStopping(monitor='val_loss', min_delta=0, patience=5, verbose=1, mode='auto', re
```

```
svm.compile(optimizer='adam', loss = 'squared_hinge', metrics=['accuracy'])
```





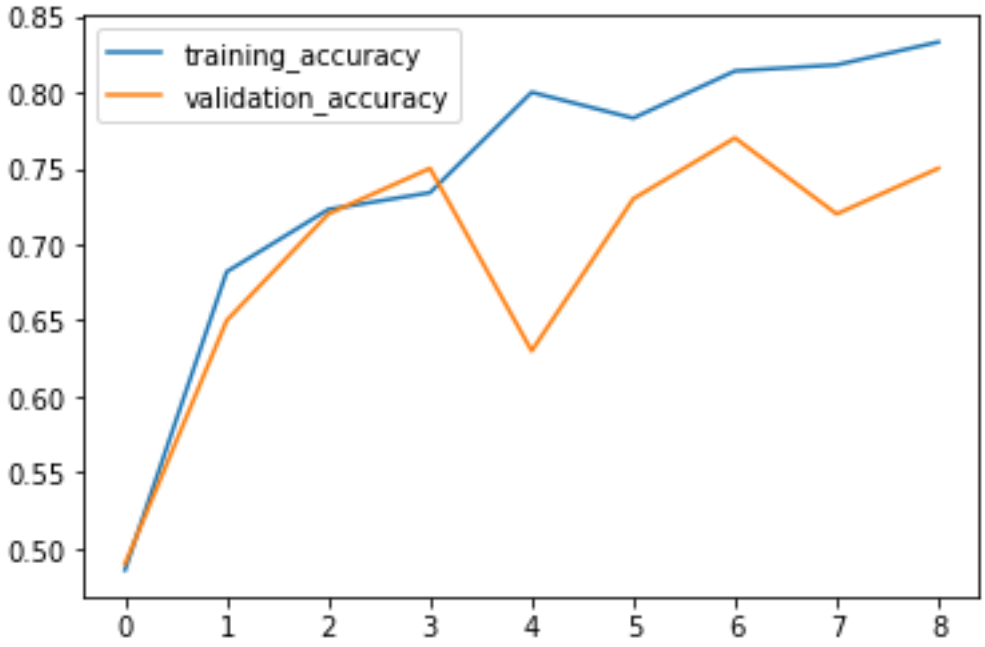
This model also gave us a very impressive accuracy.

After this we use the VGG16 model.

```
from keras.applications.vgg16 import VGG16

img_size = [224, 224]

vgg = VGG16(input_shape = img_size + [3], weights='imagenet', include_top = False)

for layer in vgg.layers:
  layer.trainable = False
```

Figure 30: importing VGG16 model

Here we import the VGG16 model and set the input size. The + [3] is the color channel which states that the color channel stands for the RGB format. Layers.trainable is set to false as it is already a trained model.



Training it with our dataset gave us a training accuracy of 84% and val_accuracy of 75%.

6. Conclusion

Flag Recognition system is an educational project for learning Image Classification system. This project helped me a lot in gaining knowledge about image classification. It can be used by any kind of users. It uses Neural Networks for the image classification task which is getting very popular recently in the field of technology. This system uses the Convolutional Neural Network (CNN) algorithm for classifying the image. The dataset is made custom by getting all the respective images of the flags of different nations. There are 4000 images for training and 400 images for testing and validation, respectively. CNN model has been generated and also pre trained model VGG 16 have also been used for comparison. The model gave satisfactory result. But the custom-made model gave a slight better result. The model is deployed using the Django framework which is based in python language and is very user friendly. Therefore, this system can be called as a web-application. During the process of building this system I researched about the mathematics of the algorithms, the programming basics and concepts and viewed all the research papers that I could possibly find. I came to know that image classification can be done with different approaches like machine learning, deep learning. We can also use SVM for this kind of projects we also can use the Hue, Saturation, Vue(HSV) color model rather than the RGB for this kind of project. There were sone overfitting issues at the beginning that were solved after fine tuning some hyperparameters and using the data augmentation. The model gave a satisfactory accuracy of 85% in training and 89% of validation accuracy. There are some future works left for this system. Currently the images can only be uploaded through the users local storage but in the future the user can upload images through the URL as well. We can add more classes in the upcoming days and gradually include all the nations of the world. The UI can be made more attractive and the user profile can also be built.

Through this project, I learned about image classification tasks. I learned about the CNN algorithm. I learned to make plans and diagrams. But the most important thing I learned would the time management. Through this project I learned about the time management and did all my tasks on time. Writing literature review was also a little difficult part for me but I did it anyways.

7. Critical Analysis

Critical evaluation refers to thinking analytically of someone's ideas or work. It is commonly produced in the form of a written essay or document, but it may also be presented directly. A good critical review weighs in on both the positive and negative aspects of an idea or piece of work. The critical evaluation of this project is shown below:

7.1. Final report:

This report contains an explanation of how the image classification works, literature review, and methodology. It is based on classification. Different diagrams are added in this portion. Evaluation of model, test planning, and different tools and technology used for developing this system are included in this portion. Most of the time was spent on the developing stage and some problem fixing so, it was difficult to make proper documentation. If there was sufficient time, I would be able to document it properly.

7.2. System

Flag Recognition System is a web-based application where users can classify flag images just by uploading the image of the flag. This system has different features like register and login into the system. The system will take image as an input and give the output as the class name the image belongs to. Convolutional Neural Network is used for image classification. Generating dataset was difficult as I could not get proper dataset anywhere and had to create it myself. I got the dataset from google downloading all the images I could possibly find and purifying it as much as I can. The training speed was quite good as there were just around 4000images and the image size was reduced to (32, 32) as the quality of image does not matters very much in image classification unlike image segmentation. The model was trained in google colab, so it did not show any issues while training. The training accuracy and validation accuracy are good. There were many steps. Firstly, I trained the images without data augmentation, so the model showed some overfitting. Then I included the data augmentation and also included the dropout layer so that the overfitting would be reduced more and changed some hyperparameters.

7.3. Findings and Process:

I got more and more knowledge about this project as everyday pasts. I have implemented everything that I know currently in this project. After reviewing different similar systems and papers, I knew there are different approaches to build this type of project. I also tried to make this system an object detection system so that it could detect the images in live state but creating dataset and labelling the image for it was very much difficult as I had to label thousands of images, so I finalized this project to be an image classification project. I have chosen the Django framework to deploy my model because of its flexibility. Django is a Python-based framework that makes us a lot easier to deploy our model on a web platform.

7.4. Planning and Management

Planning comes first then comes developing in agile methodology. So, I broke down my tasks into different parts and also build a Gantt chart for time management. At first, I collected all the requirements and analyzed them. I planned and managed them to make it easier for designing, coding, and testing, deploying, and completing the report. Gantt chart was created from work breakdown on a time basis, but it was difficult to follow the Gantt chart. Somehow, I managed to complete nearby the time given to tasks. Thanks to my supervisor for helping me constantly and giving feedback every week. The error that I got were troublesome and solved by the help of my supervisor, few classmates and the internet.

7.5. Self-reflection

I was involved in different projects, but the final year project was an important one. I came to realize this project will help me in my future career and for also personal knowledge. I understood that if I have not planned and managed my project then it would be a lot difficult to complete my project on time. I learned about the plan and management of the project along with collecting requirements related to this project. I learned how to draw a modeling diagram and its importance. I gained knowledge about image manipulation, data visualization, different algorithms, etc. During the research, I got to learn different approaches to develop this system which will help me in my career sector in the future. It was difficult to deploy the model. Hence, I gained an important idea about how to deploy it. In short word, I am capable to say that I learned about planning, developing, deploying, testing, and documentation after completion of this project. This project was all for learning purpose and have no intensions for commercial purpose. So, finally what I intended to do with this project have been done.

7.6. Evidence of Project Management

Faculty of Science and Engineering
School of Mathematics and Computer Science

UNIVERSITY OF WOLVERHAMPTON

PROJECT MANAGEMENT LOG	
First Name: Aman	Surname: Oli
Student Number: 2039271	Supervisor: Prakash Gautam
Project Title: Divorce Prediction	Month: September
What have you done since the last meeting	
Finalizing the topic	
What do you aim to complete before the next meeting	
More Research on the following topic.	
Supervisor comments	
Research on the following topic.	

We confirm that the information given in this form is true, complete, and accurate.

Student Signature:  Date: 14-Sep-2020

Supervisor Signature: Online Date: 14-Sep-2020

Faculty of Science and Engineering
School of Mathematics and Computer Science

UNIVERSITY OF WOLVERHAMPTON

PROJECT MANAGEMENT LOG	
First Name: Aman	Surname: Oli
Student Number: 2039271	Supervisor: Prakash Gautam
Project Title: Flag Recognition with deep neural networks	Month: September
What have you done since the last meeting	
Finalizing the topic.	
What do you aim to complete before the next meeting	
Finalizing Proposal.	
Supervisor comments	
Change academic questions and block diagram.	

We confirm that the information given in this form is true, complete, and accurate.

Student Signature:  Date: 22-Sep-2020

Supervisor Signature: Online Date: 22-Sep-2020

Faculty of Science and Engineering
School of Mathematics and Computer Science

PROJECT MANAGEMENT LOG	
First Name: Aman	Surname: Oli
Student Number: 2039271	Supervisor: Prakash Gautam
Project Title: Flag Recognition with deep neural networks	Month: September
What have you done since the last meeting	
Improved proposal as per the advice of the supervisor.	
What do you aim to complete before the next meeting	
Following the advice of project tracking	
Supervisor comments	
It would be helpful to complete project by dividing tasls.	

We confirm that the information given in this form is true, complete, and accurate.

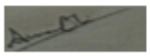
Student Signature:  Date: 29-Sep-2020

Supervisor Signature: Online Date: 29-Sep-2020

Faculty of Science and Engineering
School of Mathematics and Computer Science

PROJECT MANAGEMENT LOG	
First Name: Aman	Surname: Oli
Student Number: 2039271	Supervisor: Prakash Gautam
Project Title: Flag Recognition with deep neural networks	Month: October
What have you done since the last meeting	
Completed proposal. Searching dataset. Install required environments.	
What do you aim to complete before the next meeting	
Finalize the dataset.	
Supervisor comments	
Start coding.	

We confirm that the information given in this form is true, complete, and accurate.

Student Signature:  Date: 08-Oct-2020

Supervisor Signature: Online Date: 08-Oct-2020

Faculty of Science and Engineering
School of Mathematics and Computer Science

UNIVERSITY OF WOLVERHAMPTON

PROJECT MANAGEMENT LOG	
First Name: Aman	Surname: Oli
Student Number: 2039271	Supervisor: Prakash Gautam
Project Title: Flag Recognition with deep neural networks	Month: October
What have you done since the last meeting	
Preparation for presentation of algorithm.	
What do you aim to complete before the next meeting	
Prepare presentation slide.	
Supervisor comments	

We confirm that the information given in this form is true, complete, and accurate.

Student Signature:  Date: 13-Oct-2020

Supervisor Signature: Online Date: 13-Oct-2020

Faculty of Science and Engineering
School of Mathematics and Computer Science

UNIVERSITY OF WOLVERHAMPTON

PROJECT MANAGEMENT LOG	
First Name: Aman	Surname: Oli
Student Number: 2039271	Supervisor: Prakash Gautam
Project Title: Flag Recognition with deep neural networks	Month: November
What have you done since the last meeting	
Preparation for presentation of algorithm and project status.	
What do you aim to complete before the next meeting	
Prepare presentation slide.	
Supervisor comments	
More depth knowledge of algorithm is required.	

We confirm that the information given in this form is true, complete, and accurate.

Student Signature:  Date: 24-Nov-2020

Supervisor Signature: Online Date: 24-Nov-2020

Faculty of Science and Engineering
School of Mathematics and Computer Science

PROJECT MANAGEMENT LOG	
First Name: Aman	Surname: Oli
Student Number: 2039271	Supervisor: Prakash Gautam
Project Title: Flag Recognition with deep neural networks	Month: November
What have you done since the last meeting	
Preparation for presentation of algorithm and project status.	
What do you aim to complete before the next meeting	
Presenting presentation slide.	
Supervisor comments	
More depth knowledge of algorithm is required.	

We confirm that the information given in this form is true, complete, and accurate.

Student Signature:  Date: 27-Nov-2020

Supervisor Signature: Online Date: 27-Nov-2020

Faculty of Science and Engineering
School of Mathematics and Computer Science

PROJECT MANAGEMENT LOG	
First Name: Aman	Surname: Oli
Student Number: 2039271	Supervisor: Prakash Gautam
Project Title: Flag Recognition with deep neural networks	Month: December
What have you done since the last meeting	
Literature review. Data exploration.	
What do you aim to complete before the next meeting	
Reviewing research paper.	
Supervisor comments	
Learn how to use IEEE and Google Scholar. Have a good understanding of coding.	

We confirm that the information given in this form is true, complete, and accurate.

Student Signature:  Date: 2-Dec-2020

Supervisor Signature: Online Date: 2-Dec-2020

Faculty of Science and Engineering
School of Mathematics and Computer Science

UNIVERSITY OF WOLVERHAMPTON

PROJECT MANAGEMENT LOG	
First Name: Aman	Surname: Oli
Student Number: 2039271	Supervisor: Prakash Gautam
Project Title: Flag Recognition with deep neural networks	Month: December
What have you done since the last meeting	
Literature review. Data exploration.	
What do you aim to complete before the next meeting	
Working on feedback of the supervisor.	
Supervisor comments	
Good progress. Work hard.	

We confirm that the information given in this form is true, complete, and accurate.

Student Signature:  Date: 08-Dec-2020

Supervisor Signature: Online Date: 08-Dec-2020

Faculty of Science and Engineering
School of Mathematics and Computer Science

UNIVERSITY OF WOLVERHAMPTON

PROJECT MANAGEMENT LOG	
First Name: Aman	Surname: Oli
Student Number: 2039271	Supervisor: Prakash Gautam
Project Title: Flag Recognition with deep neural networks	Month: December
What have you done since the last meeting	
PRF completed.	
What do you aim to complete before the next meeting	
PRF submission in canvas.	
Supervisor comments	
Improve more.	

We confirm that the information given in this form is true, complete, and accurate.

Student Signature:  Date: 16-Dec-2020

Supervisor Signature: Online Date: 16-Dec-2020

Faculty of Science and Engineering
School of Mathematics and Computer Science

UNIVERSITY OF WOLVERHAMPTON

PROJECT MANAGEMENT LOG	
First Name: Aman	Surname: Oli
Student Number: 2039271	Supervisor: Prakash Gautam
Project Title: Flag Recognition with deep neural networks	Month: January
What have you done since the last meeting	
Machine learning started.	
What do you aim to complete before the next meeting	
Progress machine learning part.	
Supervisor comments	
Progressive.	

We confirm that the information given in this form is true, complete, and accurate.

Student Signature:  Date: 07-Jan-2021

Supervisor Signature: Online Date: 07-Jan-2021

Faculty of Science and Engineering
School of Mathematics and Computer Science

UNIVERSITY OF WOLVERHAMPTON

PROJECT MANAGEMENT LOG	
First Name: Aman	Surname: Oli
Student Number: 2039271	Supervisor: Prakash Gautam
Project Title: Flag Recognition with deep neural networks	Month: January
What have you done since the last meeting	
Machine learning.	
What do you aim to complete before the next meeting	
Progress machine learning part.	
Supervisor comments	
Progressive.	

We confirm that the information given in this form is true, complete, and accurate.

Student Signature:  Date: 12-Jan-2021

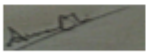
Supervisor Signature: Online Date: 12-Jan-2021

Faculty of Science and Engineering
School of Mathematics and Computer Science

UNIVERSITY OF WOLVERHAMPTON

PROJECT MANAGEMENT LOG	
First Name: Aman	Surname: Oli
Student Number: 2039271	Supervisor: Prakash Gautam
Project Title: Flag Recognition with deep neural networks	Month: February
What have you done since the last meeting	
System is built.	
What do you aim to complete before the next meeting	
Django.	
Supervisor comments	
Progressive.	

We confirm that the information given in this form is true, complete, and accurate.

Student Signature:  Date: 23-Feb-2021

Supervisor Signature: Online Date: 23-Feb-2021

Faculty of Science and Engineering
School of Mathematics and Computer Science

PROJECT MANAGEMENT LOG	
First Name: Aman	Surname: Oli
Student Number: 2039271	Supervisor: Prakash Gautam
Project Title: Flag Recognition with deep neural networks	Month: March
What have you done since the last meeting	
System is improved and documentation.	
What do you aim to complete before the next meeting	
User management system built now user can upload images to predict.	
Supervisor comments	
Progressive.	

We confirm that the information given in this form is true, complete, and accurate.

Student Signature:  Date: 09-Mar-2021

Supervisor Signature: Online Date: 09-Mar-2021

Faculty of Science and Engineering
School of Mathematics and Computer Science

PROJECT MANAGEMENT LOG	
First Name: Aman	Surname: Oli
Student Number: 2039271	Supervisor: Prakash Gautam
Project Title: Flag Recognition with deep neural networks	Month: April
What have you done since the last meeting	
System is improved and documentation.	
What do you aim to complete before the next meeting	
Model evaluation. UI design.	
Supervisor comments	
Ui must be improved.	

We confirm that the information given in this form is true, complete, and accurate.

Student Signature:  Date: 07-Apr-2021

Supervisor Signature: Online Date: 07-Apr-2021

Gyantt Chart

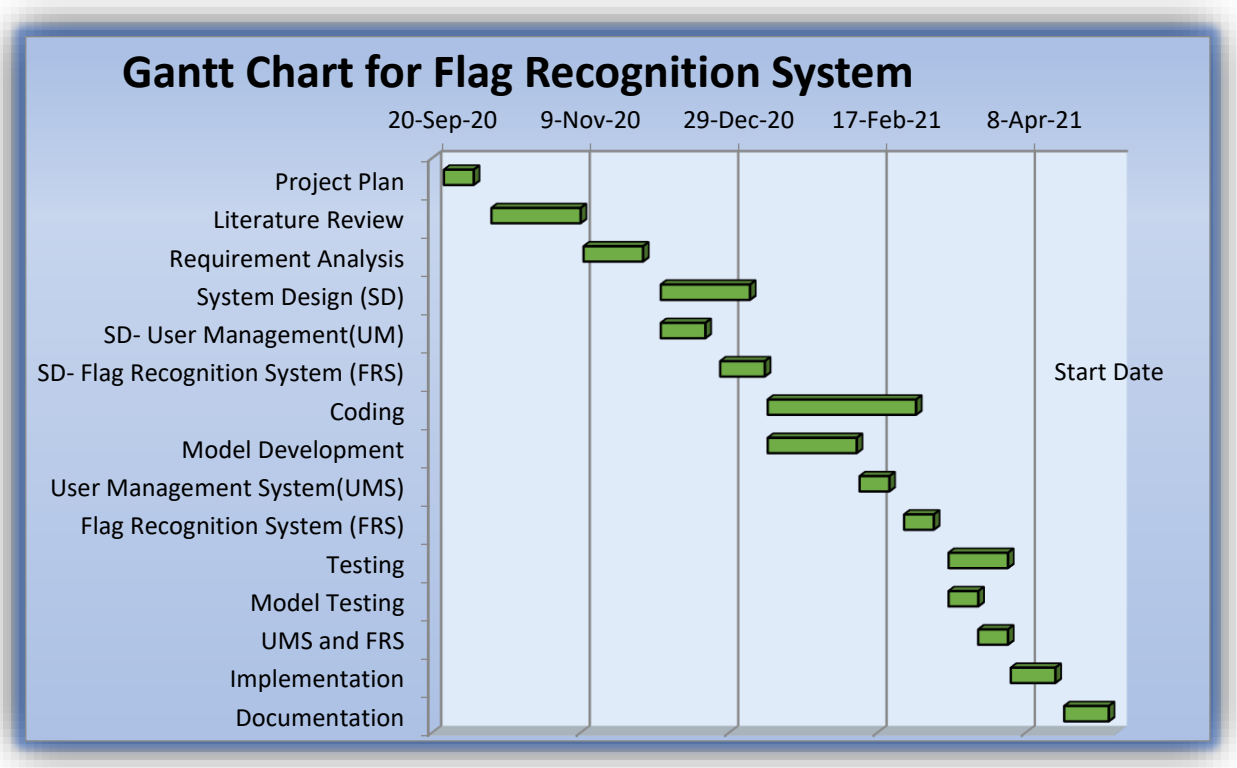


Figure 31: Gantt Chart

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Appendices