KANTIPUR ENGINEERING COLLEGE

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A MAJOR PROJECT FINAL REPORT ON

FACE MASK DETECTION SYSTEM

Submitted by:

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A MAJOR PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF BACHELOR IN COMPUTER ENGINEERING

Submitted to:

Department of Computer and Electronics Engineering

April, 2022

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DEPARTMENT OF COMPUTER AND ELECTRONICS ENGINEERING

APPROVAL LETTER

The undersigned certify that they have read and recommended to the Institute of Engineering for acceptance, a project report entitled ”Face Mask Detection System” submitted by

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Date: April 18, 2022

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ABSTRACT

The end of 2019 witnessed the outbreak of Coronavirus Disease 2019 (COVID-19), which has continued to be the cause of plight for millions of lives and businesses even in 2020.As the world recovers from the pandemic and plans to return to a state of normalcy, there is a wave of anxiety among all individuals,especially those who intend to resume in-person activity. Studies have proved that wearing a face mask significantly reduces the risk of viral transmission as well as provides a sense of protection. So our main motive is to develop a system which will recognize the overlay of the face-mask in a user with high accuracy and efficiency, which will continue to possess an important role in computer vision. The facial recognition system is a widely used in modern age. Especially after the pandemic there is a huge necessity to wear over a mask so that the pandemic both present and future ones can be controlled and lessened.interaction. In this project, we propose a Convolutional Neural Network (CNN) based architecture for recognition of the user with a face-mask. Face mask detection has become a crucial task to help global society.For this purpose we are using some basic Machine Learning packages like TensorFlow, Keras, OpenCV and Scikit-Learn. Here, in this Project a very fast image pre-processing with the mask in the center over the faces. Our Model is trained on dataset that consists of images of people of two categories that are with and without face masks.Three levels of work that we carried out are: images preprocessing, extracting crucial part from images and image classification. Features extraction and Convolutional Neural Network are used for classification and detection of a masked person. This Method attain an accuracy of 99.83%.

Keywords – Computer-Vision, CNN, Masked Face Detection, OpenCV.

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LIST OF ABBREVIATIONS

CNN Convolutional Neural Network

MTCNN Multi-Task Cascaded Convolutional Neural Network

SGD Stochastic Gradient Descent

CHAPTER 1
INTRODUCTION

1.1 Background

Coronavirus Disease 2019 (COVID-19) unexpectedly broke out in 2019 and has seriously affected the whole world. As of 26 March 2021, COVID-19 has infected more than 125 million people worldwide and caused over 2.7 million deaths. One of the transmission routes of COVID-19 is through droplets of saliva or nasal secretions when an infected person coughs or sneezes, which is highly infectious and could be worse in crowded places. Since there is no specific treatment for COVID-19 , infections have to be limited through prevention methods. Studies have shown that wearing masks can reduce the risk of coronavirus transmission, which means wearing masks is currently one of the effective prevention methods . According to the World Health Organization (WHO), the right way to wear a mask is by adjusting the mask to cover the mouth, nose, and chin . The protection will be greatly reduced if masks are not worn properly. At present, security guards are arranged in public places to remind people to wear masks. However, this measure not only exposes the guards to the air that may contain the virus, but also leads to overcrowding at the entrances due to its inefficiency. Therefore, a fast and effective method is needed to address the situations.

Computer vision is an interdisciplinary scientific field that involves how computers gain advanced understanding from digital images or videos.Mask detection has become a vital computer vision task to help the global society.

1.2 Problem Statement

In this day and age computers have become more and more smart but still a major problem that we face is for computer to recognize natural language and human behavior and to convey normal human like activities for computer.

The core problem of computer vision is object recognition and the distinction between them. The first problem is to recognise a face properly. Then we have to recognise a minute change of mask being worn and must help the system to distinguish between them. Another challenge being reducing the faulty detection cause of objects of interest in images and videos may appear in a variety of sizes and aspect ratios.

1.3 Objectives

The main objectives of the study are;

i) To detect a mask being put on face.

1.4 Applications

i) Detect People wearing no mask.
ii) Create healthy masked environment around places.
iii) Marketing and scientific research.

1.5 Project Features

i) Detect mask.
ii) Detect whether mask is properly worn or not.

1.6 Feasibility Analysis

The main objective of this study was to determine the proposed system was feasible. There were four types of feasibility study to which the system was subjected to, as described below. The key consideration involved in the feasibility study are described below:

1.6.1 Economic Feasibility

Justification of any capital outlay is that it will reduce expenditure or improve the quality of service or goods, which in turn may be expected to provide increased profits.

The technique of cost benefit analysis is often used as a basis for accessing economic feasibility. However, the main benefit motive for the project was academic graduation. Hence, only cost constraints would be needed to be considered. Since there was no need for purchase for the competition of the project owing to the fact that the project could be completed with the resources already available to the project members and those available free from college campus inventory, the project members would contribute man-hours for free throughout the duration of the project, making the project economically feasible.

1.6.2 Technical Feasibility

Our project does satisfy technical feasibility needs. The existing network protocols and operating system services of various operating systems would allow for feasible implementation of this application. As this service satisfies technological hardware and software capabilities of present day available personal devices, the proposed project was decided to be technically feasible.

1.6.3 Operational Feasibility

Operational feasibility should be accounted for after the software is developed so that it can cope up with defined objectives:

i) The software would be easy to use.
ii) The system would have user friendly interface.
iii) The system would be affordable because the requirement is low.
iv) The project does not harm the system it is executed on.

1.6.4 Schedule Feasibility

Schedule feasibility would be the most important factor for the success of the project. Since all the project members contributing their skill, knowledge and time to the project would be full-time students with a busy academic calendar, work schedule would have to be tight and very strictly managed. After this accommodation regarding the project goals, the project was found to satisfy schedule feasibility requirements.

1.7 System Requirement

1.7.1 Software Requirement

i) Python 3.7.5
ii) opencv-python 4.5.1.48
iii) tensorflow 2.7.0
iv) keras 2.7.0

1.7.2 Non-functional Requirement

i) To train and perform efficiently in short amount of time.
ii) The system should have simple interface for users to use.
iii) The system should provide better accuracy.

CHAPTER 2
LITERATURE REVIEW

In the past few years, several papers have successfully solved the problem of face mask recognization system.Face mask detection had seen significant progress in the domains of Image processing and Computer vision, since the rise of the Covid-19 pandemic. Many face detection models have been created using several algorithms and techniques.Face recognition is one of the most challenging biometric modalities when deployed in unconstrained environments due to the high variability that faces images present in the real world in a crowd, which are affected by complex factors including head poses, aging, illumination conditions, occlusions, and facial expressions. The face recognition system aims to identify and track visual data subjects, such as images and videos. More people are currently carrying masks in public, bringing new challenges to the face detection and identification system. This article focuses on the detection and recognition of masked faces. It has become very important to protect ourselves and the people around us from this situation. Wearing a face mask significantly reduces the risk of viral transmission and provides a sense of protection, according to several studies. However, manually tracking the implementation of this policy is not possible. We can take precautions such as social distancing, washing hands every two hours, using sanitizer, maintaining social distance and the most important wearing a mask. Public use of wearing a masks has become very common everywhere in the whole world now So far, several tasks have been completed for real- time face mask detection. So, some state of artwork relevant to the proposed work is discussed in this section.

Shao Liu, Sos S. Agaian et al. This paper proposes an efficient detection and recognition model for masked faces in a crowd and a novel dataset with faces of various sizes and resolutions.The presented framework is based on new artificial intelligence tools that use hand-crafted and deep learning (YOLOv3 and CNNs) features and SVM classifiers. Computer simulation on five different face mask datasets (Real-World Masked Face Dataset (RMFD), the Simulated Masked Face Dataset (SMFD), Medical Mask Dataset(MMD), Labeled Faces in the Wild (LFW)) and theirs proposed artificially simulated masked face dataset (ASMFD), CNN method has 0.9870 accuracy.[1]

Preeti Nagrath, Rachna Jain, Agam Madan, Rohan Arora, Piyush Kataria, Jude Hemanth et al. The proposed approach in this paper uses deep learning, TensorFlow, Keras, and OpenCV to detect face masks. This model can be used for safety purposes since it is very resource efficient to deploy. The SSDMNV2 approach uses Single Shot Multibox Detector as a face detector and MobilenetV2 architecture as a framework for the classifier, which is very lightweight and can even be used in embedded devices (like NVIDIA Jetson Nano, Raspberry pi) to perform real-time mask detection.The technique deployed in this paper gives us an accuracy score of 0.9264 and an F1 score of 0.93. The dataset provided in this paper, was collected from various sources, can be used by other researchers for further advanced models such as those of face recognition, facial landmarks, and facial part detection process.[2]

A.Das, Arjya and Wasif Ansari, Mohammad and Basak, Rohini et al.This paper explained the motivation of the work at first. Then,this paper illustrated the learning and performance task of the model. Using basic ML tools and simplified techniques the method has achieved reasonably high accuracy. It can be used for a variety of applications.Wearing a mask may be obligatory in the near future, considering the Covid-19 crisis. Many public service providers will ask the customers to wear masks correctly to avail of their services. The deployed model will contribute immensely to the public health care system. In future it can be extended to detect if a person is wearing the mask properly or not. The model can be further improved to detect if the mask is virus prone or not i.e. the type of the mask is surgical, N95 or not.In their proposed face mask detection system they used Convolutional Neural network which achieved 94.58% accuracy rate.[3]

Amit Chavda, Jason Dsouza, Sumeet Badgujar, Ankit Damani et al.This model present a dual-stage CNN architecture in which Stage 1 detects human faces, and Stage 2 uses a lightweight image classifier to classify and localize the faces detected by Stage 1 as either Mask' or Nomask'.This method has an advantage over other object detectors, in that it makes use of transfer learning and pre-trained models. As a result, the proposed system achieves high accuracy while using less training data. This eliminates the need for a large human annotated dataset and compute resources, which are required by most of the modern object detectors.In this paper, their detection system used a CNN model which can achieved 99.49% accuracy rate in face mask detection with RMFRD and Face Mask Detection dataset by Larxel.[4]

F.M. Javed Mehedi Shamrat,Sovon Chakraborty,Md. Masum Billah,Md. Al Jubair,Md Saidul Islam and Rumesh Ranjan et al. proposed a face mask detection system Using artificial neural network which achieved 96.49% accuracy rate. where RMFD and SMFD datasets are used. [5]

Saravanan, Sharma and Shanmugasundaram, Karthikeyan and Ramasamy, Sathees et al.The paper describes the process involved in the face recognition like face alignment and feature extraction. The paper also emphasizes the importance of the face alignment, thus the accuracy and False Acceptance Rate (FAR) is observed by using proposed technique. The computational analysis shows the better performance than other state-of-art approaches .Suggested that DLib algorithm used in this paper is the best for the face recognition and has FAR is 0.1%.[6]

Ajit.P Gosavi, S.R Khot et al. proposed a recognition system which achieved accuracy 91.63% on JAFFE images using principal component analysis and 91.63% precision rate obtained in case of PCA.[7]

Riya Chiragkumar Shah,Rutva Jignesh Shah et al.The model proposed here is designed and modeled using python libraries namely Tensorflow, Keras and OpenCV.The accuracy rate of detecting a person with a face mask is 95-97% depending on the digital capabilities. The data has been transferred and stored automatically in the system to enable reports whenever you want.[8]

M. Rahman, S. Mahmud, J. Kim, Md. M. Manik, Md. M. Islam et al.published a document aimed at developing a system for determining whether a person uses a mask or not and informing the relevant authority in the smart city network. It makes use of real-time filming of various public places of the city to capture the facial images. The facial images extracted from this video is being used to identify the masked faces. The convolutional neural network (CNN) learning algorithm is used to extract features from images, after which those features are learned through multiple hidden layers. Whenever the architecture identifies people without a mask, this information is passed through the city network to the appropriate authority in order to take the necessary actions. The proposed system assessed promising results based on data collected from various sources. In these documents, they also set out a system that can ensure proper law enforcement against people who do not follow basic health guidelines in this pandemic situation.[9]

Loey, M., Manogaran, G., Taha, M.H.N., Khalifa, N.E.M et al.have introduced the hybrid design which uses deep learning for face mask detection which has two parts. Resnet50 is used as a first part for extraction of the feature while second part used the concept of support Vector Machine, ensemble algorithm and decision trees for classification and recorded testing accuracy 99.64 percent using SVM on RMFD dataset, 100 percent on LFW dataset and 99.49 percent on SMFD dataset.[10]

Qin, B., Li, D. et al.Ejaz, M.S., Islam, M.R., Sifatullah, M., Sarker, A. et al.the authors have developed a method to identify how a person is wearing the face mask. They were able to classify three categories of facemask-wearing condition namely correct facemask-wearing, incorrect facemask- wearing, and no facemask-wearing. This method achieved over 98 % accuracy in detection.[11]

Ejaz, M.S., Islam, M.R., Sifatullah, M., Sarker, A. et al.the authors used PCA (Principal Component Analysis) method to identify faces with masks, which is essential in the field of security. This is one of the few works which concentrated on detection of human faces where they are wearing masks. They found that the accuracy in human face detection decreases by 70 % when a face mask is present.[12]

CHAPTER 3
METHODOLOGY

3.1 Working

The primary objective of the proposed methodology is to recognize recognize the face either with or without the ask worn in real-time application. It works on following steps.

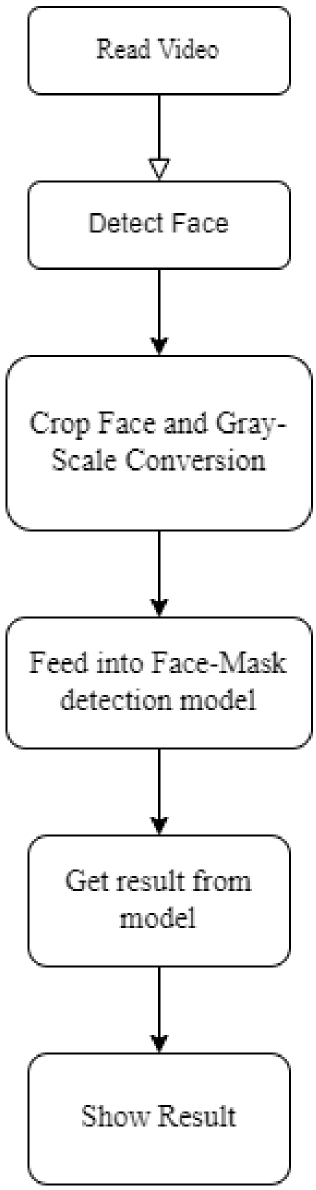

Figure 3.1: System Diagram of the Methodology

I) **VIDEO CAPTURE**

First of all, video is captured from the webcam, which has the actual resolution. From the captured video, we grab frames. The captured frame is passed for the grayscale conversion to reduce the computation power for further processing.

II) **GRAY SCALE CONVERSION**

The grayscale conversion has many ways of converting colorful images into gray form. The luminosity method is used to convert the color image into gray.

i) Read the color image.
ii) For any pixel read the intensity values of Red, Blue and Green channels as R, G and B respectively.
iii) Calculate the gray value Gr=0.299*R+0.587*G+0.114*B.
iv) Set,Gr as intensity.
v) Repeat steps from 2 to 4 until all pixels are scanned.

III) **FACIAL LANDMARK DETECTION**

Facial landmarks are used to localize and represent salient regions of the face. There are two steps while detecting the facial landmarks:

i) Localize the face in the image.
ii) Detect masked and unmasked faces.

From many landmark detection algorithms available for use, but for this project, we have used .Multi-task Cascaded Convolutional Networks (MTCNN) is a framework developed as a solution for both face detection and face alignment. The process consists of three stages of convolutional networks that are able to recognize faces and there are five landmarks: left eye, right eye, nose, left mouth corner and right mouth corner. In the first stage it uses a shallow CNN to quickly produce candidate windows. In the second stage it refines the proposed candidate windows through a more complex CNN. And lastly, in the third stage it uses a third CNN, more complex than the others, to further refine the result and output facial landmark positions which can be used for the data collection for masked and unmasked faces.

The advantages of MTCNN over other detection algorithm are :

i) Speed: good for faster face detection.
ii) Accuracy: it can detect faces accurately.
iii) Robust: faces are detected in different poses, rotation,condition and lighting environment.

IV) **FACE CROP**

MTCNN will be used to draw the bounding boxes for the detected faces as well as the probability of being a face, and the facial landmarks are: left eye, right eye, nose , left mouth corner and right mouth corner. Then we run a loop to read the frames from the camera and use the draw method to draw bounding boxes, landmarks and probabilities.

V) **BUILDING CNN MODEL ARCHITECTURE**

There are three types of layers that make up the CNN which are the convolutional layers, pooling layers, and fully-connected (FC) layers. When these layers are stacked, a CNN architecture will be formed. In addition to these three layers, there are two more important parameters which are the dropout layer and the activation function which are defined below.

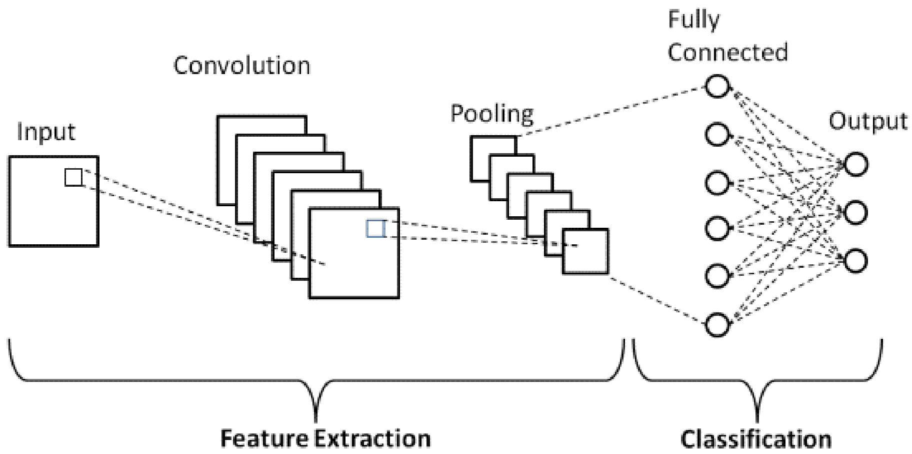

Figure 3.2: Working of CNN layer

i) **Convolutional Layer:**

This layer is the first layer that is used to extract the various features from the input images. In this layer, the mathematical operation of convolution

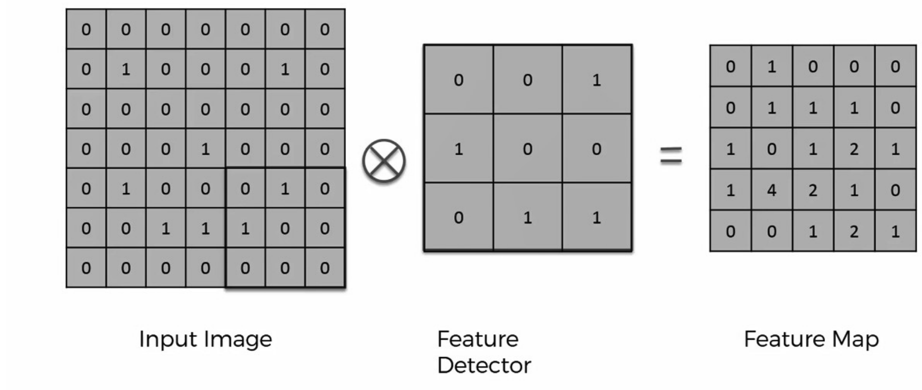

Figure 3.3: Feature Map from Feature Detector

is performed between the input image and a filter of a particular size (3x3). By sliding the filter over the input image, the dot product is taken between the filter and the parts of the input image with respect to the size of the filter (3x3).

The output is termed as the Feature map which gives us information about the image such as the corners and edges. Later, this feature map is fed to other layers to learn several other features of the input image.

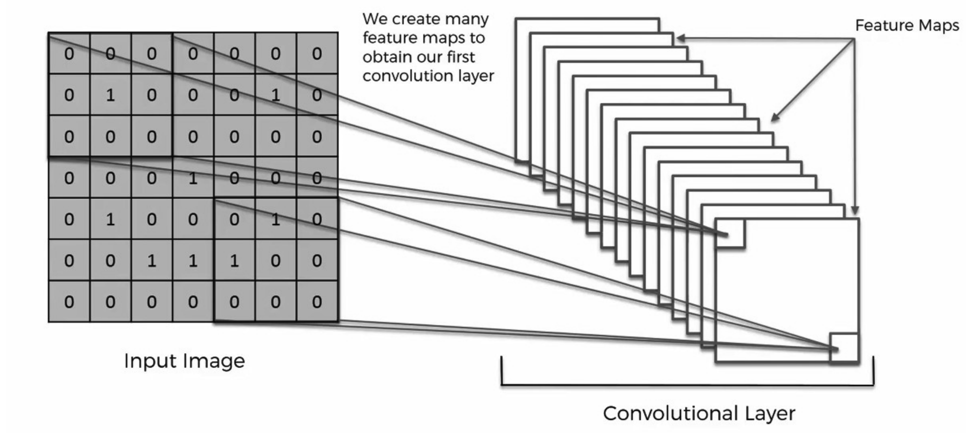

Figure 3.4: Convolution layer with help of different feature map

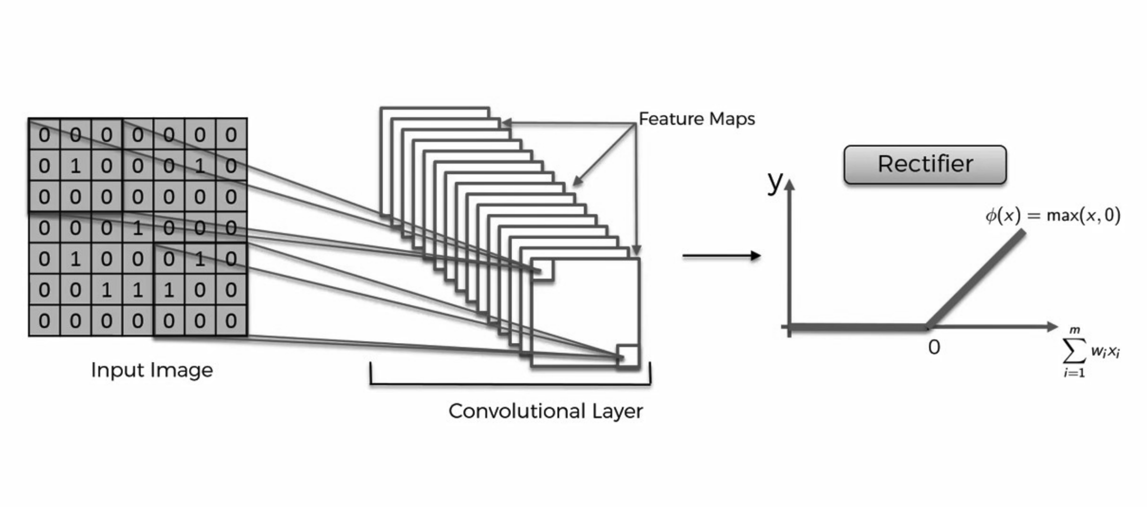

Figure 3.5: ReLU layer on top of convolution layer

ii) **Pooling Layer:** Convolutional Layer is followed by a Pooling Layer. The primary aim of this layer is to decrease the size of the convolved feature map to reduce the computational costs. This is performed by decreasing the connections between layers and independently operates on each feature map. Depending upon method used, there are several types of Pooling operations.

In Max Pooling, the largest element is taken from feature map. Average Pooling calculates the average of the elements in a predefined sized Image section. The total sum of the elements in the predefined section is computed in Sum Pooling. The Pooling Layer usually serves as a bridge between the Convolutional Layer and the FC Layer.

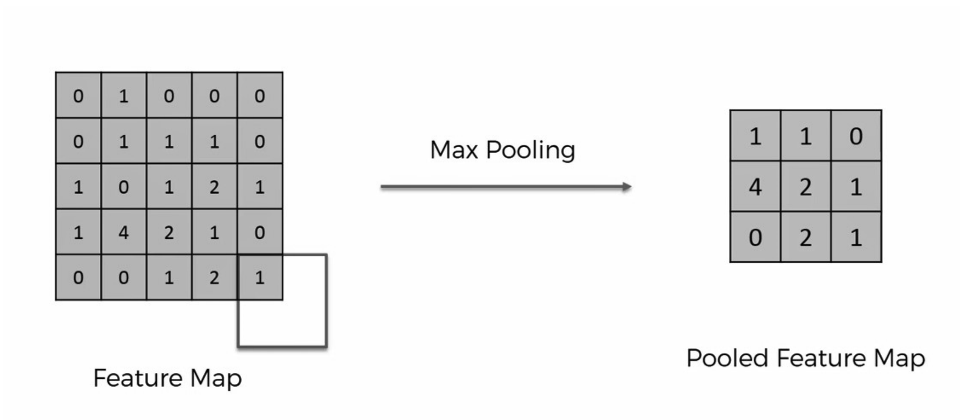

Figure 3.6: MAX Pooling for a feature map

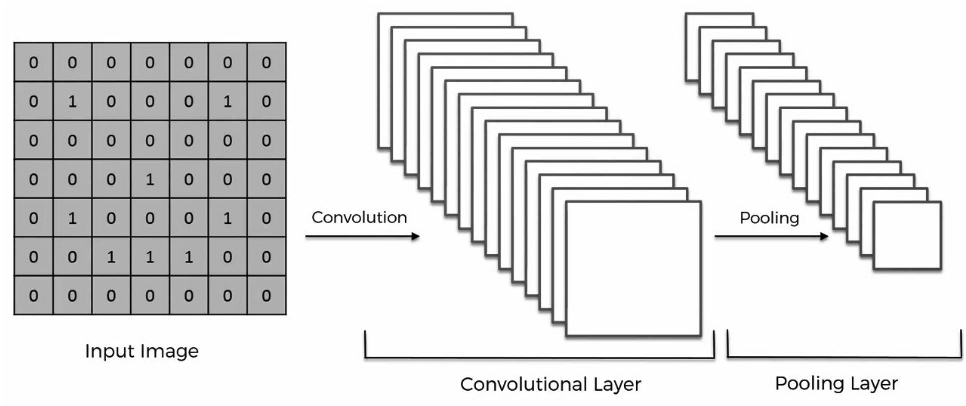

Figure 3.7: Pooling Layer

iii) **Fully Connected Layer**: The Fully Connected (FC) layer consists of the weights and biases along with the neurons and is used to connect the neurons between two different layers. These layers are usually placed before the output layer and form the last few layers of a CNN Architecture.
In this, the input image from the previous layers are flattened and fed to the FC layer. The flattened vector then undergoes few more FC layers where the mathematical functions operations usually take place. In this stage, the classification process begins to take place.

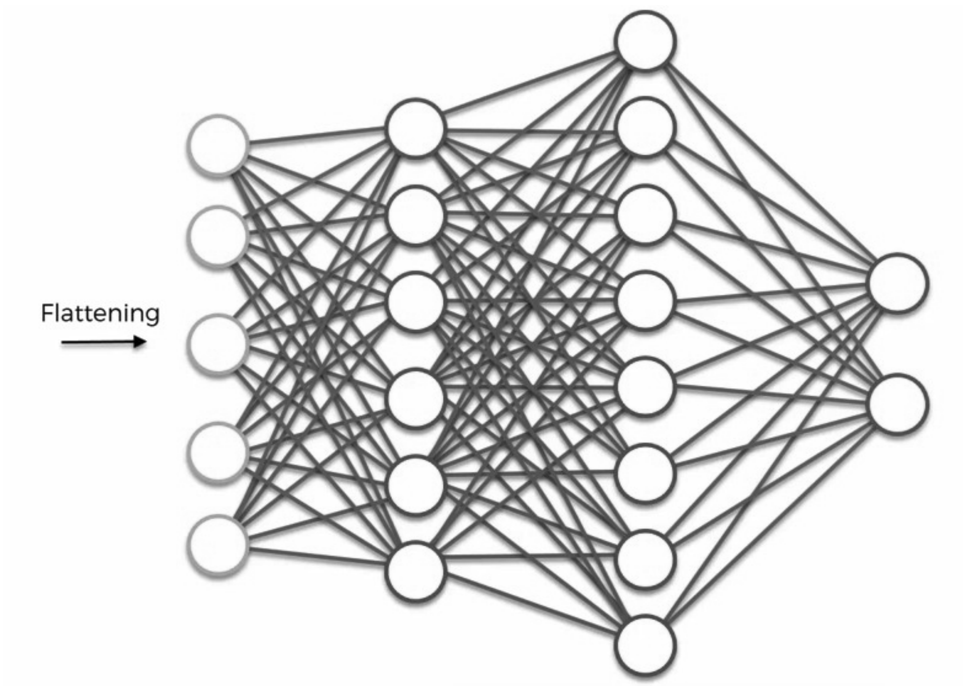

Figure 3.8: Fully connected layer

iv) **Dropout:** Usually, when all the features are connected to the FC layer, it can cause over fitting in the training data set. Overfitting occurs when a particular model works so well on the training data causing a negative impact in the models performance when used on a new data.

To overcome this problem, a dropout layer is utilised wherein a few neurons are dropped from the neural network during training process resulting in reduced size of the model. On passing a dropout of 0.5, 50% of the nodes are dropped out randomly from the neural network.

v) **Activation Functions:** Finally, one of the most important parameters of the CNN model is the activation function. They are used to learn and approximate any kind of continuous and complex relationship between variables of the network. In simple words, it decides which information of the model should fire in the forward direction and which ones should not at the end of the network.

It adds non-linearity to the network. There are several commonly used activation functions such as the ReLU, Softmax, tanH and the Sigmoid functions. Each of these functions have a specific usage. For a binary classification CNN model, sigmoid and softmax functions are preferred an for a multi-class classification, generally soft max is used.But for this project we used softmax and ReLU function.

VI) **SPLITTING THE DATA AND TRAINING THE CNN MODEL**

After setting the blueprint to analyze the data, the model needs to be trained using a specific dataset and then to be tested against a different dataset. Out of 10 datas, 8 are used to train the Network while 2 is used to testing purposes.

The images in the training set and the test set are fitted to the Sequential model. The model is trained for 20 epochs (iterations) which maintains a trade-off between accuracy and chances of over fitting

Cost functions are used to estimate how badly models are performing. Basically, a cost function is a measure of how wrong the model is in terms of its ability to estimate the relationship between X and Y.Adaptive Momentum Estimation(Adam)

Optimizer is an extension of Stochastic Gradient Descent (SGD) algorithm. It combines the best properties of the Adaptive Gradient Algorithm(AdaGrad) and Root Mean Square Propagation (RMSProp) algorithms to provide an optimization algorithm that can handle sparse gradients on noisy problems. It is also relatively easy to configure where the default configuration parameters do well on most problems. For this project we have used Adaptive Momentum Estimation(Adam)Optimizer.

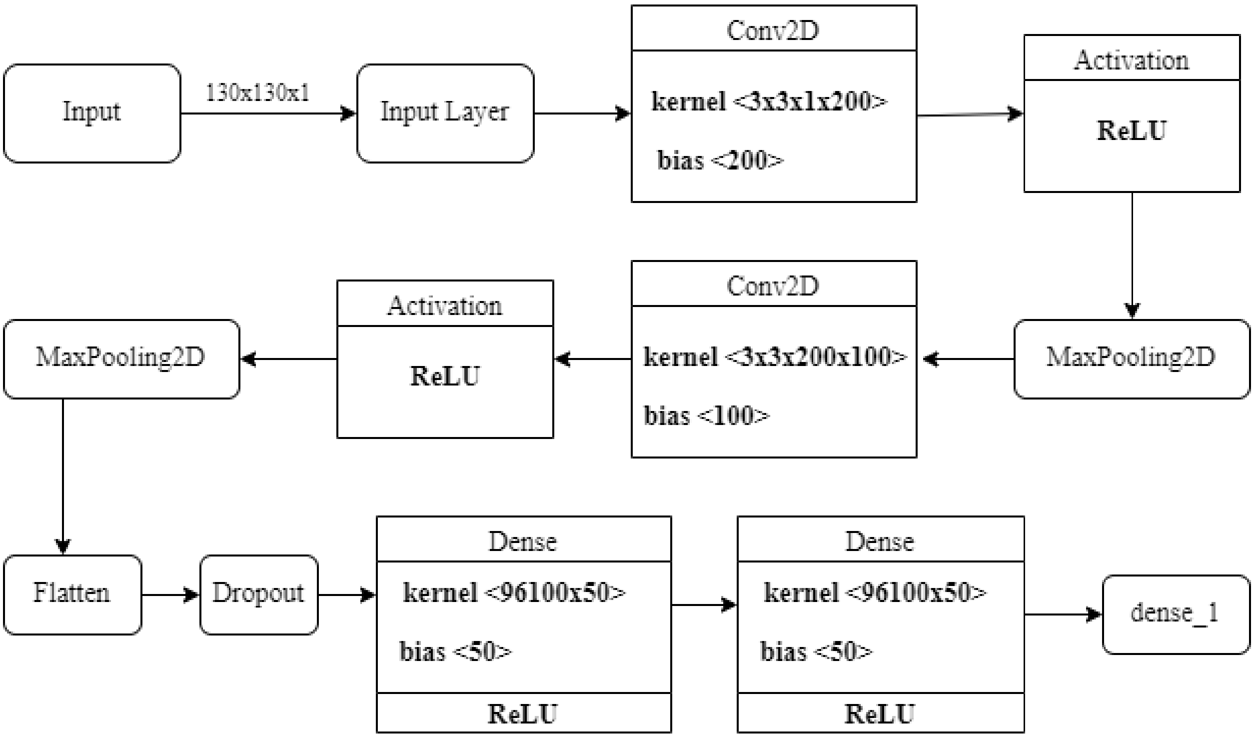

Figure 3.9: Architecture of the Face Mask Detection Model

Conv2D is a 2D Convolution Layer, this layer creates a convolution kernel that is wind with layers input which helps produce a number of outputs. MaxPooling2D downsamples the input along its spatial dimensions (height and width) by taking the maximum value over an input window for each channel of the input. Dropout is a technique used to prevent a model from over-fitting. Dropout works by randomly setting the outgoing edges of hidden units (neurons that make up hidden layers) to 0 at each update of the training phase. Dense Layer is simple layer of neurons in which each neuron receives input from all the neurons of previous layer. Flattening is converting the data into a 1-dimensional array for inputting it to the next layer.

VII) **SHOWING THE RESULT**

Finally after processing, our trained model then shows whether the mask is worn or not worn and even properly worn or not.For the case of properly not worn and mask not work there is only one class unmasked which our model can determine accurately.

3.2 Data Extractor

I) **Select Category:y** From the UI user are asked to select the two categories:

  i) **Unmasked and Improper Masked Face**

  ii) **Masked Face**

II) **Video Capture:** First of all, video is captured from the webcam, which has the actual resolution. From the captured video, we grab frame and convert it into jpeg format image.

III) **Localized Face:** Localized face task helps to create x1,y1,x2,y2 coordinates if the faces using the MTCNN algorithm to capture the face without including the background.It helps to detect the facial landmarks like eyes,mouth,nose etc but for masked faces it can capture the faces using only landmark visible like eyes.

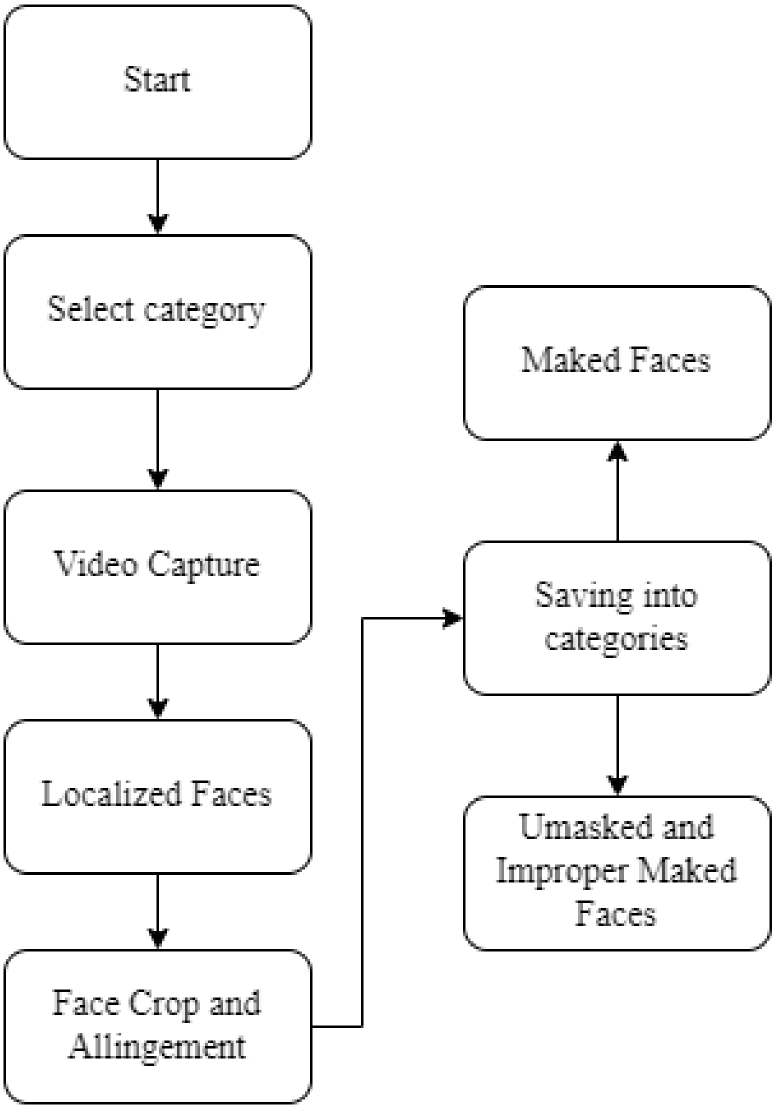

Figure 3.10: Data Extractor

IV) **Face Crop and Alignment:** After localizing the faces from the video frames we then crop the faces to desired size 150x150 and then the face are aligned to match the preferred rotation and orientation.

V) **Saving into Categories:** After all the cropping and alignment done to the image of size 130x130 we then save in into to categories for dataset creation:

   i) **Masked Faces**

   ii) **Unmasked and Improper Masked Faces**

3.3 Software Developmental Model

Incremental Model is a process of software development where requirements divided into multiple standalone modules of the software development cycle. In this model, each module goes through the requirements, design, implementation and testing phases. Every subsequent release of the module adds function to the previous release. The process continues until the complete system achieved.

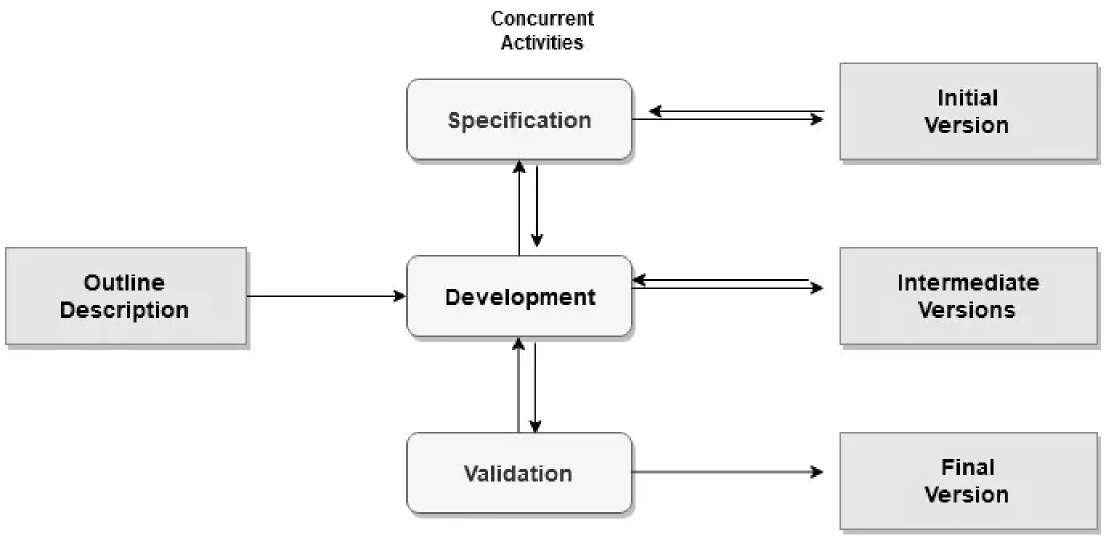

Figure 3.11: Incremental model

3.4 Use Case Diagram

The above diagram shows the interaction between the user and the system. The user provides the data i.e. real-time image. The system processes the image to detect the faces. The system then extract the features and clarifies it. Then finally, output is shown to the user.

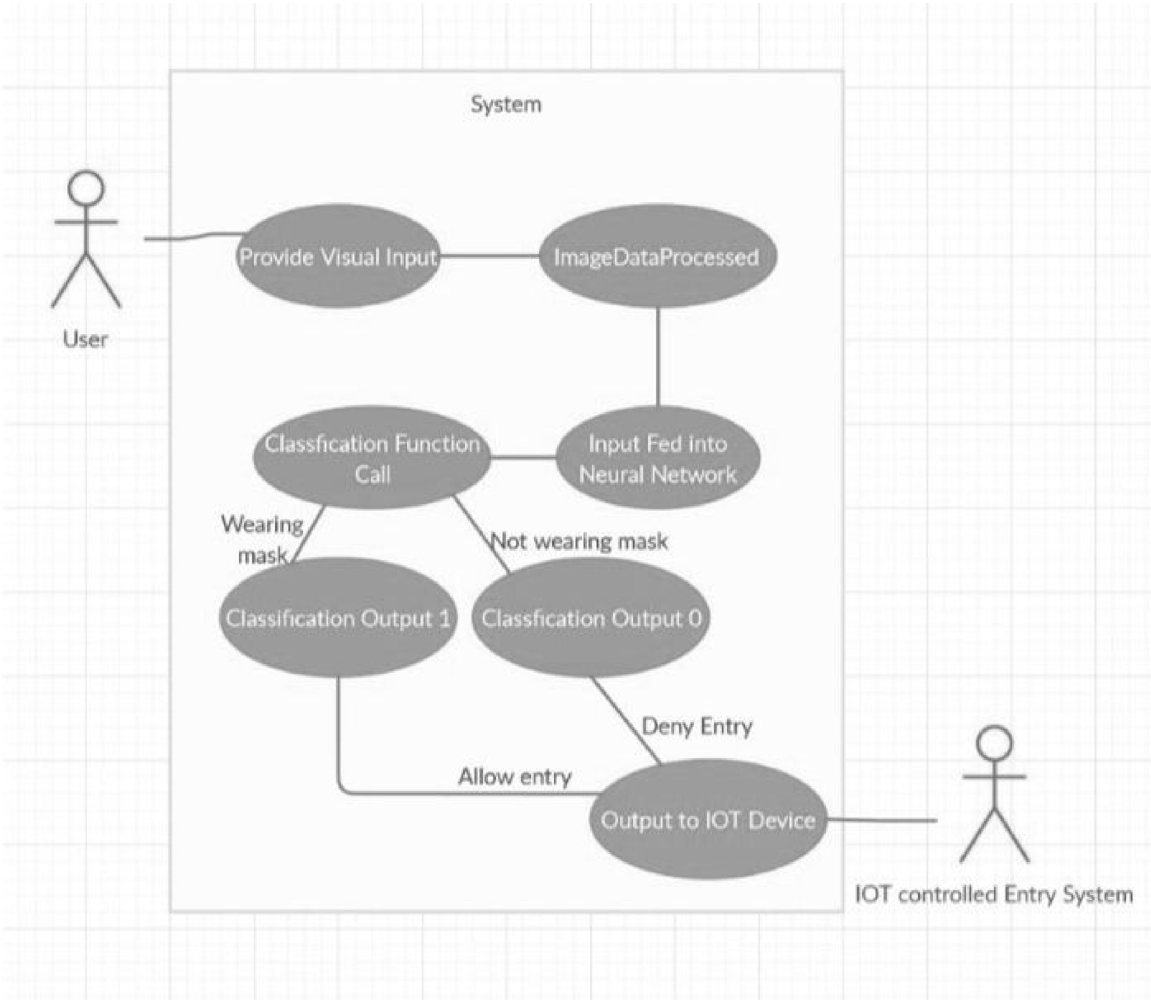

Figure 3.12: Use-case Diagram

3.5 Class Diagram

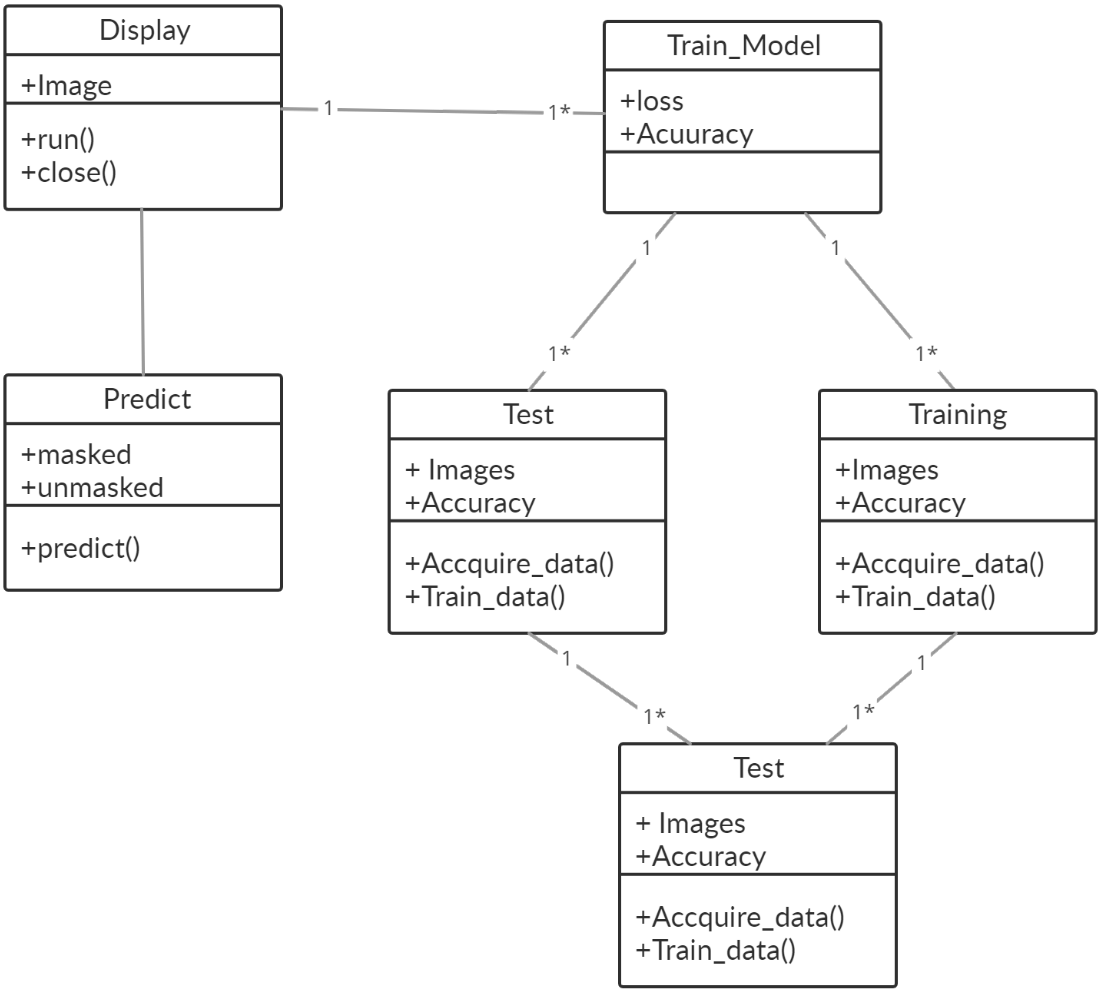

Figure 3.13: Class Diagram

3.6 Activity Diagram

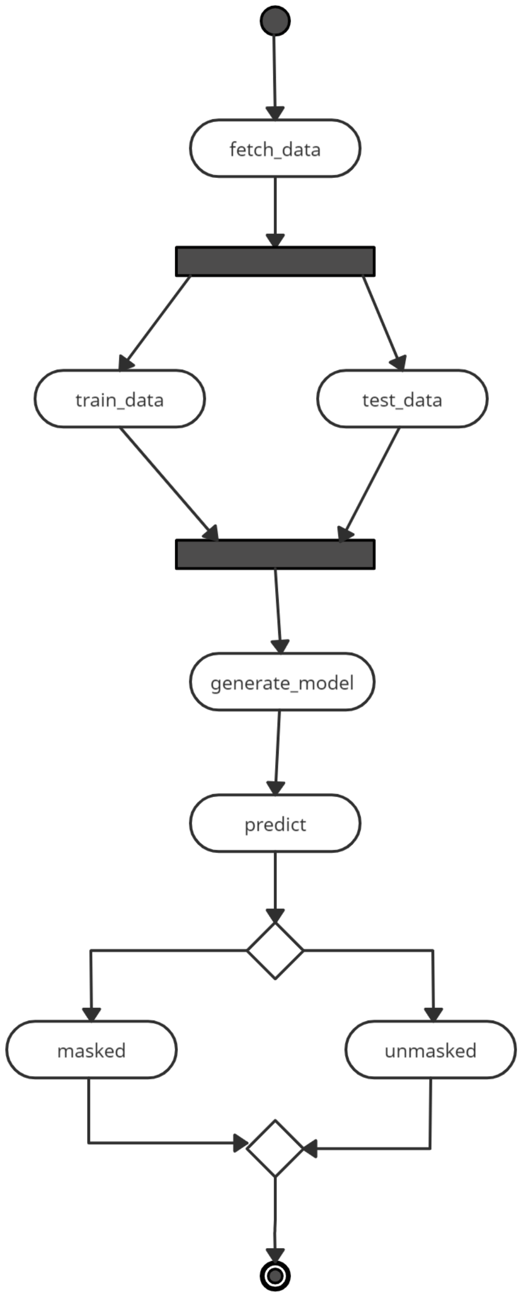

Figure 3.14: Activity Diagram

3.7 Sequence Diagram

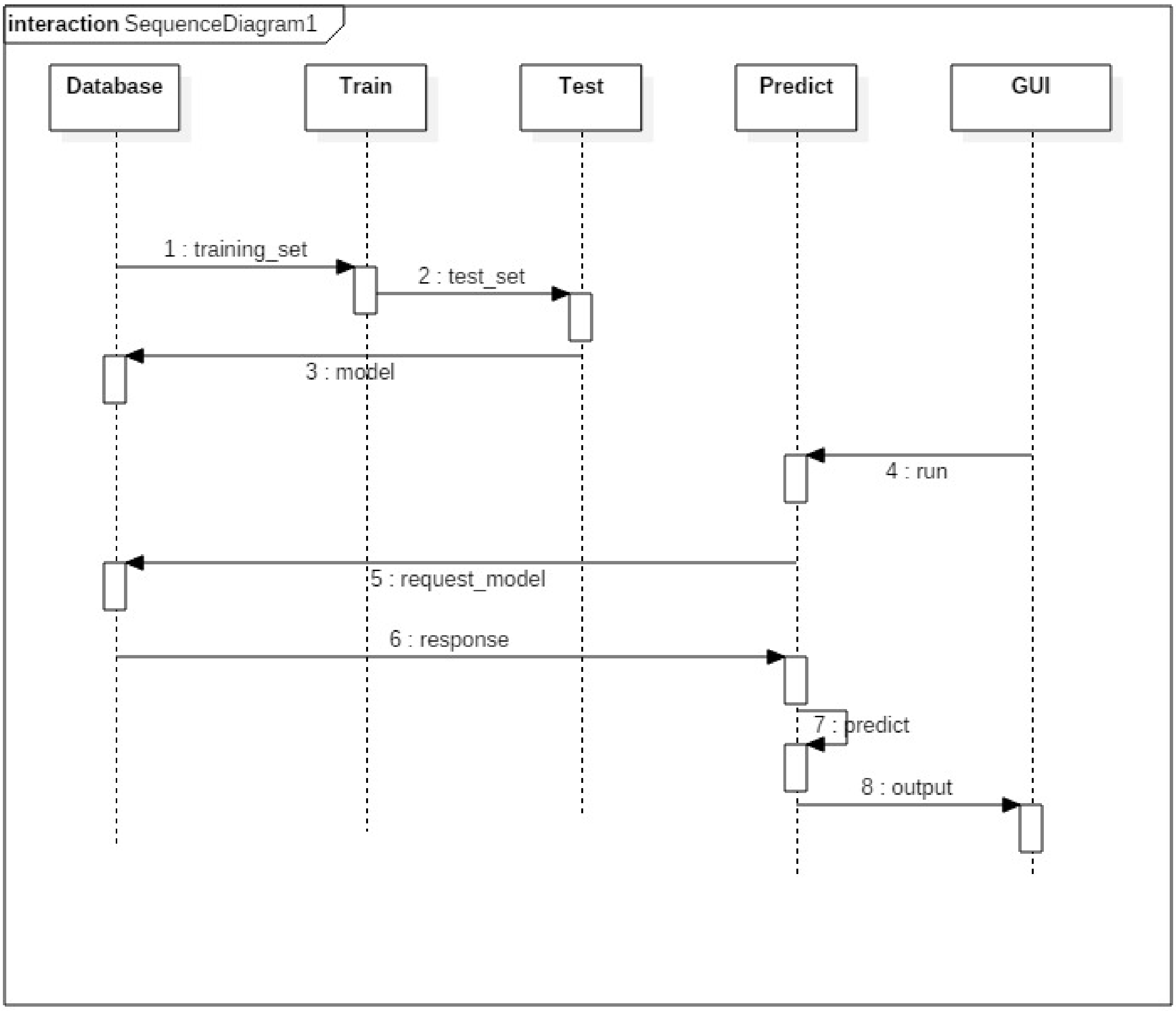

Figure 3.15: Sequence Diagram

CHAPTER 4
RESULT AND DISCUSSION

4.1 Training and Validation of Face Mask Detection

We successfully created a data extractor tool to extract images from the faces with mask worn and mask not worn as well as mask properly not worn to create a dataset. All the data were taken with our own data extracting program which is then used as a dataset for our complete project. We used hundreds of images for our dataset for better accuracy output.And our data extractor tool can take 150 images of unmasked/improper masked as well as 150 masked iumages at one batch.

We then trained all the extracted dataset to form a model. We tried to create efficient and accurate model to identify the masked and unmasked as well as improper masked faces from the video feed/frame. After the training and testing of the model, a user friendly UI is made for the user to make the task easier.

Machine learning model accuracy is the measurement used to determine which model is best at identifying relationships and patterns between variables in a data-set based on the training data.

A loss function or cost function is a function that maps an event or values of one or more variables onto a real number intuitively representing some ”cost” associated with the event.

I) **Face Mask Detection Model**

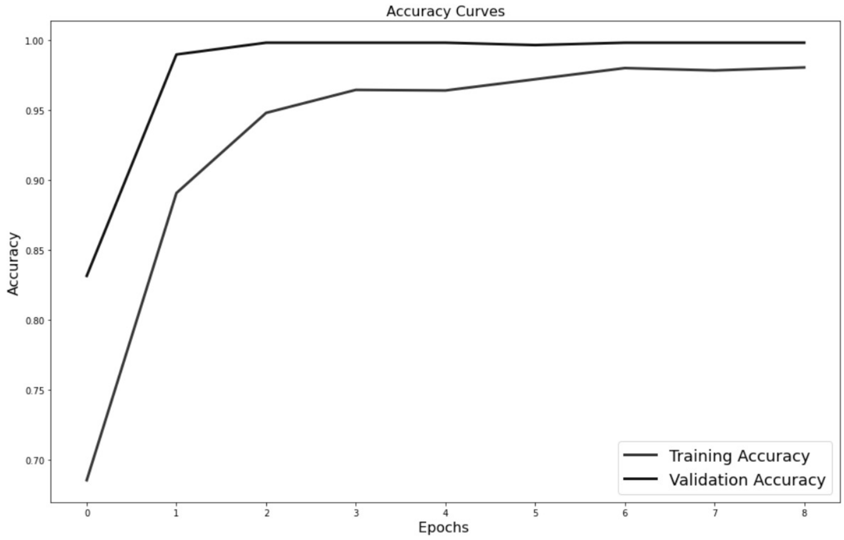

Figure 4.1: Face Mask Detection Model Accuracy

The above figure shows the graph of loss of our model. Our model at the latest epoch at 8 epoch produced an accuracy of approx 0.9906.And our model produced a validation accuracy of 0.9983 at 8 epoch.

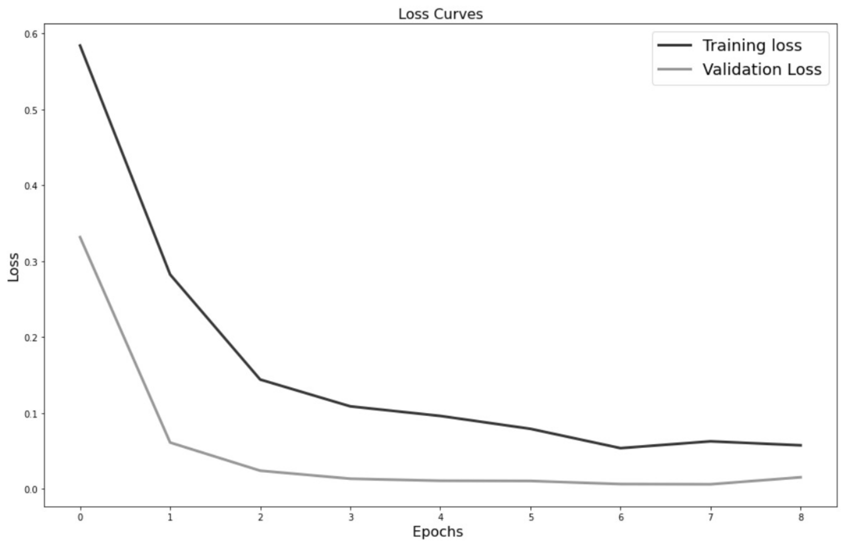

Figure 4.2: Face Mask Detection Model Loss

The above figure shows the graph of accuracy of our model. Our model at the latest epoch at 8 epoch produced a loss of approx 0.0575.And our model produced a validation loss of 0.0154 at 8 epoch.

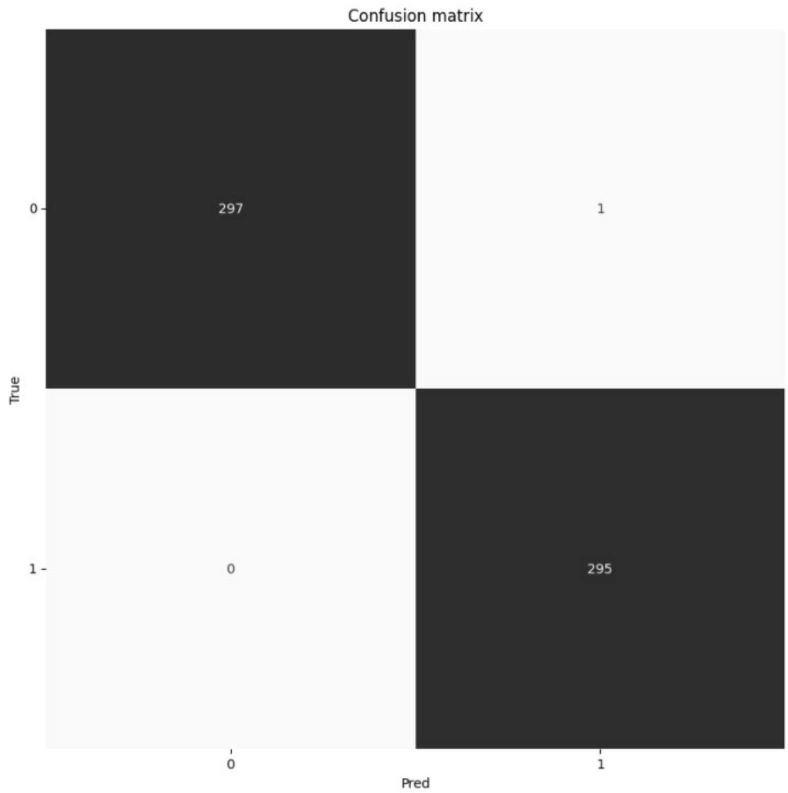

Figure 4.3: Face Mask Detection Confusion Matrix of Testing

The above figure shows the confusion matrix of testing of the face mask detection model.The training correctly predicted 297 unmasked faces and 295 masked faces and shows 1 false positive for unmasked faces.

CHAPTER 5
CONCLUSION

Face Mask Detection Platform uses Artificial Network to recognize if a user is wearing or not wearing a mask. If the camera captures an unrecognized face, a notification can be sent out to the administrator.The identification of people, violating the COVID norms increases the adaptability of the face mask detection system for the public sake. If applied in a correct way, the face mask detection system could be used to make sure our safety and for others too. This approach gives not only helps in achieving high precision but also enhance the face detection tempo considerably. The system can be applied in many areas like metro stations, markets, schools, railway stations and many other crowded places to monitor the crowd and to ensure that everyone is wearing mask. Finally, this work can be used for future researchers and enthusiasts.In this project, we are developing a deep learning model for face mask detection using Python, Keras, and OpenCV. Also,We are developing the face mask detector model for detecting whether person is wearing a mask or not. We have to train the model using Keras with network architecture. Training the model is the first part of this project and testing using webcam using OpenCV is the second part.To train the model, labeled image data are used where the images were facial images with masks and without a mask. The proposed system detects a face mask with an accuracy of 99.83%.

Hence,this project is an Artificial network based platform to recognize if a user is wearing mask or not which came into existence due to Covid-19 pandemic.

5.1 Possible Future Research

In future we can use new neural network architecture for better accuracy and better face mask and unmask faces detection. We can also add tremendous amount of images in our dataset with varieties for better model training and testing.

We can also add new class i.e improper mask in our model for better and accurate detection for the advancement of the system. We can add this system in different facilities for better use.

We can train our model enough time for making it to work on low lighting condition as well for better results.

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APPENDIX

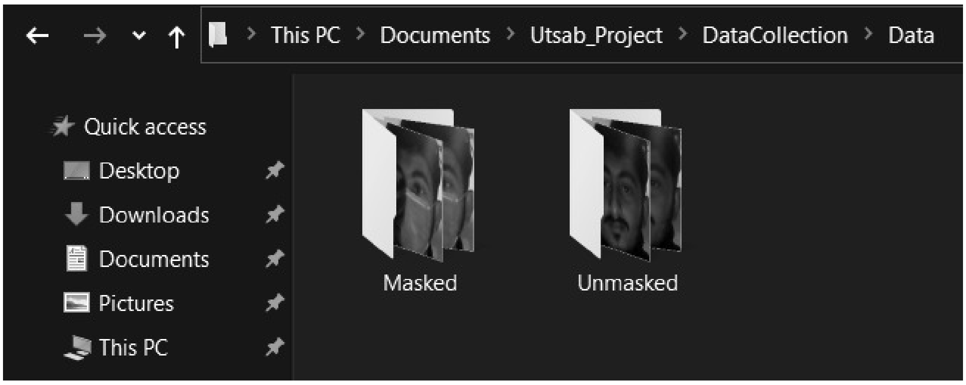

Figure 5.1: Saving image datset into categoriesl

Figure 5.2: Sample 1

Figure 5.3: Sample 2

Figure 5.4: Sample 3

Figure 5.5: Sample 4