DETECT FACEMASK IN COVID-19 PANDEMIC BY USING DEEP LEARNING AND IMAGE PROCESSING

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ABSTRACT

In current days the Corona Virus (COVID 19) is causing a global health crisis for each and every part of the continent. Hence there is a great need to take preventive steps for effective protection from this virus. One among the best protection step is wearing face mask in public places, which is officially announced by the WHO (World Health Organization).All the state and central governments in and around the world impose strick lockdowns to prevent and optimize the virus transmission. But still there are lot of new cases reported and many death cases are continuously updated in every part of the world. Reports clearly indicate that those who wear facemask while they go to work or public places to buy vegetables, daily grocery items and so on, has less impact from virus transmission into their body compared with those who don't wear any face protection mask. Hence this motivated me to design an application which can identify the person whether he is wearing mask or not by taking the help of hybrid models. As we are using hybrid model for face mask detection, this model is designed by combining several classical ML algorithms as well as deep learning algorithms for face mask detection. In order to train the model for accurate detection of face mask, we try to gather dataset from UCI repository database or KAGGLE website, which contains of with mask and without mask images; we are going to use OpenCV to do real-time face detection from a live stream via our webcam. We will use the dataset to build a COVID-19 face mask detector with computer vision using Python, OpenCV, and Tensor Flow and Keras. Our goal is to identify whether the person on image/video stream is wearing a face mask or not with the help of computer vision and deep learning.

Keywords:

Machine Learning Algorithms, Deep Learning Model, Computer Vision, KAGGLE, UCI Repository, World Health Organization (WHO), Virus Transmission, COVID 19.

1. INTRODUCTION

Now a days there was a great usage of face mask publically due to the increase of number of Covid-19 cases which is reported in and around the world. Normally from a recent survey we came to know that people don't wear face mask to shield their health condition from air pollution but rather they use to hide

their emotions from general public who try to watch their current activities. But now a day it is becoming very mandatory for each and every one to wear facemask to protect from spreading corona virus from one person to another. In 2020, we faced a lot of deaths due to corona virus and the world declared COVID 19 as international pandemic due to fast spreading of multiple covid deaths. This infection is increased over 6 million cases in not less than 10 days across 180 countries. This virus is mainly spread through close contact who is packed in certain crowded areas or inside a closed room through air. Hence the usage of face mask is becoming more and more mandate to prevent the fast spreading of this virus[1].

Figure 1. Represent the COVID 19 Pandemic Situation

In current days almost all state and central governments enforced strict protocols for humans to wear the face mask and protect their lives from this novel covid spread, but still most of them are not following any precautions, which is clearly seen in figure 1.We can see some public are wearing face mask in order to cover their complete nose and mouse part, some are not wearing the mask at all, while some are partially covered. In order to detect those persons we try to design an application using machine learning and deep learning algorithms and try to figure out those who are wearing mask and who are not using face mask[2]-[5].In general the information technology supported ML and DL models with a great number of facilities to fight against the covid19 infection in several ways. In general ML algorithms are used to take bulk amount of information related to COVID 19 patients and try to find out the possible reasons for early prediction of vulnerable situations which are occurred with Covid. The deep learning models are applied in order to calculate the accuracy and efficiency in detecting the preventive steps against the spread of Covid19.Currents in many countries all the public are forced by strict laws and rules to wear face masks when they move in public places. These rules and laws are mainly monitored in manual way by the concern police department for identifying the public whether they are wearing face mask or not. However, this manual method for detecting face mask is very difficult to check each and every one who is in a group. This motivated us to design the current application in which by applying several ML or DL models to train the public from web camera and identify those who are wearing face mask and those who didn't wear face mask in public places. The proposed model can able to detect the mask image from the real time video and it can

tag with some indication like who is having face mask and who is not having any facemask very accurately and automatically. The proposed model is mainly integrated with DL and ML techniques with Open CV package along with tensor flow and keras[6].

2. LITERATURE SURVEY

Literature survey is that the most vital step in the software development process. Before developing the new application or model, it's necessary to work out the time factor, economy, and company strength. Once all these factors are confirmed and got approval then we can start building the application. The literature survey is one that mainly deals with all the previous work which is done by several users and what are the advantages and limitations of those previous models. This literature survey is mainly used for identifying the list of resources to construct this proposed application.

MOTIVATION

1) A Facemask Detector Using Machine Learning and Image Processing Techniques.

AUTHORS: Amrit Kumar Bhadani

In this paper, the author mainly concentrated on the importance of facemask and its detection technique by using ML and image processing techniques. The author said due to several changes in lifestyle in various parts of our world, there is a great impact on wearing face mask by several public when they move in public places. The author mainly concentrated on the current pandemic situation of Covid 19 and they want to show the difference between number of users who are survived after covid by using facemask and those who are died due to because of negligence behaviour of not using face mask[7].The author designed a project for facemask detection by detecting people's faces and segregating them into two classes namely the people with masks and people without masks is done with the help of image processing and deep learning.

2) COVID-19 face mask detection in a crowd using multi-model based on YOLOv3 and hand-crafted features

AUTHORS: Shao Liu

In this paper, the author mainly concentrated on the importance of facemask and its detection technique in crowd by using multi model based on YOLO v3 and hand crafted features. The authors concentrated more on face recognition technique which is becoming more interesting task in many environments.The author used face recognition system for identifying the visual data objects such as images or videos and then try to verify whether those images are related to public who are having face mask or not[8].They presented a framework like YOLOv3 and CNN model to predict the facemask from public over crowded places.

3)The Face Mask Detection For Preventing the Spread of COVID-19 at Politeknik Negeri Batam
AUTHORS: Susanto and Febri Alwan Putra

In this paper, the authors mainly discussed about concentrated on the importance of facemask and its detection technique for preventing of covid-19 at politeknik negeri batam.The authors discussed the root cause or birth for this covid-19 virus occurred in Wuhan-china in December 2019.The world health organization (WHO) confirmed that Covid 19 as one of the dangerous virus which can spread from one human being to other and even for animals, living beings either in airborne or droplets[9]. The WHO announced wearing a face mask is only preventive step from this dangerous virus and everyone need to follow this rule strictly when they go outside or meeting others. Although it is followed by many public, still some public refuse to wear face mask and they are very irresponsible in spreading the virus. In this article the authors are very much concentrated on designing an application which can detect the face mask and try to find out several face masks and their structure and train the system with several types of face masks. By training the system with several types of face masks, the application can able to scan individual face and check if it is matched with any of the face mask structure and generate outcome as either mask present or not[10]-[11].

3. EXISTING SYSTEM AND ITS LIMITATIONS

In the existing system we try to use the general ML algorithms for image processing techniques technique for finding whether a person is having mask or not.Machine learning (ML) is the study of computer algorithms that improve automatically through experience. It is seen as a subset of artificial intelligence. Machine learning algorithms build a mathematical model based on sample data, known as "training data", in order to make predictions or decisions without being explicitly programmed to do so. Machine learning algorithms are used in a wide variety of applications, such as email filtering and computer vision, where it is difficult or infeasible to develop conventional algorithms to perform the needed tasks. In order to detect a human wearing face mask or not is quite difficult task with ML algorithm and even though it is developed it may not give accurate results.

LIMITATIONS OF THE EXISTING SYSTEM

1. The existing system didn't concentrated on the property of deep learning.
2. Machine learning works with lot of applications which are using image as main prediction input.
3. In primitive ML, for image based application we use Computer Vision package but this is not accurate for all image based applications.

4. The existing Ml algorithms failed to identify the face mask detection for humans in accurate manner.

4. PROPOSED SYSTEM AND ITS ADVANTAGES

In the proposed system we try to design a hybrid model for image analysis . A hybrid model using deep and classical machine learning for face mask detection will be presented. A face mask detection dataset consists of with mask and without mask images , we are going to use OpenCV to do real-time face detection from a live stream via our webcam. We will use the dataset to build a COVID-19 face mask detector with computer vision using Python, OpenCV, and Tensor Flow and Keras. Our goal is to identify whether the person on image/video stream is wearing a face mask or not with the help of computer vision and deep learning

ADVANTAGES OF THE PROPOSED SYSTEM

1. Machine learning works with large amounts of data. It is useful for small amounts of data too. Deep learning on the other hand works efficiently if the amount of data increases rapidly.
2. This proposed hybrid model use MobileNetV2 to train the images for the system by taking collection of both mask images and images without face mask.
3. This proposed hybrid model can easily find out those who are having face mask and those who are not having face mask easily from a static image or from video sequence.

5. PROPOSED MODEL FOR MACE MASK DETECTION

In this section we try to discuss about proposed CNN model which is used to identify and detect the face mask from both real time video or from still images and then show the accuracy of our proposed model.

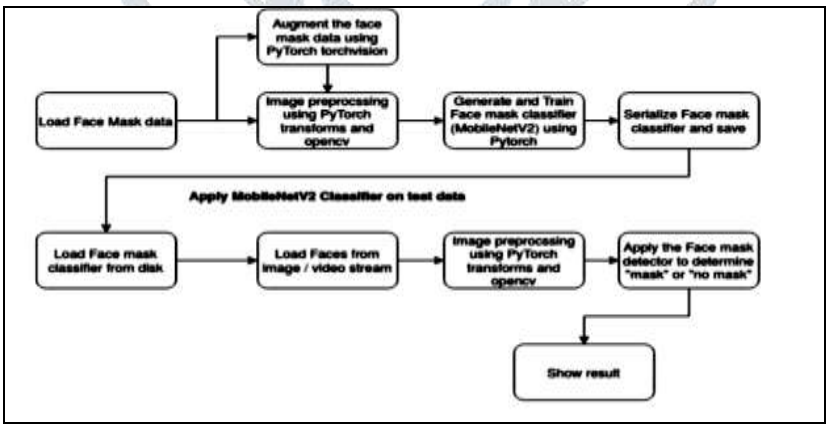

Figure 2. Represent the Architecture of Proposed Model

The Application is mainly divided into 4 modules. They are as follows:

1. Data Collection
2. Data Pre-Processing
3. Training the Deep Learning Module

4. Apply Mask Detector using Images or Video

1) DATA COLLECTION MODULE

The majority of the images were augmented by OpenCV. The set of images were already labeled "mask" and "no mask". The images that were present were of different sizes and resolutions, probably extracted from different sources or from machines (cameras) of different resolutions. Here we try to collect images from well-known dataset **https://www.kaggle.com/andrewmvd/face-mask-detection**

2) DATA PRE-PROCESSING MODULE

Pre-processing steps as mentioned below was applied to all the raw input images to convert them into clean versions, which could be fed to a neural network

A. Resizing the input image (256 x 256)

B. Applying the color filtering (RGB) over the channels (Our model MobileNetV2 supports 2D/3 channel image)

C. 3.Scaling / Normalizing images using the standard mean of PyTorch build in weights

D. Center cropping the image with the pixel value of 224x224x3

E. Finally Converting them into tensors (Similar to NumPy array)k machine learning model.

3) TRAINING THE CNN MODEL

To implement this deep learning network we have the following options.

1. Tensor Flow

2.Keras

3.PyTorch

4.Caffee

5.MxNet

6.Microsoft Cognitive Tool Kit.

We are using the PyTorch because it runs on Python, which means that anyone with a basic understanding of Python can get started on building their deep learning models, and also it has the following advantage compared with Tensor Flow.MobileNetV2 builds upon the ideas from MobileNetV1, using depth wise separable convolution as efficient building blocks. However, V2 introduces two new features to the architecture:

4) APPLY MASK DETECTOR USING IMAGE OR VIDEO

The flow to identify the person in the webcam wearing the face mask or not. The process is two-fold.

1. To identify the faces in the webcam

2. Classify the faces based on the mask

6. EXPERIMENTAL RESULTS

Implementation is a stage where the theoretical design is converted into a programmatic manner. In this proposed application we try to use PYTHON as a programming language in which Jupiter Notebook as a working platform to process the current application.

STEP 1: IMPORTING ALL NECCESARY LIBRARIES

```
# import the necessary packages
from tensorflow.keras.applications.mobilenet_v2 import
preprocess_input
from tensorflow.keras.preprocessing.image import img_to_array
from tensorflow.keras.models import load_model
import numpy as np
import argparse
import cv2
import os
def mask_image():
```

STEP 2: LOAD TRAIN AND TEST DATA INTO SEPARATE VARIABLES

```
def mask_image():
      # construct the argument parser and parse the arguments
      ap = argparse.ArgumentParser()
      ap.add_argument("-i", "--image", required=True,
            help="path to input image")
      ap.add_argument("-f", "--face", type=str,
            default="face_detector",
            help="path to face detector model directory")
      ap.add_argument("-m", "--model", type=str,
            default="mask_detector.model",
            help="path to trained face mask detector model")
      ap.add_argument("-c", "--confidence", type=float, default=
0.5,
            help="minimum probability to filter weak detections")
      args = vars(ap.parse_args())
```

STEP 3: DATA PRE-PROCESSING

```
        # pass the blob through the network and obtain the face
detections
        print("[INFO] computing face detections...")
        net.setInput(blob)
        detections = net.forward()

        # loop over the detections
        for i in range(0, detections.shape[2]):
                # extract the confidence (i.e., probability)
associated with
                # the detection
                confidence = detections[0, 0, i, 2]

                # filter out weak detections by ensuring the
confidence is
                # greater than the minimum confidence
                if confidence > args["confidence"]:
```

STEP 4: Building CNN Model

```
# load the MobileNetV2 network, ensuring the head FC layer sets
are
# left off
baseModel = MobileNetV2(weights="imagenet", include_top=False,
        input_tensor=Input(shape=(224, 224, 3)))

# construct the head of the model that will be placed on top of
the
# the base model
headModel = baseModel.output
headModel = AveragePooling2D(pool_size=(7, 7))(headModel)
headModel = Flatten(name="flatten")(headModel)
headModel = Dense(128, activation="relu")(headModel)
headModel = Dropout(0.5)(headModel)
headModel = Dense(2, activation="softmax")(headModel)

# place the head FC model on top of the base model (this will
become
# the actual model we will train)
model = Model(inputs=baseModel.input, outputs=headModel)

# loop over all layers in the base model and freeze them so they
will
# *not* be updated during the first training process
for layer in baseModel.layers:
        layer.trainable = False
```

STEP 5 : Start Training CNN with Parameters and fit the model.

```
# plot the training loss and accuracy
N = EPOCHS
plt.style.use("ggplot")
plt.figure()
plt.plot(np.arange(0, N), H.history["loss"], label="train_loss")
plt.plot(np.arange(0, N), H.history["val_loss"],
label="val_loss")
plt.plot(np.arange(0, N), H.history["accuracy"],
label="train_acc")
plt.plot(np.arange(0, N), H.history["val_accuracy"],
label="val_acc")
plt.title("Training Loss and Accuracy")
plt.xlabel("Epoch #")
plt.ylabel("Loss/Accuracy")
plt.legend(loc="lower left")
plt.savefig(args["plot"])
```

STEP 6 : Start TESTING CNN with Various Inputs

After training the model with respective inputs we got the output either mask or No mask with accuracy value also.

7. CONCLUSION

In this current work we for the first time designed and implemented an application using deep learning CNN model in order to develop face mask detection. This paper builds a CNN-based framework to precisely match both still images or moving real time video from the web camera and then check whether a person is wearing mask or not. As we are using hybrid model for face mask detection, this model is designed by combining several classical ML algorithms as well as deep learning algorithms for face mask detection. In order to train the model for accurate detection of face mask, we gathered r dataset from KAGGLE website, which contains of with mask and without mask images; we used OpenCV to do real-time face detection from a live stream via our webcam. By conducting various experiments on our proposed model, we achieved a face mask detection technique along with accuracy of equal to 100 percent when applied to the test dataset.

8. REFERENCES

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