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Face Mask Detection using Machine Learning

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Abstract— Transformation is a positive factor in the lives of everyone around the world. within the wake of the COVID-19 epidemic, WHO has made obligatory mask to protect against this lethal virus and other related social media such as digital scanning tool. The database for this present work is divided into two categories namely masked people and non-masked people. In this present work we used support vector machine to train the model and to detect whether a person is wearing a mask or not. We got accuracy of 89% for our machine learning model.

Keywords— Machine learning, accuracy, Support vector machine , epidemic, COVID-19

I. INTRODUCTION

We all are familiar with the pandemic situation all over the world. And during this pandemic COVID-19 [1-2], WHO has made wearing a mask compulsory to protect against deadly virus. We all are human being and by nature we can see whether a person wearing mask or without mask but the machine cannot do by just seeing the human being. After so many researches, the researchers discovered how the human brain works or receive signals and act according to that. In the same way, the researcher used computer vision to visualize the object in an image. Like this way there are a lot of programs that reduces the effort of human being. The increase of virus infection led to the increasing the use of computer vision to identify the patients or any movement. Throughout the present day situation of global-wide pandemic, our present work is very much efficient in reduction of the mass unfold of the deadly virus. In this project we did focus on monitoring peoples whether the person is with mask or without mask. As it has been instructed by the scientists that wearing mask will reduce the rate of transmission of virus from one to other so that we can control the pandemic [6-8] all over the world. In this present work, we have developed the machine learning model by loading the dataset (images of persons with or without mask) so that we can train our model and using that trained model we can detect whether a person is wearing mask or not. Our model can be used at different places as described below:

Hospitals: As the hospital are main place where viruses can spread faster, the best use of this to detect every patient's face by the detector.

Working places: To retain the safety standards, the system or detector will help us in monitoring if the employees are maintaining the rules or not. The system can be installed at the entrance gate and it will send immediate message or alarm if anyone doesn't maintain the safety standard.

Airport: As the airport is also a place from where the virus can spread much. So, the system thus detects the passenger who is moving without mask. The system will capture the image of the passenger and send it to the control room for immediate action against him or her.

II. RELATED WORK

To reverse the losses caused by this global epidemic, the country is going through various stages of reopening. Face masks have become a very crucial part in our daily life. Therefore, dressing is important for the safety and control of the spread. Our main focus is on whether the person is wearing a mask or not.

III. METHODOLOGY

Our main target or moto is to train the machine learning model to determine whether a person is wearing or not wearing mask.

Computer vision is a multidisciplinary field of science that works on how the computers can achieve higher understanding from videos or digital photography. From the technical point of view, it understands and performs task that the human visualization can perform. Computer viewing proceedures include methods for detecting, processing, analyzing and understanding digital images, and fetching of high-quality data from the outside real world to generate numerical and symbolic data, e.g. and comprehension of useful information from a single image or a couple of images. It involves the generation of a theoretical and also algorithmic framework to acquire automatic visual comprehension. As a scientific discipline, computer vision is concerned with the idea of artificial systems that extract information from images. Image data can take many forms, such as video sequences, views from multiple cameras, or various multi dimensional data from a medical scanner. As a technical command, computer vision uses ideas and their models in the design of computer viewing programs.

Steps:

1. Importing the required packages.
2. Pre-processing of data.
3. Fetch the list of images into our dataset directory, then initialize the list of data (i.e., images) and classify those images.
4. On the labels of that dataset perform one-hot encoding.
5. Data augmentation has been done.
6. Support vector machine classifier has been used.
7. Plotting of the required graphs.
8. Result Extraction.

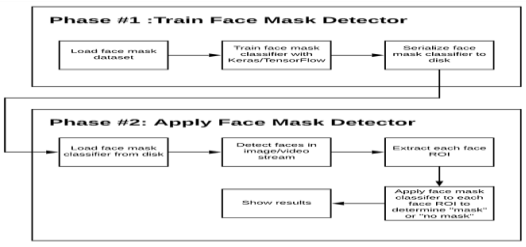

Figure 1. Training and Testing phases

To train a customized face mask detector, we need to segregate our project into two distinct phases, each with its own steps (as shown in Figure 1 above):

- Training: We will focus on loading our face mask discovery dataset here, train the model (using Keras/ TensorFlow) on this dataset, and make a face mask detector.
- Deployment: Once the face mask detector is being trained, then we can carry on to load the mask detector, make the face detections, and then classify each face as with mask or without mask.

We will review each of these categories and related data in detail for the rest of this study, but for now, let's look at the data we will be using to train our COVID-19 face mask for detection.

TensorFlow [9] is a free and open software source for programs that are segmented across a range of tasks and data flow. It is an illustrative mathematical library, and is used in neural networks, which is a machine learning application. It is used for Google's production and research. It is a second-generation Google Brain type of system. Version 1.0.0 was released on February 11. While the implementation of the reference works on single devices, TensorFlow can work on multiple GPUs (with CUDA and SYCL extensions for standard computer graphics processing frameworks) and CPUs. Its flexible design allows easy deployment of various platforms (CPUs, GPUs, TPUs), and from desktops to server clusters on mobile and side devices. It is available for 64-bit macOS, Linux, Windows, and desktop platforms including iOS and Android. The term Tensor Flow is taken from the function performed by such neural networks in several data systems, called the tensors. Jeff Dean said, during the Google I / O Conference in June 2016, that 1,500 GitHub clues refer to TensorFlow, only 5 of which are from Google for production, not RankBrain in Google Search and the fun Deep-Dream project. It can work on single CPU programs, GPUs and mobile devices and large distributed applications for hundreds of devices.

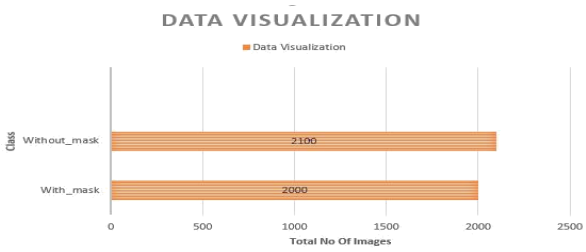

Figure 2. Data visualization

IV. Results and Discussion

We have collected a very large amount of information from the online source "www.kaggle.com" and from public domain. We are also incorporating our images into this project to build a large dataset that guarantees good predictions. The dataset used here comprises of total 1000 images where 500 images are with mask and 500 without mask. 80% data has been taken as training set and 20% for test set. The dataset is collected to train the face mask prediction model. The data is stored in the next two phases:

Figure 3: With Mask dataset

Figure 4: Without Mask dataset

Figure 3 and Figure 4 are showing sample dataset of person with or without mask respectively.

Table 1. Classification Report

	precision	recall	f1-score
without_mask	0.83	0.92	0.87
with_mask	0.93	0.86	0.90
accuracy			0.89
macro avg	0.88	0.89	0.88
Weighted avg	0.89	0.89	0.89

We obtained the accuracy of 89% .
The motive of Linear SVC (Support Vector Classifier) is to fit the data we provide, return the "best fit" hyper-plane that classifies, or categorizes your information. After discovering the hyper-plane, we can add some features to our classifier to see what the "predicted" class is. This makes that particular algorithm suitable for our use.
Matplotlib is used for visualisation purpose that is to see the output at the end. Normally, we will not be able to visualize as much size as we will have features. However, it is worth looking at at-least once to understand how linear svc works.

Apart from the visualization packages that we use, we'll just need to import SVM from sklearn and numpy for array conversion of the same components. Figure 5 is depicting the performance of classifier.

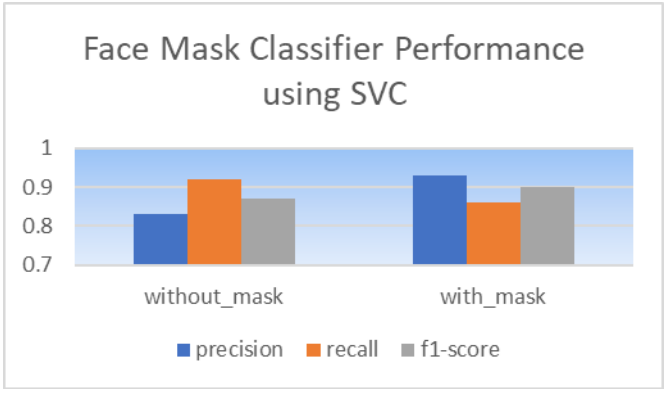

Figure 5. Performance of classifier

V. Conclusion and Future Scope

We have developed here a machine learning model that can detect or determine if a person is wearing face mask or not. As an addition to this, work is going on which will also warn that person with some beep sound and showing that there is no Mask! Considering how the masks will be an important part of our society and the health of the community as a whole, in such scenerio this process will become necessary to ensure that safety guidelines are followed. We got 88% using SVC which is really capable enough to use it as digitalized scanning tool in an observation system. As a future direction of this publication we are working with deep learning [10-15] model to address the same issue.

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