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Implementation of Face Mask Detector for Prevention of Covid-19 using Tensor Flow, Keras and OpenCV

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ABSTARCT: The COVID-19 pandemic has had a dramatic impact on our daily lives, disrupting global trades and economies. We can say that the wearing or usage of facemask has become the new normal. Many public service providers will need clients to wear masks correctly in the near future in order to use their services. As a result, detecting face masks has become a critical responsibility in aiding international society. This paper proposes a simplistic method to accomplishing this goal utilising basic Machine Learning packages like TensorFlow, Keras, OpenCV and Scikit-Learn. The suggested approach successfully identifies the face in the image and then determines whether or not it is covered by a mask. It can also detect a face with a mask in motion as a surveillance task performer. On two separate datasets, the technique achieves accuracy of up to 95.77 percent and 94.58 percent, respectively. We investigate optimum parameter values using the Sequential Convolutional Neural Network model to appropriately detect the existence of masks without overfitting.

KEYWORDS: Coronavirus, Covid-19, Machine Learning, FaceMask Detection, Convolutional Neural Network, TensorFlow

I. INTRODUCTION

Coronavirus disease has infected over 20 million individuals worldwide, resulting in over 0.7 million deaths, according to the World Health Organization's official Situation Report –205. COVID-19 patients have reported a wide range of symptoms, ranging from mild signs to major sickness. One of them is respiratory issues such as shortness of breath or difficulty breathing. COVID-19 infection can cause major consequences in elderly patients with lung disease, as they appear to be at a higher risk. 229E, HKU1, OC43, and NL63 are some of the most common human coronaviruses that infect people all over the world. Viruses like 2019-nCoV, SARS-CoV, and MERS-CoV infect animals before infecting humans and evolving into human coronaviruses. The environment of a tainted person can trigger contact transmission because virus-carrying droplets can land on his nearby surfaces.

Wearing a clinical mask is important to prevent some respiratory viral infections, such as COVID-19. The public should be aware of whether they should wear the mask for COVID-19 source control or aversion. The use of masks has the potential to reduce vulnerability to danger from a noxious individual during the "pre-symptomatic" stage, as well as stigmatise specific individuals who wear masks to prevent virus spread. Face mask detection has thus become a critical task in today's global society.

Face mask detection is identifying the location of a person's face and then deciding whether or not that person is wearing a mask. The problem is related to general object detection, which is used to identify different types of things. Face identification is the process of identifying a specific group of entities, i.e. faces. It has a wide range of applications, including autonomous driving, education, and spying. The core Machine Learning (ML) packages such as TensorFlow, Keras, OpenCV, and Scikit-Learn are used in this research to propose a simpler solution to serve the desired objective.

In this project, we present a susceptible–infected– recovered (SIR) model with individuals wearing facial masks and individuals who do not. The disease transmission rates, the recovering rates, and the fraction of individuals who wear masks are all time-dependent in the model.We develop a progressive estimation of the disease transmission rates and the recovering rates based on the coronavirus disease 2019 (COVID-19) dating a published by John Hopkins University. We determine the fraction of individual who wear masks by a maximum likelihood estimation, which maximizes the transition probability of a stochastic SIR model. The transition probability is numerically difficult to compute whether the number of infected individuals is large. We develop an approximation for the transition probability based on the central limit theorem and mean-field approximation. We show through numerical study that



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our approximation works well. We develop a bond percolation analysis to predict the eventual fraction of population who are infected, assuming that parameters of the SIR model do not change anymore. The percolation threshold is exactly the basic reproduction number of the epidemic. We predict the outcome of COVID-19 pandemic using our theory.

II. RELATED WORK

In summary [1], this experiment examined three common types of label noise in medical image datasets, as well as the relative effectiveness of several approaches for mitigating label noise's negative impact. Label noise in medical imaging has a variety of sources, statistics, and strengths, and this study demonstrates that the effects of label noise should be carefully analysed when training deep learning algorithms. This necessitates additional research and the development of robust models and training algorithms.

On the first layer of the CNN model, the most primitive [2] building blocks that comprise the images are located; these building blocks correspond to the motifs. By applying filters to the images, the CNN detects these motifs. Each filter is composed of pixels that have the same shape as the corresponding motif. The first layer filters in this example correspond to the letters of the alphabet. Each filter is sequentially shifted to each location in the image, and the degree to which the image's local properties match the filter at each location is measured, a process known as convolution. Convolution produces a new array (or new image) called a featuremap as a result of this process. The degree to which the filter matches each local region in the original image is quantified by feature maps. If there are N first layer filters, the convolutional process generates N 2D feature maps.

The purpose of this study [3] was to evaluate a quantitative CT Image Parameter, defined as the percentage of lung opacification (QCT-PLO), that was automatically calculated using a deep learning tool. We evaluated QCT-PLO in covid -19 patients at baseline and on follow-up scans, with an emphasis on cross-sectional and longitudinal differences in patients with varying degrees of clinical severity.

The diagnosis of 2019-nCoV pneumonia[4] was made based on epidemiologic characteristics, clinical manifestations, chest images, and laboratory findings. After three days of treatment with interferon inhalation, the patient's clinical condition deteriorated, with progressive pulmonary opacities discovered on repeat chest CT.

This article[5] proposes that a deep learning model can accurately detect and distinguish COVID -19 from communityacquired pneumonia and other lung diseases. The author[6] used this pipeline to compare the evolution of two confirmed COVID-19 cases from Wuhan, China, who received similar supportive therapy. Figure 1 depicts the favourable evolution of a 48-year-old woman imaged at four time points over a 16-day period, whereas Figure 2 depicts the disease progression of a 44-year-old man over a 12-day period, particularly between the second and third studies.

Authors present UNet++, a new, more powerful architecture for medical image segmentation, in this paper [7]. This architecture is essentially a densely supervised encoder-decoder network, with the encoder and decoder sub-networks connected via a series of nested, dense skip paths.

A cluster of patients with pneumonia of unknown origin was linked to a seafood wholesale market in Wuhan, China, in December 2019[8]. Unbiased sequencing of samples from pneumonia patients identified a previously unknown betacoronavirus. We isolated a novel coronavirus, 2019-nCoV, from human airway epithelial cells. This virus formed a new clade within the subgenus sarbecovirus, Orthocoronavirinae subfamily. In contrast to MERS-CoV and SARS-CoV, 2019-nCoV is the seventh member of the human coronavirus family.

This study[9] describes the same population genetic dynamic as the SARS 2003 epidemic, emphasising the critical need for the development of effective molecular surveillance strategies for Betacoronavirus in animals and Rhinolophus in the bat family.

This article[10] discusses how artificial intelligence (AI) can be used to provide safe, accurate, and efficient imaging solutions for COVID-19 applications. COVID-19 covers the entire pipeline of AI-enabled imaging applications, including intelligent imaging platforms, clinical diagnosis, and pioneering research. Two imaging modalities, X-ray and CT, are used to demonstrate the efficacy of AI-assisted medical imaging in the diagnosis of COVID-19.



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III. DATASETS

Two datasets are used for experimenting this method. Dataset 1 [1] consists of 1376 images. I this dataset, 690 images with people wearing face masks and the rest 686 images who do not wear face masks. Fig. 1 contains front face pose with single face in the frame. It has exact same type of mask having white colour only.



Dataset 2 from Kaggle [1] consists of 853 images and it clarifies the countenances either with or without a mask. Fig 2.shows some face collections having head turn, tilt and slant with multiple faces in the frame and different types of masks having different colours as well.



IV. INCORPORATED PACKAGES

Tensorflow : -

Tensorflow is an open-source library for numerical computation that bundles together Machine Learning and Deep Learning models and algorithms. It is utilized for implementing Machine learning systems into fabrication over a many areas of computer science, like

sentiment analysis, voice recognition, geographic information extraction, computer vision, text summarization, information retrieval, computational drug discovery and flaw detection. In the suggested model, TensorFlow is used at backend for the whole CNN architecture which includes several layers. It is also used to reshape the data(image) in the data processing [1].

Keras: -

Keras is an Open-Source Neural Network library that runs on top of Theano or Tensorflow. Layers and models are the core data structures of Keras. All the layers

used in the CNN model are implemented using Keras. Along with the conversion of the class vector to the binary class matrix in data processing, it helps to compile the overall model [1].



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OpenCV: -

OpenCV (Open-Source Computer Vision Library) is an computer vision and machine learning software library, which was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception. It is utilized to recognize faces, recognize objects, group movements in recordings, trace progressive modules, track camera actions, follow eye gesture, expel red eyes from pictures taken utilizing flash, perceive landscape and set up markers to overlay it with increased reality and so forth, find comparative pictures from an image database. OpenCV is used in the proposed model for resizing and colour conversion of data images.

V. PROPOSED METHOD

Face detection:-

It also uses Convolutional Neural Network (CNN)based deep learning model is used for face recognition. We are using CNn model because this model can detect the faces even in low resolution. CNN model can detect if you are wearing a face mask by using the webcam of your PC. Also uses mobilenetv2 model for accuracy of pixels and face size that can be detected.

We have four modules

1.Datasets Collecting: - We are collect no of datasets with face mask and without masks. We can get high accuracy depends on collecting the number of images.

2.Datasets Extracting: - We can extract the features using mobile net v2 of mask and no mask sets.

3. Models Training: - we will train the model using open CV, Keras (Python Library).

4.Face Mask Detection:- We can detect Pre processing image and also detect via live video . If people wear mask, it will permit them , if not then it will give the buzzer to wear mask to prevent them from virus transmission.



Fig. System Architecture

V. RESULT

We've used two datasets for the training, testing and validation of the model. Dataset 1 attains accuracy upto 95.77%. Dataset 2 attains an accuracy of 94.58%. Dataset 2 has multiple faces in the frame and different types of masks having different colors hence we can say that dataset 2 is more versatile than dataset 1. Max Pooling is the main reason behind achieving this accuracy. Pool size and optimized filter value helps to filter out face which is themain portion of the



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image which detects the existence of facemask without over-fitting. The system considers the occlusion degree of nose, mouth, chin and eye to differentiate between face covered by hand and annotated mask. Therefore, mask covering nose and chin face fully will be treated as "with mask" by the system.

VI. CONCLUSION

In our project we have proposed a system which helps us in recognizing the use of face mask by the people. This system automatically detects whether the person is wearing face mask or not and if not then it captures the image of specific person. This proposed system uses basic machine learning algorithms such as keras tensor flow,openCV and deep learning. This face mask detector can immensely help police officers and higher authorities to identify whether a person is wearing mask or not and if not then they will have a victim's photo and they can take further actions against the victim. In areas like shopping malls, airports and heavy traffic places spread of the disease occurs at high extent so the face mask detector can be deployed in such areas to monitor the public and to avoid spread of disease by checking who is following basic rules and who is not.

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