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AI Driven Face Mask Recognition for Real-Time Safety

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Abstract: ***Wearing a face mask in public is the most effective preventive approach against the corona virus COVID-19 pandemic, according to the World Health Organization (WHO), which is producing a global health calamity. Lockdowns were imposed by governments across the globe as a means of controlling the spread of the virus due to the COVID-19 pandemic. There are indications that wearing a face mask at work greatly lowers the likelihood of transmission. a productive and economical way to use AI to establish safety in an industrial scenario. A deep learning model will be used to show face mask detection. We'll use a face mask detection dataset made up of photographs taken with and without masks to use OpenCV to detect faces in real time from a live feed captured by our webcam. We will create a deep learning COVID-19 face mask detector with Python, OpenCV, and Karas. We aim to identify whether or not the person in the image/video stream is wearing a face mask using deep learning.***
Index Terms: Adam, VGG16, OpenCV, MobilenetV2, COVID-19

I. INTRODUCTION

It's difficult to identify someone wearing a mask. Due to its rapid spread, the corona virus infection has attracted a lot of interest. This has led to the implementation of rules like "No entrance without a mask" in some nations. Face mask detection is a critical component in the security and prevention of COVID-19. In the medical industry, wearing a mask lowers the chance of contracting an illness from an infected individual whether or not they exhibit symptoms. Among other places, face mask detection is employed in airports, hospitals, offices, and educational institutions. The corona virus pandemic has led to hitherto unheard-of levels of international scientific collaboration. There are several methods that artificial intelligence (AI) based on deep learning and machine learning can assist in combating COVID-19. By analyzing vast amounts of data, machine learning may be utilized by scientists and physicians to forecast the development of COVID-19, serve as a pandemic early warning system, and pinpoint vulnerable populations. It is crucial to invest in the development of technologies like artificial intelligence and machine learning in order to prevent and predict emerging diseases.

The Covid19 pandemic is being addressed with the use of AI, which enables researchers to more accurately estimate infection rates and locate and identify infections more rapidly. There are laws in many countries mandating the wearing of face masks in public. These guidelines and recommendations were developed in response to the notable rise in cases and fatalities in different areas. Nonetheless, it's getting harder and harder to keep an eye on big crowds of people. Anyone not donning a face mask is picked up during the monitoring operation. Face recognition with a mask is more difficult because it is harder to extract masked face features against regular face features than face identification without a mask. The nose, lips, and chin are among the facial features that are absent from the veiled face. It is possible to identify a large number of face masks in two periods. 1) Facial recognition 2) Feature Extraction The first step is face recognition, which involves identifying a person's face from a picture. A common issue is identifying multiple mask and unmasked faces in an image. The issue can be resolved by applying a standard object detection technique. The process of separating interesting aspects of a face is called feature extraction. Feature extraction is the process of identifying the interesting facial features and extracting them. Using a classifier, the extracted image is matched with mask and no mask images to obtain the desired outcome.

II. REVIEW OF LITERATURE

Such a solution is crucial in many use cases to stop the spread of Covid-19 during the current lockdown period. A few examples of applications that will profit from this technology are as follows.

Airports: The suggested system may be very helpful in identifying visitors who do not have masks on. Traveler data may be stored in the system at the entrance as movies. If a traveler is discovered to be missing their facemask, an alarm is sent to the airport authorities so they can respond promptly.

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Hospitals: The proposed system can be integrated with CCTV cameras, and information from those cameras can be utilized to ascertain whether or not hospital staff members are mask-wearing. A notification reminding the health worker to wear a mask may be sent if they are discovered not wearing one.[6] Offices: By maintaining safety standards, the suggested approach can help stop the spread of Covid-19 and other airborne illnesses.[15] Employees who are not wearing masks might be reminded to do so. The best performance must be the basis for system selection. The best system for widespread deployment may therefore take into account the aforementioned performance metrics. The following classifiers have been used to work with the system:

MobilenetV2[5]: In terms of classification, object detection, and semantic segmentation, MobileNetV2 represents the state of the art in mobile visual recognition[17]. This classifier employs Depth wise Separable Convolution, which was created to substantially reduce the complexity cost and network model size, making it ideal for mobile devices or devices with limited CPU capability. Another excellent module included in MobileNetV2 is inverted residual structure. Non-linearity is removed from narrow layers. Using MobileNetV2 as the feature extraction backbone yields the best performance for object detection and semantic segmentation. ResNet50: We can train deep neural networks with more than 150 layers using ResNet50. Training very deep neural networks was difficult prior to ResNet due to the problem of vanishing gradients. ResNet was the first to develop the skip connection concept. VGG16: One of the greatest vision models on the market right now is the CNN architecture VGG16. The most notable aspect of VGG16 is that it concentrates on 3x3 filters with a stride of 1 rather than a large number of hyper-parameters. Throughout the architecture, the convolution and max pool layers are positioned in the same manner. Two FC (completely connected layers) are the last ones, and a softmax is the output after that. VGG16 stands for sixteen weighted layers. The following three optimizers are used for each classifier in order to assess the system's performance. ADAM[6]: Adam is a stochastic objective function optimization technique that operates on a first-order gradient and adaptively estimates lower-order moments. This approach uses minimal memory and is computationally efficient. It is a diagonal rescaling of the gradients that is invariant, making it ideal for issues with vast amounts of data or parameters. Most of the time, there is minimal need for adjusting the hyperparameters, and their interpretations are simple. Empirical evidence suggests that Adam performs well in practise and compares favourably with other stochastic optimisation methodologies. ADAGRAD [8]:Adagrad is a parameter-specific learning rate optimizer that changes its learning rate based on how frequently a parameter is changed during training. When a parameter receives more updates, the updates get smaller. SGD: In Stochastic Gradient Descent, some samples are randomly selected for each iteration rather than utilizing the complete data set. The total number of samples from a dataset that are used to compute the gradient for each iteration is referred to as the "batch" in the context of gradient descent. To reach the minima in a less noisy and random way, it is helpful to use the entire dataset. The problem arises when the datasets get unnecessarily big. A traditional Gradient Descent optimization technique would need using all one million samples in order to complete one iteration of the Gradient Descent, and this would have to be done for each iteration until the minima were reached if the dataset contained one million samples. Its execution thus becomes computationally costly. Using stochastic gradient descent, this issue can be resolved. A single sample is used for each SGD iteration, yielding a batch size of one. To carry out the iteration, a randomly selected and mixed sample is used. The path traveled by the algorithm to reach the minima in SGD is often noisier than the one taken by a standard Gradient Descent method since just one sample from the dataset is selected at random for each iteration.

III. RESEARCH METHODOLOGY

A. Deep Learning

From the provided examples, the deep learning architecture picks up a variety of important nonlinear properties. Following that, previously unseen samples are predicted using the learned architecture. Our deep learning architecture was trained using a range of picture sources. CNN has a big impact on how the learning experience is designed. The ensuing sections cover every facet of deep learning architecture. Acquiring Datasets: To train and evaluate the model, data is gathered from two distinct sources. A total of 1915 images, both with and without masks, were collected. The remaining pictures are utilized for testing, and the remaining 80% are used for training. ii) Learning Model Architecture: A deep learning classifier that can identify patterns in images serves as the foundation for the learning model. An input layer, numerous hidden layers, and an output layer comprise the structure of the network. Numerous convolution layers that produce suitable filters for extracting important features from the input data make up the hidden layers. DL properties are used by several dense neural networks to make classification decisions.

B. Tensorflow

A free and open-source software framework for differentiable programming and dataflow, TensorFlow can be used to solve a variety of issues. Neural networks and other machine learning applications use this symbolic math library. TensorFlow, Google's second-generation technology, is used for both production and research.

C. Keras

Instead of being machine-centric, Keras is a human-centric API. Keras follows best practices for reducing cognitive load by offering consistent and simple APIs, reducing the amount of user activities required for typical use cases, and delivering clear and actionable error signals. In order to facilitate working with neural networks, Keras includes numerous implementations of standard neural-network building blocks such as layers, objectives, activation functions, optimizers, and a host of other tools.

D. Pytorch

PyTorch is an open-source machine learning framework built on the Torch library for computer vision and natural language processing applications. It was primarily created by the FAIR team at Facebook AI Research.

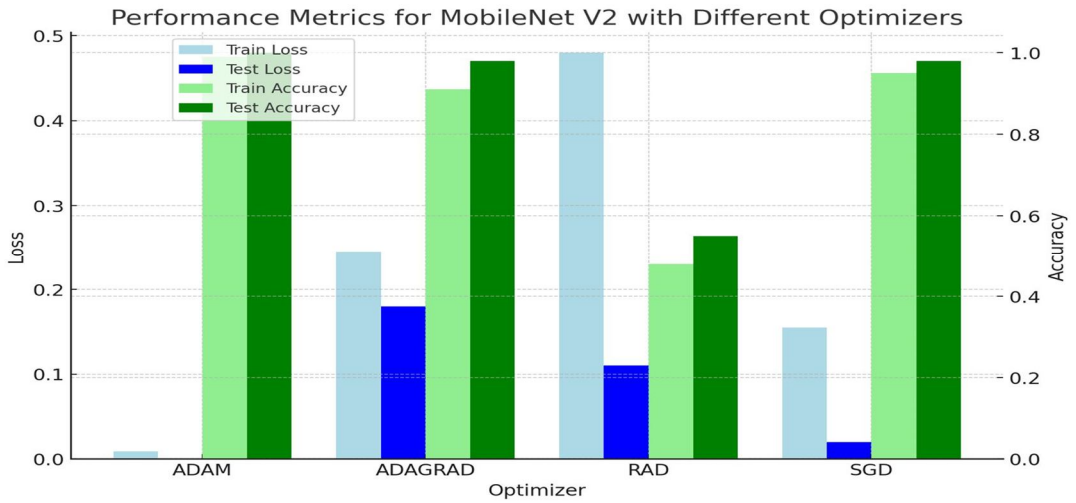
E. Applications Airports

The suggested method could be quite helpful in identifying those who aren't wearing masks when traveling through airports. Traveler information can be gathered at the entry as system movies. If a person is seen not wearing a face mask, the airport authorities are alerted, enabling them to act promptly. Hospitals: This method can be used in conjunction with CCTV cameras to ascertain whether or not staff members are mask-wearing. If a medical professional is not wearing a mask, they might be reminded to do so. Office: The suggested approach may help to uphold safety regulations and stop the spread of Covid-19 or any other virus that spreads through the air. An employee who does not have a mask on may receive a reminder message. When choosing a system, the optimal performance needs to be taken into account. Therefore, in designing the best system for a large-scale implementation, the previously described performance indicators can be taken into account.

F. Limitations

The constructed system finds it difficult to discern faces hidden by hands because it makes the wearer look like they are hiding their identity. It is difficult to tell each person's face in a packed room. Identifying individuals in this scenario who aren't wearing face masks would be quite challenging with our suggested approach. To get the most out of this system, the city will require a lot of CCTV cameras to watch over the entire city and committed personnel to execute the laws against infractions.

Classifier	Epochs	Train/test	Optimizer	Train loss	Train accuracy	Test loss	Test accu racy
Mo	20	90/10	ADAM	0.0090	0.99	0.00	1.00
bile					81	71	00
net			ADAG	0.2454	0.91	0.18	0.98
V2			RAD		48	11	55
			SGD	0.1549	0.95	0.02	0.98
					02	16	55



Here is the bar graph representing the performance metrics for MobileNet V2 with different optimizers. The graph shows both the training and testing losses and accuracies for each optimizer (ADAM, ADAGRAD, RAD, and SGD), with loss values on the left y-axis and accuracy values on the right y-axis. This provides a clear comparison of each optimizer's effectiveness in terms of loss and accuracy.

IV. RESULTS AND DISCUSSION

The dataset is divided into training and testing sets by maintaining an appropriate percentage of different classes. The dataset contains 1915 samples in total, of which 80% are used in the training phase and 20% are used in the testing phase. There are 1532 and 383 photos in the training and testing datasets, respectively. Due to overfitting on the training data from prolonged training, the final architecture is trained for 100 epochs. When a model picks up on undesirable patterns from the training set, it is said to have overfitted. As a result, test precision falls while training precision rises.

To determine whether or not people were wearing face masks, we employed OpenCV, Tensor Flow, Keras, Pytorch, and Deep Learning. As technology develops, more and more solutions become accessible. Both still photos and streaming video feeds were used to assess the models. The precision of the model has been attained, and model optimization is an ongoing process whereby we adjust the hyperparameters to get an extremely accurate response. One way to illustrate how edge analytics functions is with this model. Moreover, using a publicly available face mask dataset yields state-of-the-art results using the proposed method. Technology that can identify whether someone is wearing a mask and grant access would be extremely beneficial to society. Different classifiers are used to assess the existing system. In the near future, the best system and an interface with alerting and alarm systems might be developed. A healthy system that significantly reduces the spread of disease might be created by combining this one with another that makes advantage of social distance. A future without faces is not far off, and masks are quickly taking on the role of the new normal. Experts worry that there may be a serious security danger from this. Even if they are wearing faces, Luke McGee (Luke McGee) (Luke McGee) wants to conceal them for evil reasons. Experts are concerned that the increasing use of masks may hinder future criminal investigations as face recognition technology becomes increasingly crucial to apprehending criminals. Statement on Conflicts of Interest The writers certify that they have no competing interests

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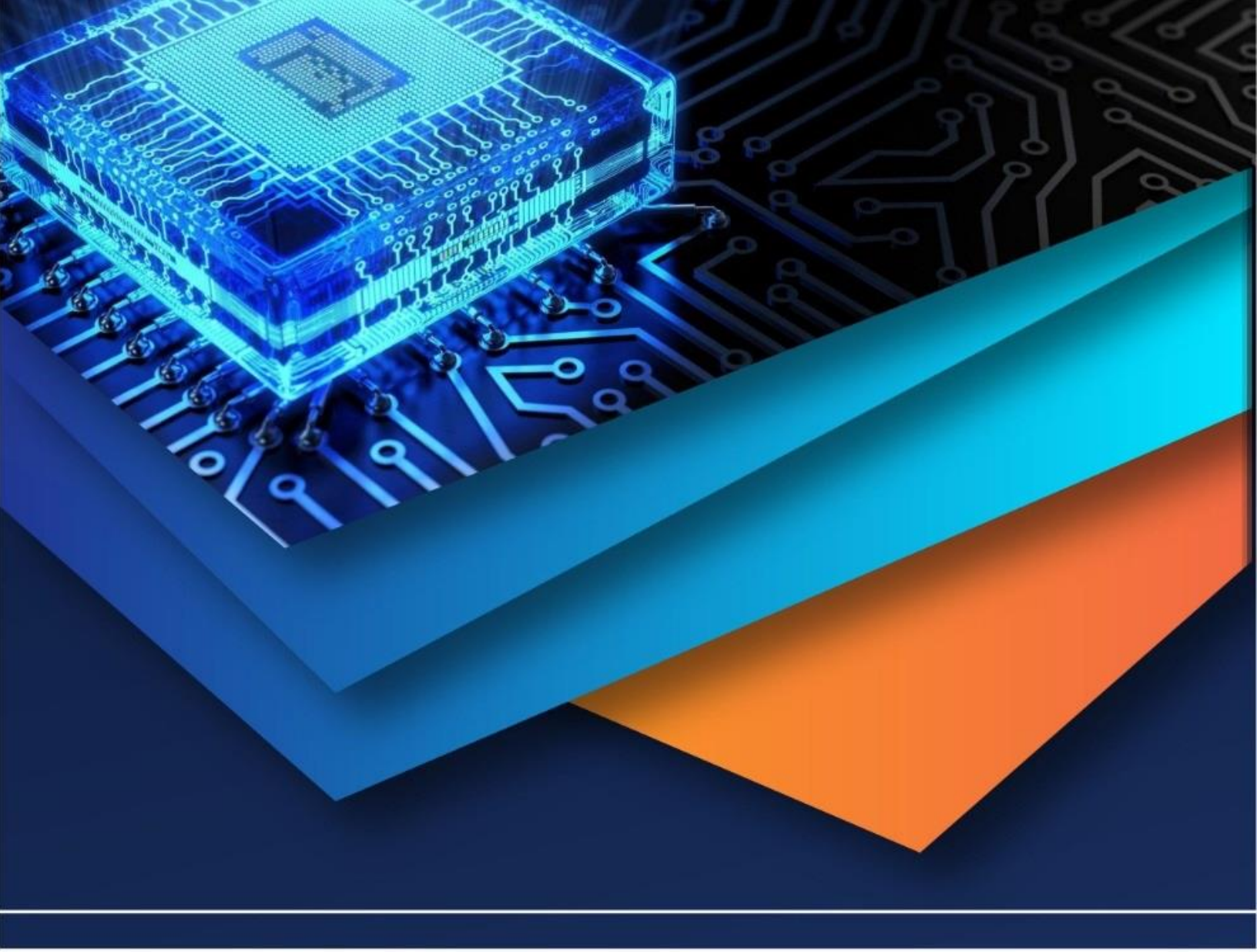
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