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Face Mask Detection Using Image Processing and Deep Learning

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ABSTRACT

Researchers will use deep learning to improve face mask detection technologies at COVID 19, which will take place in May. The concept of deep learning has given rise to the development of a variety of different types of learning systems. It is necessary to improve the precision and effectiveness of the deep learning processes that are now in use. In this work, an attempt is made to limit the spread of the Corona virus among local people using a technology that is based on deep learning and can recognise disguised identities in public locations. It is possible to successfully deal with occlusions in crowded environments by using a mix of single-stage and two-stage detectors. In spite of its speed, the ensemble approach ought to provide results that are highly precise. Previous work on topics such as the Internet of Things, pattern rearrangement, and face mask detection assisted in the discovery of research challenges associated with this topic. Combining compression, edge detection, and a neural network is an interesting concept with the goal of improving performance while maintaining or improving accuracy. The f-score, the recall value, and precision are the metrics that are used to evaluate the performance and accuracy of a researcher.

Keywords: Image processing, Deep Learning, Face mask Detection, Convolution network layer, RESNET

INTRODUCTION

In certain locations, neural classifier technology has been installed in order to verify whether or not visitors are wearing masks before allowing them access to the premises. The process of semantic segmentation is one of the first phases in face recognition. A neural classifier may be used to figure out what kind of mask a person has on their face. There is a connection between face mask detection and video surveillance. A notification system that is based on the Internet of Things does not need a mask as a consequence of this. The cameras are connected to the internet so that everyone may feel secure. A warning is sent if an Internet of Things device is unable to identify a person who is not concealing their identity using a mask. There has been a growth in the number of surveillance operations that make use of intelligent CCTV systems. The use of Internet of Things (IoT) devices [11, 12 and 13] that are compatible with video surveillance systems is growing. The use of this form of apparatus is often utilised in the monitoring of the population density in public areas. This device may provide a warning or trigger an alert in the event that an individual in a crowded area is discovered to be without a face mask. It is also able to identify people who are in close proximity to the system.

Deep learning is being used by researchers at COVID 19 with the intention of improving face mask detection. The idea of "deep learning" has been the foundation for the development of a variety of different systems. Despite this, there remains room for improvement in both the accuracy and efficiency of deep learning. This study makes use of a technology that is based on deep learning in order to recognise masked faces in public spaces. The goal of this research is to decrease the spread of the Coronavirus. The proposed model makes use of a multi-stage detector in addition to a sequence of single-stage detectors in order to cope with the vast range of occlusions that may occur in an area that is highly inhabited.

The use of the ensemble methodology ought to result in a substantial cutback in the amount of time required for the detection process. It is anticipated that the accuracy of the mask detection will be more than 98% despite the fact that the average inference time per photo would be less than 0.05 seconds. By implementing these strategies, the imbalance ratio ought to be reduced to the greatest extent possible. Transfer learning and bounding box affine transformations were also used in the construction of the exceptionally successful model. It is anticipated that using mask detection in combination with the modified bounding box would result in better outcomes. It has been discovered that pre-trained models, such as ResNet 50, which are trained on huge datasets, such as ImageNet, provide for excellent jumping off places for transfer learning models. Experiments were run using the three baseline models that are used most often, which are Resnet50, AlexNet, and Mobile Net. This allowed for the collection of results. When put through its paces, ResNet 50 has shown that it is capable of attaining an accuracy level equivalent to 98.2 percent.

Challenge & Issue

It is possible that in order to halt the growth of the illness, it will be necessary to conduct education and awareness efforts among the general population. In order for this initiative to be effective, it is necessary to locate areas that are considered to have a high risk of infection, educate the general population, and take preventative measures against the sickness. It is vital that the highest priority be put on preventing the infectious illness and raising awareness about it. In Indian society, every individual, even total strangers, is dependant on the other members of society. Because there was so much frequent hand-holding and bumping going on during the pandemic, people were strongly discouraged from maintaining a social distance from one another. This was due to the fact that there was so much hand-holding and bumping going on. People have been spotted swarming into places of worship, transportation, and even establishments selling alcoholic drinks when the curfew is in effect. These instances have occurred during the hours that the curfew is in effect. The decision made by COVID19 to allow horizontal distancing in India has directly contributed to a significant worsening of the country's preexisting inequality.

1.2 Detection of Face Mask

In order to ensure that visitors are not concealing their identities using masks, neural classifiers have been used. When a person's face is caught on camera for the very first time, a process known as semantic segmentation takes place. It is possible to ascertain the contours of a mask by using facial neural classifiers. In more recent generations of intelligent surveillance systems, the ability to recognize masked faces has been included. It is now possible to make use of the mask-absence notification system that is based on the Internet of Things. For reasons pertaining to security, the cameras are linked to the internet. In the event that a mask pattern is not identified, an Internet of Things device can sound an alert and inform the relevant authorities. In recent years, there has been a discernible rise in the use of CCTV surveillance systems that are equipped with AI.

1.3 Face mask detection using image processing and machine learning

In order to resize, resample, compare, and otherwise alter the appearance of graphical components, image processing methods are the ones that are used most often. It is feasible to use convolutional neural networks (CNNs) to evaluate photographs of individuals who are concealing their identities by wearing masks. Although the CNN-based classification method is effective, there are a few downsides to using this strategy. During the recent COVID-19 epidemic, there was no improvement in face mask detection. Despite the fact that various research have been conducted in the area of image processing, predicting a picture still takes a considerable amount of time. The amount of space that is taken up by graphics might be rather large.

According to the results of the research, it could be able to make more accurate predictions in a shorter amount of time and use less space than was previously believed to be possible. Researchers have focused the majority of their efforts, for the most part, on locating and eliminating the limitations of the already available research and methods of image processing.

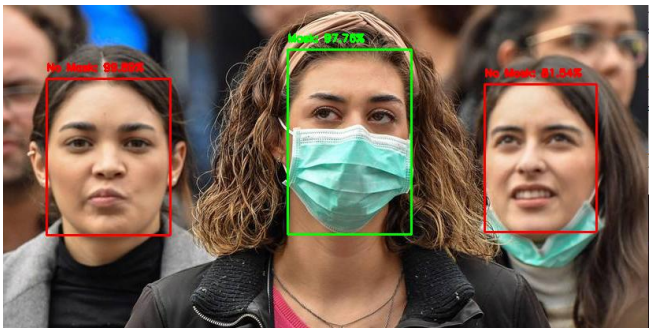

Fig 1 Face Mask detection

A recent research suggests that an compression-based convolution neural network could be able to identify masks worn by people's faces. By removing graphical components that are not necessary from the representation, it is possible to reduce the amount of time required to apply convolutional neural networks. As an additional benefit, this meant that the storage space needed for the graphical dataset was reduced. As more and more data sets become available, it becomes more challenging to make meaningful comparisons across different collections of data. The implementation of the recommended strategy will be highly dependent on the programming language MATLAB. In a number of computer simulations, more recent methods and algorithms get better results than their predecessors. It has been shown that traditional approaches to the identification of face masks are unsuccessful. In

principle, the new method should provide more accurate results than the previous one did. For the purpose of improving the efficiency of face mask recognition, the suggested study will make use of edge detection algorithms. These gadgets, when used in combination with video surveillance systems, have the potential to notify authorities if an individual does not remove their mask. In the event that a mask pattern worn by an unidentified person cannot be decoded, an alert will be triggered.

LITERATURE REVIEW

The identification of face masks has been the subject of a significant amount of study. In order to investigate face mask detection, semantic segmentation [1] as well as other works were used. The Internet of Things (IoT), for instance, was used in the development of an improved neural classifier that can differentiate between the various shapes of micro screws [3]. [4] Among the most popular Internet of Things-based solutions are Raspberry Pi-based smart surveillance security solutions. These solutions place an emphasis on protecting users' privacy and safety in internet-connected cameras. There has been a great deal of discussion in the past on the technology, applications, and potential repercussions of smart surveillance. A number of writers [9, 10] have advocated for the use of intelligent CCTVs as well as other high-tech surveillance systems. Vision-based intelligent home automation and security systems have been the subject of study conducted by a number of researchers, including the author of this article. During the course of our work on this topic, we investigated graphical classification using both digital image processing (14), as well as adaptive, high-performance CNNs. Research using convolutional neural networks (CNNs) [16,17] has been conducted on the subject of character recognition in handwriting. Deep CNNs [19], which are a kind of CNNs, were used to classify the images. During the process of face feature optimisation, a comparison was made between histogram-based picture enhancement and different edge detection techniques, as well as Bezier curves and multiple edge detection approaches. L Guo and colleagues conducted research in 2019 on an FDTD approach that was based on a recurrent CNN. CNN's method of decision-making has been significantly influenced as a result of the methodology. In 2018, improvements in bug localization were achieved with the combined use of CNN and RNN at the character level. CNN is an excellent news and information source. B In 2019, Abdul Qayyum and his colleagues may diagnose a disorder related to the patient's emotional state. If you want to have a conversation with other people, you should talk to other people. The year 2020 will be G. [26] Convolutional neural networks (CNNs) were used by Lou et al. in order to successfully identify persons in photographs. The ability to recognise faces was the primary focus of these research. It was discovered that a CNN is the most effective technique for determining attributes. In 2019, Almakky et al. [27] conducted a research in which they used deep convolutional neural networks for the purpose of text localization. The investigation relied on information taken from published medical studies. As a consequence of this, the scope of our research was restricted to the analysis of textual data. In 2019, Samudre et al. [28] suggested using a computational strategy to increase the effectiveness of a CNN in order to improve its performance. S suggested using EDA as the basis for a system that could recognise visual edges. Research was conducted by U. Lihua and his colleagues [29] in the year 2010. In the course of our investigation, we are using a novel approach to examining the candidate selection process. S. drew parallels between red blood cells and video graphics edge detecting operators in a paper he wrote about his research. (2013) The Suwanmanee and Company, Ltd. The processing of graphical images has been the subject of a lot of effort recently. E. suggested employing multi-level morphological fuzzy edge detection for colour graphics. This was his suggestion. Perumal et al. reported their findings in 2017 in a scientific journal. This method is used in order to arrive at a conclusion on an example of fuzzy logic. In 2019, Q was responsible for carrying out real-time monitoring of floods. According to the findings of Zhang et al.,

Problem Statement

A number of pattern recognition methods, including SVM, CNN, and RF, have been shown to be successful. The majority of the goals of the earlier inquiries have been achieved over the course of this research. to check the accuracy of the sorting that was performed on the data. A number of analyses have been carried out in order to ascertain whether or not every algorithm generates credible conclusions. When it comes to analysing and categorising text data, SVM performs far better than CNN, as our assessment of the relevant literature has shown. In spite of the many advantages it offers, pattern detecting technologies need more investigation. In spite of these restrictions, the current CNN model offers a great deal of room for development in the future. Comparing the visual content of two different things takes a lot of time. As a consequence of this, the existing CNN models need certain improvements. Further development of a pattern recognition model is required in order to make optimal use of CNN's capabilities. The tests that were conducted by CNN hardly scratched the surface in terms of how accurate and effective the system is.

Significance of work

Research has been conducted into the Internet of Things as well as pattern identification utilising convolutional neural networks. After then, a discussion of the findings took place. Researchers in this industry face a variety of obstacles, including differences in performance and accuracy. When the data has been compressed to the

appropriate level, it may then be used to locate edges and construct an appropriate learning model. The efficiency as well as the precision of the model that has been developed will be examined. The raw photos that are collected by spacecraft, space probes, aeroplanes, and even people on the ground may be enhanced by a method that is termed "Image Processing." The algorithms used for image processing have seen significant development during the last four or five decades. When editing photographs, you should get rid of any information that doesn't contribute to the overall effect. Examining something's colour, pattern, limits, stiffness, and general shape are necessary steps in arriving at an accurate description of that thing.

Implementation of Proposed work

In the present line of study, image data is processed utilising edge detection algorithms in order to cut down on the amount of time spent training and testing. In addition, using this method would result in more accurate conclusions being taken from the research that was conducted. In this part, a summary is provided for the proposed study, including an explanation of its aim, approach, and flowchart. The simulated factors are also taken into consideration, as previously mentioned. The current methods of face mask identification and detection are going to be investigated as part of this planned study. Several deficiencies were found in the conventional pattern identification procedures when they were investigated in detail. Researchers have developed a methodology for the identification of masks that makes use of an compression-based CNN algorithm. For the purpose of carrying out the implementation of the technique, the proposed effort should make use of MATLAB. A comparison has been made between the newly developed method and algorithm and the one that was previously used. It is anticipated that using traditional procedures would take up more time than using the strategy that was recommended.

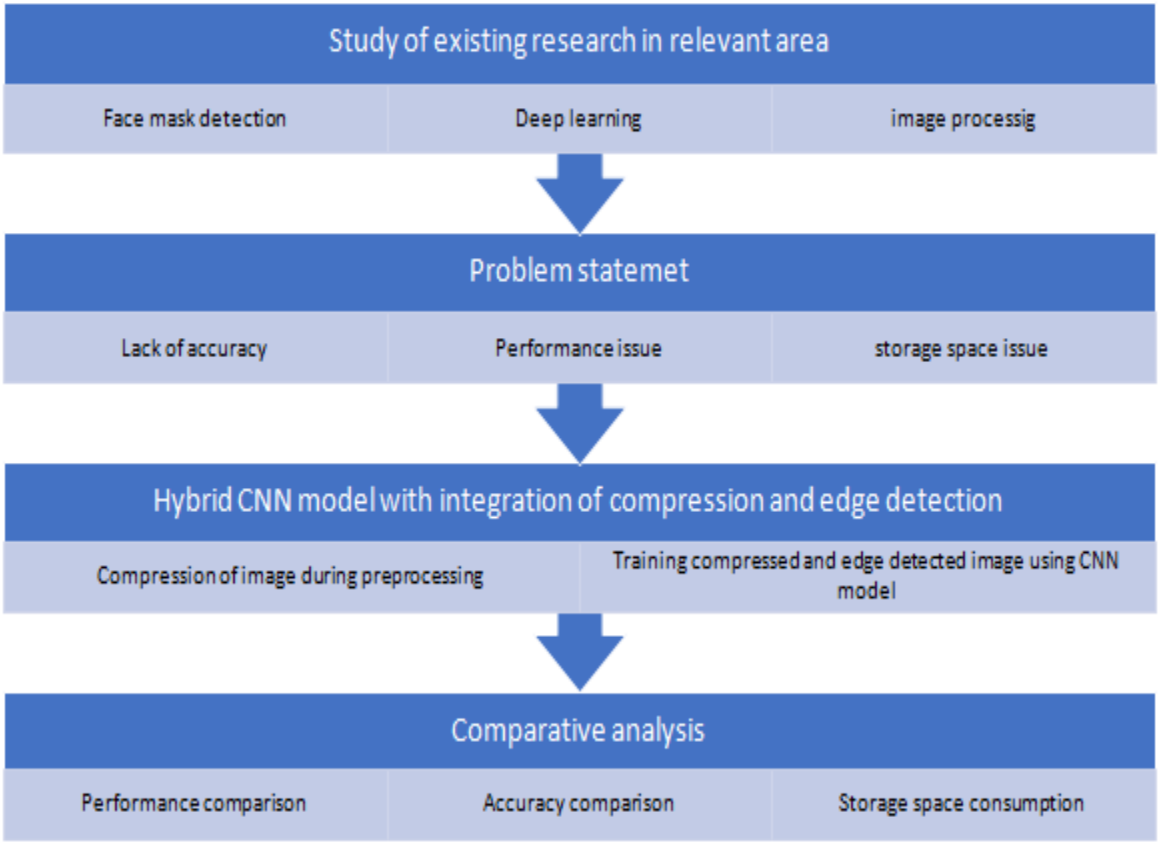

Fig 2 Proposed research methodology

Simulation for Accuracy comparison

According to this study, the implementation of compression-based CNNs takes much less time than that of standard CNNs. The following graph illustrates the difference in accuracy that would have been required to implement the traditional method as opposed to the one that they proposed.

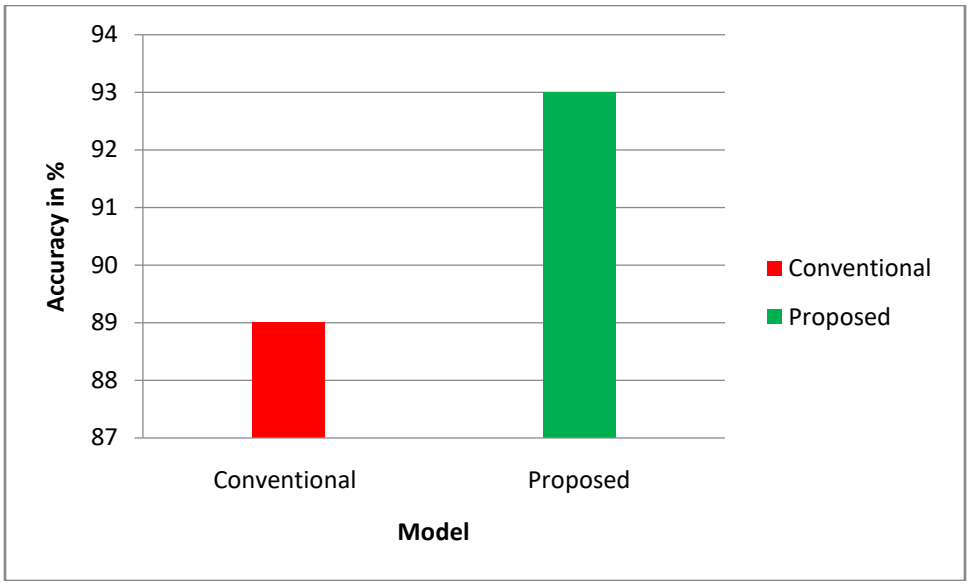

Fig 3 Accuracy for traditional and proposed

Simulation for Time comparison

According to this study, the implementation of compression-based CNNs takes much less time than that of standard CNNs. The following graph illustrates the difference in amount of time that would have been required to implement the traditional method as opposed to the one that they proposed.

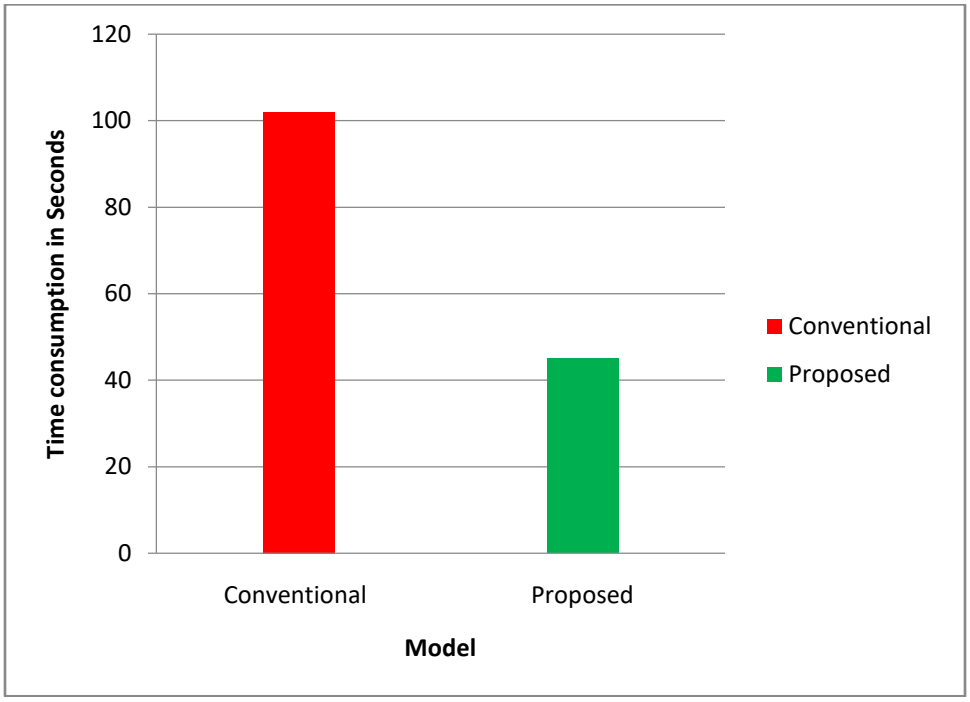

Fig 4 Time consumption for traditional and proposed

Simulation for space consumption

Edge detection has the added benefit of reducing the amount of space that the data set needs to store its information. The required amount of floor space for both traditional solutions and proposed ones is shown in the graph below.

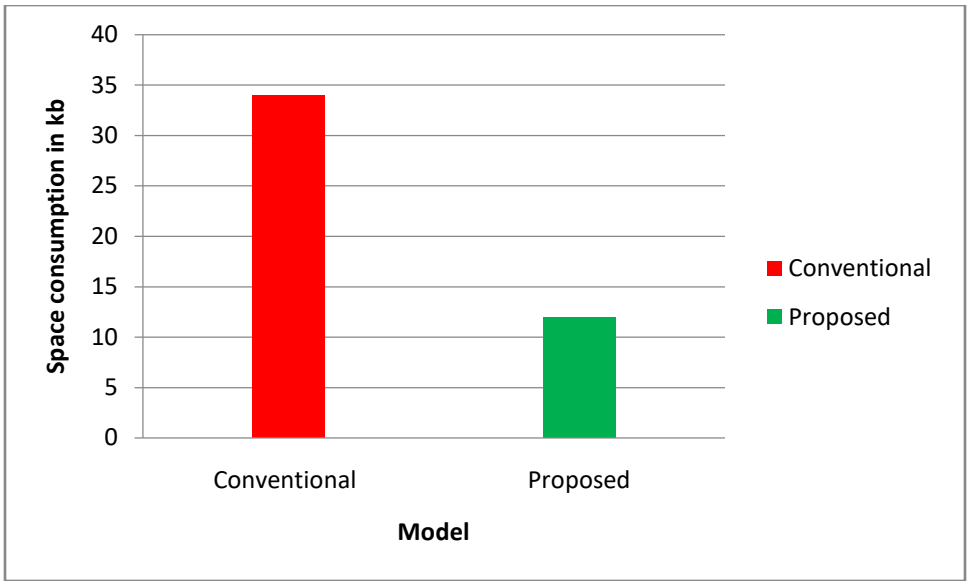

Fig 5 Space consumption for traditional and proposed

CONCLUSION

According to the findings, using compression takes far less time investment than the current CNN technique does. In contrast, graphical illustrations use a comparatively little amount of space. Because of this change, neither the categorization nor the prediction techniques will be altered in any way. Neuroscientists have high hopes that the planned study would result in convolution neural networks with improved decision-making capabilities. According to the simulation, the accuracy of this method is increased in comparison to the conventional approach. It is possible for the degree of accuracy of a picture to change depending on the size of the picture as well as the degree to which an image dataset has been modified. According to the findings of conventional research, CNNs are superior over SVMs when it comes to the analysis and classification of graphical data; nevertheless, SVMs are superior when it comes to textual data. It's possible that CNN's face mask detecting system needs additional development. SVM, as opposed to CNN, places more emphasis on textual data, whereas CNN places more emphasis on graphical data. In CNN, the use of layers is what's required to detect the characteristics of a mask-based data collection. According to one of the hypotheses put up in this research, the effectiveness of the traditional neural network model may be improved by using image compression strategy.

Scope of Research

When it comes to pattern recognition, each of these algorithms has shown that they have potential. The majority of the objectives of the previous paradigm have been accomplished by the research that is being done now. In this particular instance, the correctness of the data arrangement was investigated. Accuracy is a crucial parameter that is used in order to evaluate the overall performance of an algorithm. According to the findings of the study, SVM performs much better than CNN in terms of textual data as well as graphical evaluations and classifications. Making comparisons between visual elements takes a lot of time. As a result of this, a significant amount of research has been conducted with the intention of boosting both the speed of detection and the accuracy of detecting persons who are hiding behind masks.

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