FACE MASK DETECTION USING DEEP LEARNING

K JYOTHI Student, M.Tech (CS), Department of Information Technology, JNTU Hyderabad, Hyderabad, India
G PRAVEEN BABU Professor of CS, Department of Information Technology, JNTU Hyderabad, Hyderabad, India

ABSTRACT:
Everyone has learned the value of face masks in their lives as a result of the COVID-19 pandemic. A person can spread the contagious virus known as Severe Acute Respiratory Syndrome (SARS-COV-2) by sneezing or talking and releasing respiratory droplets. It is transferred by coming into contact with an infected person or by touching an infected surface. Wearing face masks is being encouraged by local authorities and World Health Organization healthcare workers as one of the complete ways to combat the transmission. As technology has advanced, 'Computer Vision' and 'deep learning' have emerged as efficient methods for image processing-based recognition. It has a 95% accuracy rate after being trained on a dataset of about 10,000 photos with width and height measurements of 200 by 200. To select the best model for this kind, a Convolutional Neural Network (CNN) was used to train and build this model for distinguishing accuracy. It can be used to determine if a person is following a COVID-19 regulations or not in public places including offices, schools, railroads, and airports. An economical and effective method of establishing a safe environment in an industrial setting using artificial intelligence (AI). For face mask identification, a hybrid model combining deep and traditional machine learning will be showcased. Images with and without masks make up a face mask detection dataset. This project uses Python, Computer Vision (CV), Tensor Flow, and Keras to develop a COVID-19 face mask detector using the dataset. Our objective is to use computer vision and deep learning to determine whether the individual in the image or video stream is wearing a face mask.

1. INTRODUCTION

Since December 2019, the COVID-19 pandemic has created a lasting effect on numerous nations throughout the planet. Wuhan, China, is where it started. As of March 11, 2020, the "WHO" deemed it a fatal illness that has spread over the globe and had a significant impact on 114 nations. The virus spreads through air space to opposite person when the infected person communicate or sneezes, the water droplets from their nose or mouth disseminate through the air and affect other peoples within the vicinity. The problem of mask detection has not yet been adequately addressed, despite efforts to address other issues including social alienation and sanitization. Mask wearing is essential, particularly for those who are more susceptible to serious disease from COVID-19 infections. The spread of COVID-19 has been shown to occur mostly amongst communities that are within close proximity to one other (which is almost 6 feet); it is spread by individuals who are asymptomatic and do not realize they are infected. As a result, the Centers for Prevention and Control of Diseases recommended mask wearing in public for all people two years of age and older, especially in situations where other forms of social distancing are difficult to adhere to. Therefore, reducing the chance of this deadly virus transferring across an infected individual to a healthy one greatly reduces both the virus's transmission and the extent of the illness.

ISSN: 2278-4632
Vol-14, Issue-11, November: 2024

2. LITERATURE SURVEY:

2.1 Efficient Masked Face Recognition Method during the COVID-19 Pandemic

Authors: Walid Hariri

The COVID-19 is an unparalleled crisis leading to huge number of casualties and security problems. In order to reduce the spread of coronavirus, people often wear masks to protect themselves. This makes the face recognition a very difficult task since certain parts of the face are hidden. A primary focus of researchers during the ongoing coronavirus pandemic is to come up with suggestions to handle this problem through rapid and efficient solutions.

2.2 COVID-19 FACE MASK DETECTION WITH DEEP LEARNING AND COMPUTER VISION

Authors: Vinitha.V1, Velantina.V2.

The mask face detection model that is based on computer vision and deep learning. The model is integration between deep learning and classical machine learning techniques with OpenCV, tensor flow and Keras. We have used deep transfer leering for feature extractions and combined it with three classical machine learning algorithms. We introduced a comparison between them to find the most suitable algorithm that achieved the highest accuracy and consumed the least time in the process of training and detection.

2.3 Face Recognition Systems: A Survey

Authors: Yassin Kortli, Maher Jridi, Ayman Al Falou, and Mohamed Atri.

The objective of developing biometric applications, such as facial recognition, has recently become important in smart cities. Besides, many scientists and engineers around the world have focused on establishing increasingly robust and accurate algorithms and methods for these types of systems and their application in everyday life.

All types of security systems must protect all personal data. The most commonly used type for recognition is the password. However, through the development of information technologies and security algorithms, many systems are beginning to use many biometric factors for the recognition task.

These biometric factors make it possible to identify people's identities by their physiological or behavioral characteristics. They also provide several advantages, for example, the presence of a person in front of the sensor is sufficient, and there is no more need to remember several passwords or confidential codes anymore.

3. METHODOLOGY:

3.1 DEEP LEARNING:

Deep learning is an AI function that mimics how the mind of humans processes information so as to analyze data for use in identifying objects, recognition of speech, translation of language, and decision-making.

Deep learning AI can be trained on unlabelled and unstructured data without human oversight. Face mask detection is built using convolution neural networks (CNN), a deep learning technique. Deep learning approaches aim to learn feature hierarchies by using characteristics from higher levels of the hierarchy that are produced by the synthesis of lower-level features. By autonomously acquiring characteristics at several layers of abstraction, systems can learn complicated tasks mapping inputs to the outputs directly from data without fully depending on human-crafted features. Deep learning methods use an unidentified architecture in the distribution of inputs to identify appropriate representations, often at many

ISSN: 2278-4632
Vol-14, Issue-11, November: 2024

levels, of higher-level learned features represented in terms of lower-level qualities.

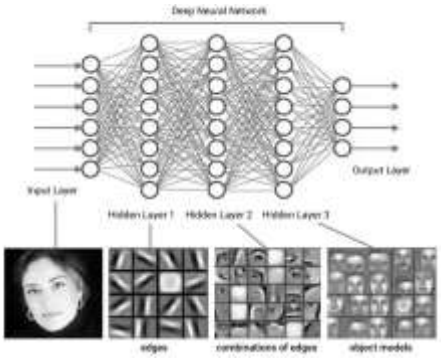


Fig 3.1 Deep Learning

4. Convolution Neural Network:

Convolutional neural networks, often known as CNNs or ConvNets, are a family of deep, feed-forward artificial neural networks used in deep learning. They are most frequently used for visual imagery analysis.

Because the connecting pattern between neurons is similar to how the visual brain is organized, convolutional networks were motivated by biological processes. CNNs need somewhat less pre-processing than other image categorization techniques. CNN is a special kind of multi-layer neural network that processes 2-d arrays, usually pictures, using spatially localized neural input. CNN The goal is to identify patterns by establishing "patterns of patterns". Patches from earlier layers are combined in each layer. Multiple stages make up the trainable multistage architectures known as convolutional networks. Each stage's input and output are feature maps, which are collections of arrays. Every feature map in the output reflects a specific feature that was taken from the input at every place. Filter bank layers, non-linearity layers, and feature pooling layers make up each stage. One, two, or three of these layers make up a ConvNet.

Their are three main types of layers to build ConvNet architectures: Convolutional Layer**,** Pooling Layer**,** and Fully-Connected Layer.

- INPUT [32x32x3] will save the image's raw pixel values; in this example, the image has three colour channels (R, G, and B) and measures 32 by 32 by 32.
- The CONV layer will calculate the output of neurons connected to local input regions. Each neuron will calculate the dot product of its weights and the input volume's small region to which it is attached. If we want to utilize 12 filters, the volume may be [32x32x12].
- RELU layer will apply an element wise activation function, such as the max(0,x)max(0,x) thresholding at zero. This leaves the size of the volume unchanged ([32x32x12]).
- POOL layer will perform a downsampling operation along the spatial dimensions (width, height), resulting in volume such as [16x16x12].
- FC (i.e. fully-connected) layer will compute the class scores, resulting in volume of size [1x1x10], where each of the 10 numbers correspond to a class score, such as among the 10 categories of CIFAR-10. As with ordinary Neural Networks and as the name implies, each neuron in this layer will be connected to all the numbers in the previous volume.

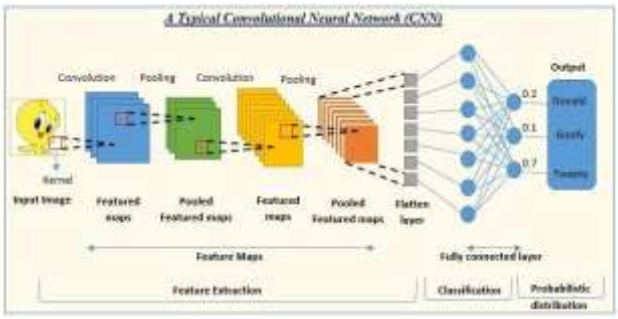


Fig 4 Convolutional Neural Network

5. Algorithm:

A real-time face mask identification system has been created with the aid of a combination of CNN and deep learning approaches. For face detection, the picture segmentation method yields reliable and efficient results. According to face-reading, more over half of the participants were able to correctly identify if a or not the person was wearing a mask. The face mask

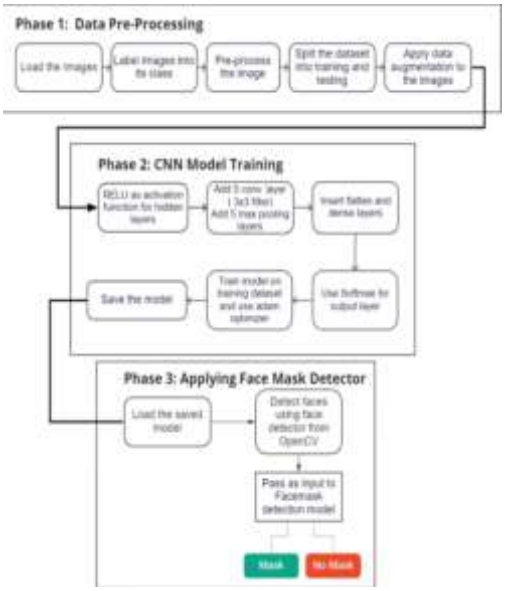
ISSN: 2278-4632
Vol-14, Issue-11, November: 2024

detection process's technique is explained via algorithms.

Face Mask Detection Algorithm

- Step 1: Create Dataset (Arrays).
- Step 2: Create python file Train Mask Detector and import libraries.
- Step 3: Append images to data List.
- Step 4: Go through Path and Create Loops for Images with and without Mask.
- Step 5: Use Keras and MobilenetV2 for preprocessing.
- Step 6: Use Label by arrays method which includes sklearn module.
- Step 7: For deep learning Model Convert into numpy Arrays.
- Step 8: Track the Accuracy Matrix to save generated model.
- Step 9: Plot the accuracy using matplotlib. Run and check the Accuracy.
- Step 10: Train the model by images/Live Webcam to check whether the person is wearing a mask or not.

6. SYSTEM ARCHITECTURE:



Phase 1: Data pre-process.

- Firstly the images are labelled as classes, then pre-process the image.
- After pre-processing the data split the dataset into training and trained dataset, then apply data augmentation to the images.

Phase 2: CNN Model Training.

- A Convolutional Neural Network (ConvNet/CNN) it will take an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other.

Phase 3: Applying Face Mask Detector.

- The face will be captured, detected and the model will predict the output by providing us bounding boxes around the region showing us whether the person is wearing mask or not. If the camera captures a face without a mask it will show as a red colored bounded box.

7. EXPERIMENTAL RESULTS

Detection of face mask through Images

ISSN: 2278-4632
Vol-14, Issue-11, November: 2024

Screenshot-7.1 Input image with mask

The above image describes the sample of person wearing a mask.

Screenshot-7.2 Result Detected By Model (with mask)

The above image is detected by the CNN model and displayed as the person is wearing a mask.

8. CONCLUSION

This work aims to prevent the spread of the coronavirus by presenting a deep learning-based approach for detecting masks on faces in public places. At the pre-processing level, the proposed solution efficiently handles blockages under crowded conditions by employing a group of single and two-stage detectors ensemble. The ensemble approach not only aids in achieving high accuracy but also greatly accelerates detection speed. Future research and development can focus on the system's ability to withstand challenging lighting conditions, occlusions, and shifts in face orientations.

9. REFERENCES

1) M. S. Ejaz and M. R. Islam, "Masked Face Recognition Using Convolutional Neural Network," 2019 International Conference on Sustainable Technologies for Industry 4.0 (STI), 2019, pp. 1-6, doi: 10.1109/STI47673.2019.9068044.

2) M. R. Bhuiyan, S. A. Khushbu and M. S. Islam, "A Deep Learning Based Assistive System to Classify COVID-19 Face Mask for Human Safety with YOLOv3," 2020 11th International Conference on Computing, Communication and Networking Technologies (ICCCNT)

3) M. M. Rahman, M. M. H. Manik, M. M. Islam, S. Mahmud and J. -H. Kim, "An Automated System to Limit COVID-19 Using Facial Mask Detection in Smart City Network," 2020 IEEE International IOT, Electronics and Mechatronics Conference (IEMTRONICS), 2020

4) Y. Sun, Y. Chen, X. Wang, and X. Tang, “Deep learning face representation by joint identification-verification,” in Advances in neural information processing systems, 2014, pp. 198hy, A. Khosla, M. Bernstein, A. C. Berg, and L. Fei-Fei, “ImageNet Large Scale Visual Recognition Challenge,” 2014.

5) X. Cao, D. Wipf, F. Wen, G. Duan, and J. Sun, “A practical transfer learning algorithm for face verification,” in Computer Vision (ICCV), 2013 IEEE International Conference on, pp. 3208–3215, IE8–1996.

6) W. Zhao, R. Chellappa, P. J. Phillips, and A. Rosenfeld, “Face recognition: A literature survey,” ACM computing surveys (CSUR), vol. 35, no. 4, pp. 399–458, 2003.

7) O. Russakovsky, J. Deng, H. Su, J. Krause, S. Satheesh, S. Ma, Z. Huang, A. KarpatEE, 2013.