Deep Learning Framework to Detect Face Masks from Video Footage

Aishwarya Takale, Vaishnavi Dubey, Ganesh Kinage
Department of Computer Science, Padmabhooshan Vasantdada Patil Institute of Technology (PVPIT)

Complete detail of each student(s)

Full Name (Student 1): Aishwarya Takale
Affiliation (Department and College/University): Department of Computer Science, Savitribai Phule Pune University
Academic year/Semester: 8th Semester
Course level: (Master/Bachelor): Bachelor
Course name: Bachelor of Engineering
Course year/semester:8th Semester
email id:aishwaryatakale2000@gmail.com

Full Name (Student 2): Vaishnavi Dubey
Affiliation (Department and College/University): Department of Computer Science, Savitribai Phule Pune University
Academic year/Semester: 8th Semester
Course level: (Master/Bachelor): Bachelor
Course name: Bachelor of Engineering
Course year/semester:8th Semester
email id:286dubeyvaishnavi@gmail.com

Full Name (Student 3): Ganesh Kinage
Affiliation (Department and College/University): Department of Computer Science, Savitribai Phule Pune University
Academic year/Semester: 8th Semester
Course level: (Master/Bachelor): Bachelor
Course name: Bachelor of Engineering
Course year/semester:8th Semester
email id:ganeshkinage2@gmail.com

Complete detail of each supervisor(s)

Full Name (Supervisor 1): Prof. Sarika Bodake
Affiliation (Department and College/University) with postal address: Department of Computer Science, Savitribai Phule Pune University
Post/Rank: Head of Department
email id: sarikasjadhav@gmail.com

Abstract— The current COVID-19 scenario necessitates an effective face mask detection application. The project's major purpose is to put this system in place at college entrances, airports, hospitals, and offices where the possibilities of COVID-19 spreading through infection are greatest. Real-time deep learning was applied in our proposal. Face mask detection and classification models according to reports, that wearing a face mask at work lessens the chance of getting sick transmission. It's an issue with object detection and classification with two separate classes (Mask and Without Mask). A mix of Face detection model based on deep and traditional machine learning, a mask will be shown. This face mask detector is built with Python, Open CV, Tensor Flow, and Keras and is based on a dataset. Everyone should inspect their face before entering the building and make sure they have a mask with them. If anybody is discovered to be missing, a beep alarm will be issued if you wear a face mask.

Keywords: COVID-19, Open CV, Python, CNN, Keras etc.

1. INTRODUCTION

Coronavirus disease 2019 (COVID-19) has infected over 2.7 million individuals worldwide and killed over 180,000 people, according to the report. In addition, there have been several similar large-scale deadly respiratory infections in recent years, such as severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS). The reproductive number of COVID-19 is larger than that of SARS, according to Liu et al. As a result, an increasing number of people are concerned about their health, and governments regard public health to be a major priority. Thankfully, Leung et al. Fortunately, Leung et colleagues, shown that surgical face masks helped reduce coronavirus transmission. At the moment, WHO recommends that people should wear face masks if they have respiratory symptoms, or they are taking care of the people with symptoms. Furthermore, several public service providers insist that clients only use their services if they wear masks. As a result, face mask identification has become a critical computer vision problem for assisting the global civilization, yet research on the topic is scarce.

2. PROBLEM STATEMENT

We will use Open CV, Tensor Flow, Keras, and Python to determine whether a person is wearing a mask or not, and our face mask detection is trained using CNN model and ML method. As a result, it will sort people and provide alerts automatically. It can be brought to a close if everyone observes the safety precautions. As a result, we expect that this module will assist in detecting people wearing masks to work.

3. LITERATURE SURVEY

Shabir Hussain, Yang Yu, Muhammad Ayoub , Akmal Khan , Rukhshanda Rehman , Junaid Abdul Wahid and Weiyan Hou ,et.al [1] COVID-19's spread has reached pandemic proportions, with the virus now infecting over 200 countries in just a few months. The virus is spreading swiftly through direct and indirect contacts in this period of COVID-19 emergency, especially when precautions are still required and produced vaccines are not yet available to all developing countries in the initial phase of vaccine distribution. Manual disinfection systems

have also become a source of infection due to their widespread use. To reduce the possibilities and risk of COVID-19 spreading, this study intends to design and construct a low-cost, quick, scalable, and effective virus spread control and screening system. For all public locations entrances, we proposed an IoT-based Smart Screening and Disinfection Walkthrough Gate (SSDWG). The SSDWG is intended for quick screening, comprising temperature measurement with a contact-free sensor and the storage of the suspected individual's record for future management and monitoring. Real-time deep learning models for face mask recognition and classification were also integrated in our suggested IoT-based screening system. Using a transfer learning technique, this module identified individuals who wear the face mask appropriately, badly, and without a face mask using VGG-16, MobileNetV2, Inception v3, ResNet-50, and CNN. In the mask detection and classification module, we achieved the greatest accuracy of 99.81 percent using VGG-16 and the second highest accuracy of 99.6 percent using MobileNetV2. We also used classification to categories the individuals' face masks, which were either N-95 or surgical masks. We also compared the outcomes of our proposed system to state-of-the-art approaches, and we strongly advised that our system may be utilized to prevent local transmission of COVID-19 and lower the risk of human infection.

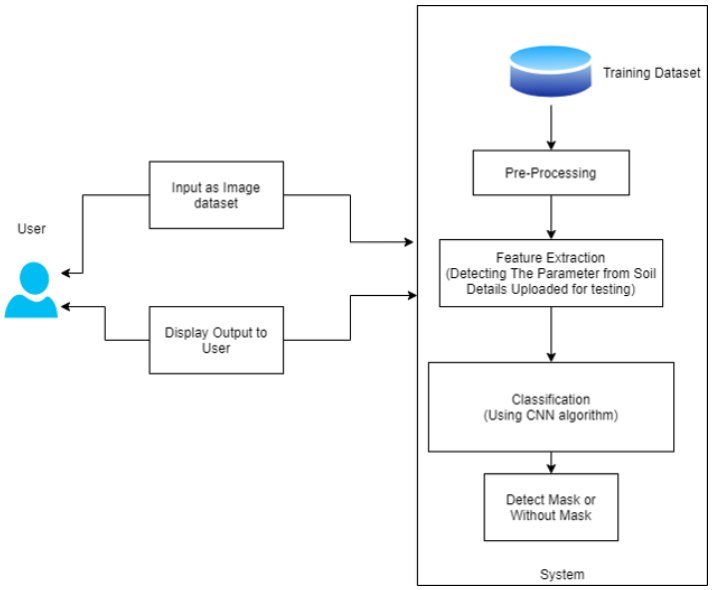
Arjya Das, Mohammad Wasif Ansari, Rohini Basak,et.al [2] The COVID-19 epidemic has had a dramatic impact on our daily lives, disrupting global trade and transportation. Protecting one's face with a mask has become the new normal. Many public service providers will need clients to wear masks correctly in the near future in order to use their services. As a result, detecting face masks has become a critical responsibility in aiding worldwide society. This paper proposes a simplified approach to accomplishing this goal utilizing Tensor Flow, Keras, Open CV, and Scikit -Learn, as well as some basic Machine Learning packages. The suggested approach successfully detects the face in the image and then determines whether or not it is covered by a mask. It can also detect a face and a mask in motion as a surveillance task performance. 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.

Parul Maurya Sejal Nayak Samarth Vijayvargiya Megha Patidar,et.al [3] The current COVID-19 scenario necessitates an effective face mask detection application. The project's major purpose is to put this system in place at college entrances, airlines, hospitals, and offices where the risk of COVID-19 spreading through contagion is highest. According to reports, wearing a face mask while at work significantly minimizes the chance of transmission. It's a problem of object recognition and classification with two classes (Mask and Without Mask). For recognizing face masks, a hybrid model combining deep and traditional machine learning will be shown. This face mask detector is built with Python, Open CV, Tensor Flow, and Keras and is based on a dataset. Everyone should inspect their face before entering the building and make sure they have a mask with them. A beep alert will be triggered if somebody is found without a face mask. As a result, all of the workplaces are reopening.

Gokul Sudheesh Kumar and Sujala D. Shetty,et al [4] using Machine Learning and Object Detection, this research seeks to detect face masks and social separation on a video feed. Tensor Flow and Keras were used to create a CNN model for detecting face masks, which was trained on a dataset of over a million images. There are 3800 photos in total. YOLO Object detection was used to detect and check for persons in a frame.

Calculate the Euclidean distance between the centroids of two groups for social distancing. The crates that were discovered "Stay Safe" is an Android app that allows the user to keep track of their belongings, will be notified and will be able to keep track of the violations. Firebase was utilized to accomplish this is the service in charge of the backend. If a violation is identified, the image will be uploaded to a Firebase Cloud Storage with a message, and the user will be able to view the images, as well as the date and time on their Android app. Notifications were sent using the Firebase Cloud Messaging service, which will be handled by the Android app. Viewing history, storing photographs to the device, and deleting images from the cloud are just some of the options available in the program.

4. SYSTEM DESIGN



Module:

- Preprocessing
- Feature extraction
- Classification
- Deepfake or Real Detection

5. ALGORITHM

CNN - A CNN's input, in this example an image, is processed through a series of filters to produce a labelled output that can then be classed, much like any other neural network. The filtering layers of a CNN, which comprise at least one convolution layer, give it its uniqueness. It can now interpret more complicated images than a traditional neural network. Unlike the latter, which is best suited to basic, well-centered images such as handwritten digits, CNNs are used in image analysis in a variety of applications, ranging from Facebook's automatic tagging algorithms to object categorization and detection, particularly in the field of radiology.

Convolutional Neural Networks (CNNs) are neural networks that specialize in image and video recognition. Image recognition, object detection, and segmentation are among of the most common image analysis tasks that CNN is employed for.

Convolutional Neural Networks have four different sorts of layers:

1. **Convolutional Layer:** Each input neuron in a conventional neural network is linked to the next hidden layer. Only a small portion of the input layer neurons connect to the hidden layer neurons in CNN.
2. **Pooling Layer:** The pooling layer is used to minimize the feature map's dimensionality. Inside the CNN's hidden layer, there will be several activation and pooling layers.
3. **Flatten:** Flattening is the process of transforming data into a one-dimensional array for use in the next layer. To construct a single lengthy feature vector, we flatten the output of the convolutional layers.
4. **Fully Connected Layers:** Fully Connected Layers are the network's final layers. The output from the final Pooling or Convolutional Layer, which is flattened and then fed into the fully connected layer, is the input to the fully connected layer.

Mathematical Model:

Let S stand for the entire system.
S stands for I, P, and O.
I- Input
P- Procedure
O- Output
I - Dataset as Image Format Input (I), where Image Dataset is included in the Dataset
Procedure (P), P = I. The system executes operations and computes the detection.

1. Pre-processing
2. Feature Extraction
3. Separation
4. Detection of the face mask from video footage using CNN Output (O).

6. ADVANTAGES AND DISADVANTAGES:

Advantages:

1. Alerts that are intelligent.
2. Facial Recognition is a type of facial recognition software.
3. Agnostic towards cameras.
4. Implementation is simple.

Disadvantages:

"They don't have control over their personal data." Mask recognition critics believe the new technology could suffer from some of the same flaws as face recognition. Light-skinned people dominate many of the training datasets used for facial recognition.

7. CONCLUSION

In this system, we developed a sophisticated framework for identifying facemask. As the number of cases of covid19 decreases, more and more workplaces are opening with half or full staff. Even educational institutions are slated to open. This device can be deployed in the doors of businesses, educational institutions, public and private workplaces to filter people who are not wearing mask. If the system recognizes a person's face without a mask, a buzzer will sound to remind them to put one on.

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We are making this project not only for marks but also to increase our knowledge.

9. REFERENCES

1. World Health Organization (WHO), "Coronavirus disease 2019 (covid-19): Public health information (CDC) ,Research information (NIH) , SARS-CoV-2 data (NCBI) ,Prevention and treatment information (HHS) , Espanol: Situation report, 205" , 2020.
2. Ying Liu , Albert A Gayle , Annelies Wilder-Smith Joacim Rocklöv: The reproductive number of COVID-19 is higher compared to SARS coronavirus, Jr. National Library of Medicine, National Center for Biotechnology Information, 2020.
3. Centers for Disease Control and Prevention, "Coronavirus Disease 2019 (COVID-19) — Symptoms," 2020. (Online). Visit https://www.cdc.gov/coronavirus/2019-ncov/symptomstesting/symptoms.html for more information. "Coronavirus- Human Coronavirus Types -CDC," Cdc.gov, 2020.
4. "Coronavirus — Human Coronavirus Types — CDC," Cdc.gov, 2020 (Online). The CDC's Coronavirus Types page can be found at https://www.cdc.gov/coronavirus/types.html. 2020.
5. World Health Organization, "Guidance on the Use of Masks in the Context of COVID-19: Interim Guidance," 2020.
6. "RetinaMask: A Face Mask Detector," M. Jiang, X. Fan, and H. Yan, 2020.
7. B. Suvarnamukhi and M. Seshashayee: "Big Data Concepts and Techniques in Data Processing," International Journal of Computer Sciences and Engineering, vol. 6, no. 10, pp. 712-714, 2018.
8. Fred Hohman; Minsuk Kahng; Robert Pienta; Duen Horng Chau: "Visual Analytics in Deep Learning: An Interrogative Survey for the Next Frontiers," in IEEE Transactions on Visualization and Computer Graphics, vol. 25, no. 8, pp. 2674-2693, 1 August 2019.
9. COVID-19 Response Team from the Centers for Disease Control and Prevention: Preliminary estimates of the prevalence of certain underlying health problems among coronavirus illness patients in the United States, February 12–March 28, 2020. 2020, 69, 382–386. Morb. Mortal. Wkly. Rep. 2020, 69, 382–386.