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Automated Facemask Detection for Covid Surveillance

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Abstract: *Today, the biggest problem the world is facing is the Covid-19 pandemic. However, few ways are there to control the outbreak as instructed by the WHO (World Health Organization). The objective of the project is to detect face masks in a public gathering or an event. In order to reduce the complexity, we can use our software and monitor people efficiently. Since CCTV cameras are present in every nook and corner of our city, it is quite effective in detection of face mask. Face mask recognition is strenuously growing especially after the COVID outbreak and has widespread application in law enforcement. This paper introduces a CNN based neural network system, which can be trained to identify people's facial features while half of their faces are covered by face masks. The presented approach would be beneficial in reducing the spread of this infectious disease and will encourage people to use face masks. During the training phases, network structures and various parameters were adjusted to achieve the best results. The results obtained by the proposed system has an accuracy of around 97.1%.*

Keywords: World Health Organization (WHO), Convolution Neural Network, MobileNetV2, COVID-19

I. INTRODUCTION

Coronavirus disease 2019 (COVID-19) is a contagious disease caused by severe acute respiratory syndrome coronavirus. The disease is mainly spread through the airborne route where the virus is transmitted via droplets coming from infected people like cold, cough or sneeze etc. The WHO has imposed various restrictions to control the spread of this virus which includes wearing face masks and maintaining social distance. In the middle of such an intense crisis this application can be used in social gathering venues to detect the face masks that can help reduce the spread of Covid-19. The virus can spread to others who are in close proximity to those infected by virus for example by sneezing, coughing. In recent studies, scientists found that the existing corona virus has the ability to mutate and form a new strain of its own. These mutated strains are more virulent and infectious than its precursor and remain undetected in the RT-PCR tests. In an overpopulated country like India, monitoring of people for wearing mask becomes tedious and exhausting for manual monitoring and a galore of money is still spent for detection of facemask. Because people find wearing mask as difficult task because they experience suffocation and find it difficult to breathe through mask. Manual monitoring by Police officers and sanitary workers makes them more susceptible to virus and spread might also increase drastically. So, the need for efficient and safe monitoring of people was the need of the hour and the main idea behind our project.

II. EXISTING SYSTEM

The existing systems to detect face masks were developed using yolov3. In the existing system, the introduction of a backbone network which can allocate more resources and employed GIou (General Intersection Over Union) and focal loss to accelerate the training process and improve performance. It produced an accuracy of 86% and was most effective in the detection of a single individual.

III. PROPOSED SOLUTION

In this paper, the system proposed for face mask detection is done by using MobileNetV2. MobileNetV2 can be used to detect face masks over a group of people and can yield better accuracy when compared to the existing systems. By providing datasets containing images of a people wearing a mask and not wearing a mask as input dataset and the system is trained and tested and the tested accuracy along with precision, recall, f1 score is obtained as output. Then, this trained

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model is applied to the detection system which is implemented using a webcam where the video is read by frame and resized as required. Then, the pre- processing function is called to get the result of people wearing a mask and not wearing a mask along with the accuracy in percentage.

Flow Chart

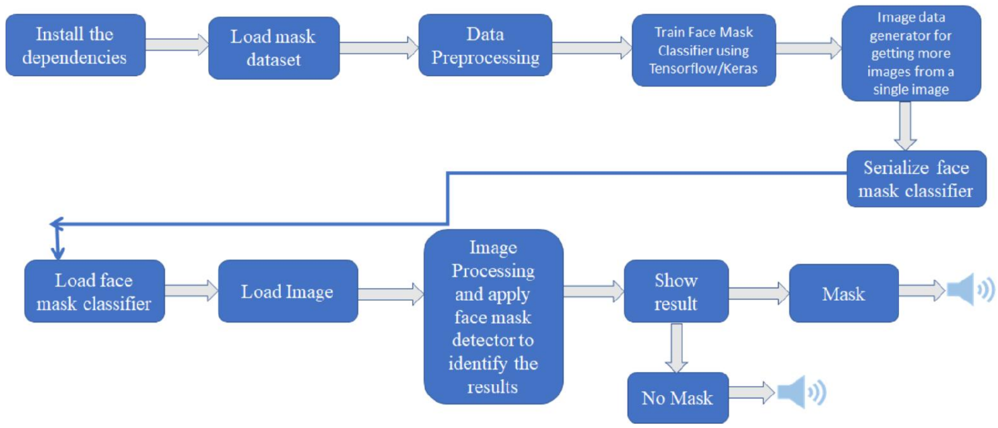

Fig.1 Flow Diagram

IV. MODULE DESCRIPTION

Image Preprocessing:

- **Input:** Image from dataset.
- **Output:** One hot encoding of the images.

Process Description:

- **Step 1:** First, the input image is resized to a particular resolution.
- **Step 2:** The resized image data and labels are updated and verified.
- **Step 3:** Then the image is converted into a numpy array finally one hot encoding is performed on the images.
- **Step 4:** The dataset is split into training and testing.

```
# perform one-hot encoding on the labels
lb = LabelBinarizer()
print(lb)
labels = lb.fit_transform(labels)
labels = to_categorical(labels)

data = np.array(data, dtype="float32")
labels = np.array(labels)
print(labels)
```

Fig.2 Image pre-processing

Data Augmentation

- Input: Image from dataset
- Output: Augmented input image

Process Description:

- Step 1: In this module, there are three processes involved.
- Step 2: First the image is rotated
- Step 3: Then the image is zoomed
- Step 4: Finally, the image is flipped horizontally.

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```
# construct the training image generator for data augmentation
aug = ImageDataGenerator(
        rotation_range=20,
        zoom_range=0.15,
        width_shift_range=0.2,
        height_shift_range=0.2,
        shear_range=0.15,
        horizontal_flip=True,
        fill_mode="nearest")
```

Fig. 3 Data Augmentation

Model Training:

- Input: Pre-processed input image
- Output: Trained Data for 30 Epochs

Process Description:

- Step 1: Initially, the base model MobilenetV2 is loaded with "ImageNet" and the last layer of pretrained model is fine tuned.
- Step 2: Then the dimension is flattened and the dense activation value (relu) and dropout value are entered.
- Step 3: Then the dense and activation function value (softmax) are entered.
- Step 4: The Model summary is obtained and configuration is saved. It shows the total parameters and those trainable and non-trainable parameters.
- Step 5: The optimizer loss entropy and accuracy metric are configured and the trained model is evaluated and saved.

```
====================================
Total params: 2,422,210
Trainable params: 2,388,098
Non-trainable params: 34,112
```

Fig.3 Model Summary

Testing the Model

- **Input:** Trained data
- **Output:** Predicted data

Process Description:

- **Step 1:** In this module, the training loss and training accuracy data are plotted.
- **Step 2:** Next, a prediction on the training set is done.
- **Step 3**: Finally, the model is evaluated.
- **Step 4:** A Confusion Matrix is also generated to show the true positive, true negative, false positive and false negative values used to calculate the evaluation metrics.
- **Step 5:** A graph is obtained showing the training and validation loss and accuracy.
- **Step 6:** A classification report is also generated showing the evaluation metrics.

```
[INFO] evaluating network...
              precision    recall  f1-score   support

   with_mask       0.99      0.99      0.99       383
without_mask       0.99      0.99      0.99       384

    accuracy                           0.99       767
   macro avg       0.99      0.99      0.99       767
weighted avg       0.99      0.99      0.99       767

Testing accuracy: (0.9935)
```

Fig.4 Evaluation Metrics

Image Segmentation using Mask R-CNN:

- **Input:** Input dataset
- **Output:** Segmented image of people with and without mask

Process Description:

- **Step 1:** First, the dataset is loaded and ID mapping is done, where mask and no mask is assigned.
- **Step 2**: Next a tensorflow session is created and the Mask RCNN model is loaded.
- **Step 3:** Then, actual detection of Boxes, Class, Scores and Masks are done.
- **Step 4:** Finally, Instance segmentation is performed and Detection results are displayed.

Fig.5 Image segmentation

Implementing the Model In OpenCV

- **Input**: Saved Model
- **Output:** Mask or no mask using webcam

Process Description:

- **Step 1**: First, the video is read by frame and it resized as required to process.
- **Step 2:** Then the pre-processing function is called.
- **Step 3:** Finally, people wearing a mask and not wearing a mask is predicted from the input data from the camera connected to the system.
- **Step 4:** The results are captured using webcam along the accuracy.

Fig.6 Output

V. CONCLUSION

The spread of Covid-19 is increasing every day in every part of the world. This needs to be controlled and contained in order to get back to our normal lives. While the doctors and scientists take care of the vaccination to reduce the instances, we can help them by following the guidelines provided by WHO and by the Government to reduce and control the spread of this virus. This paper illustrates a facemask detector using Convolutional Neural Network that is by using MobileNetV2. To train, validate and test the model, we utilized the dataset that consisted of 1915 masked images and 1918 images without masks. The pictures used in the dataset are taken from different open-source providers like Kaggle and RMFD datasets. To choose a base model for the proposed system, certain important variables like precision, accuracy, and recall were assessed. Finally, MobileNetV2 architecture gave the best results having 99% precision and 99% recall accuracy. MobileNetV2 is computationally efficient which makes it simpler to introduce the model to the inserted frameworks. The objective of the project is to recognize people wearing and not wearing masks using MobilenetV2. This algorithm is to identify whether people in a crowded place are wearing mask or not. Finally, evaluating the numerical results. This face mask detector can be employed in numerous places like shopping malls, air terminals and other substantial traffic places to screen people in general and to minimize the spread of the infection in general.

With the help of this project implemented in proper circumstances can help detect people not wearing masks. This could help health and sanitary officials to implement the WHO guidelines in a much better way. This project is tested in a webcam using the above discussed methods and the results are as expected. With wide use of this project in public gatherings and crowded localities, it will be easier to detect people violating the use of masks.

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REFERENCES

[1] Xinbei Jiang, Tianhan Gao, Zichen Zhu and Yukang Zhao., Real Time Face Mask Detection Method Based on YOLOv3, Electronics, 7, pp.130-147,2021.

[2] Sunil Singh, Umang Ahuja, Munish Kumar, Krishna Kumar and Monika Sachdeva., Face Mask Detection using YOLOv3 and faster R-CNN, International Journal of Engineering and Technology, 12, pp.81-104, 2021.

[3] G. Jignesh Chowdary, Narinder Singh Punn, Sanjay Kumar Sonbhadra and Sonali Agarwal, Face Mask Detection using Transfer Learning of InceptionV3, IEEE Access, 20, pp. 456-665, 2021.

[4] Shilpa Sethi, Mamtha Kathuria and Trillok Kaushik., Face mask detection using deep learning, Multimedia Tools and Application, 8, pp.42-72, 2020.

[5] Safa Teboulbi, Seifeddine Messaoud, Mohamed Ali Hajjaji and Abdellatif Mtibaa., Real-Time Implementation of AI-Based Face Mask Detection and Social Distancing Measuring System for COVID-19 Prevention, Scientific Programming, 32, pp.167-254, 2021.