International Journal of Advance Research in Science and Engineering
Volume No. 10, Issue No. 09, September 2021
www.ijarse.com
IJARSE
ISSN 2319 - 8354

Open CV and CNN Based Real Time Face Mask Detection System

P. Deepthi[1], Dr. M. Dhinakaran[2]

[1]*Assistant Professor, Department of Electronics and Communication Engineering, Government College of Engineering, Salem-636011, Tamil Nadu, India*

[2]*Associate Professor, Department of Electronics and Communication Engineering, Government College of Engineering, Salem-636011, Tamil Nadu, India*

ABSTRACT

The end of 2019 witnessed the outbreak of Coronavirus Disease 2019 (COVID-19), which has continued to be the cause of plight for millions of lives and businesses even in 2020. As the world recovers from the pandemic and plans to return to a state of normalcy, there is a wave of anxiety among all individuals, especially those who intend to resume in-person activity. Studies have proved that wearing a face mask significantly reduces the risk of viral transmission as well as provides a sense of protection. However, it is not feasible to manually track the implementation of this policy. In this paper we are going to use Open CV to do real time facemask detection from a live stream via our webcam. Our system consists of a dual-stage Convolution Neural Network (CNN) architecture capable of detecting masked and unmasked faces and can be integrated with pre trained models and web cameras. The proposed deep learning classification models in terms of accuracy, precision, and time consumption are established and validated experimentally with the data set. This will help track safety violations, promote the use of face masks, and ensure a safe working environment.

Keywords - CNN-Convolutional Neural Network, AI-Artificial Intelligence, ML-Machine Learning, FCL-Fully Connected Layer, RELU- Rectified Linear Unit

I. INTRODUCTION

The trend of wearing face masks in public is rising due to the COVID – 19 coronavirus epidemic all over the world. Before Covid-19, People used to wear masks to protect their health from air pollution. While other people are self-conscious about their looks, they hide their emotions from the public by hiding their faces. Scientists proofed that wearing face masks works on impeding COVID-19transmission. COVID19 (known as corona virus) is the latest epidemic virus that hit the human health in the last century. In 2020, the rapid spreading of COVID-19has forced the World Health Organization to declare COVID- 19 as a global pandemic. More than five million cases were infected by COVID-19 in less than 6months across 188 countries. The virus spreads through close contact and in crowded and overcrowded areas. The corona virus epidemic has given rise to an extraordinary degree of worldwide scientific cooperation. Artificial Intelligence (AI) based on Machine learning and Deep Learning can help to fight Covid-19 in many ways.

In earlier days face detection models are implemented using edge, line and centre near features and patterns are recognized from those features. These approaches are used to find binary patterns locally. These approaches are very effective to deal with Gray-scale images and the computation effort required also very less[1] European Journal of Molecular & Clinical Medicine ISSN 2515-8260 Volume 07, Issue 06, 2020 662 AdaBoost is a regression based classifier which is going to fit regression function on original data set even some miss classified objects waits also adjusted during back propagation to optimize the results[2] Viola Jones Detector proposed an real time object model used to detect different classes of objects. It uses 24x24 base window size to evaluate any image with edge ,line and four rectangular features. Harr-like features are like convolutions to check weather given feature is available in the image or not[3]. This model fail to work in when image brightness varies even it exhibits poor performance when images are in different orientations. Convolution networks are mainly used for classification problems there are various kinds of CNN architectures such as VGG-16 this architecture consists of 2 convolution layers with input size224 kernel (64,3x3) followed by max pool with size 2x2 then again two convolution layers followed by max pool then three convolution layers with max pool again three convolution layers and max pool and three fully connected layers final FC is soft max this architecture works fine when compared to AlexNet[4,7]. Google Net architecture fundamentally using inception method by constructing small convolution layers to reduce number of parameters it having around 22 layers with convolution and max pooling etc it can able to work effectively over Alexnet it can able to bring down 60 million features in Alex net to 4 million features[8].

In this paper Deepnueral networks which adopts residual learning to train the models more deeper around 152 layers are used in this which is 8 times more than VGGnet with minimum complexity. This approach achieved relatively better performance in object detection over COCO data set[9] In this paper UNet and SEnet are used to perform segmentation of heart ventricular segmentation . This model is arrange the weights in such a way like more weights are given to useful features and less weights are given to unimportant features.[10]Support vector machines are used to perform classification on objects which is going to build an equation for constructing line and classifies the objects based on the values mapping to this line. Semantic segmentation method was used to detect facial mask in this paper they have used VGG net for training and FCN is used to semantically segment the faces available in the image[11] performed experiments on multi parsing human data sets and achieved higher accuracy. In this paper medical image processing was done. They have taken human brain images and are trained by using FCN to identify tumours very effectively in this paper rather than using 2D segmentation for detecting tumour we have used 3D segmentation[12]. Tumuluru,Lakshmi Ramaniet. al.[13], used CNN model to detect human face which is used efficiently in security related applications. In this paper they have collected various facial features such as mouth, nose, eyes stored as facial template and used it for detecting difference between faces. Malathi, J. et. al., [14] mainly focused on identifying forgery images used in different places like in social media, and other publicity required places. In this paper various techniques are proposed to find out features of a forgery image like image spicing,copy move attack which can be handled by using correlation analysis to find duplicate features.Patelet. al., [15]proposed a model to find out the quality of the ironore by extracting the features from sample material in the mining industry. It is very important to asses the quality of the ore . SVR support vector regressor used for online measure of the quality of the ore. In this process they have extracted 280 features extracted for object identification, SFFS was model was developed using SVR.

Object detection become the important area in the field of image investigation there are various techniques are there for image analysis in [15]. In this paper author introduced a European Journal of Molecular & Clinical Medicine ISSN 2515-8260 Volume 07, Issue 06, 2020 663 wavelet based nueral network for feature extraction and learning which is working efficiently in object detection[. Satapathy, Sandeep Kumar, et al.,[16]proposed a model to detect number plate which is very important problem helping police to chase many criminal cases. Authors used OCR based approach to detect characters in the number plate and they are stored and processed to client server based model for collecting the details of the owner.Pathaket.al.,[17]**.** In this paper, we consider a problem of detecting masks from camera. In this new era where we experiencing a pandemic and people are advised to wear masks, some people are not used to it and are avoiding to wear masks and also it requires more labors in malls, banks, offices to check the person is wearing mask or not and also it takes more time and extra human effort is required for that we propose a new technology.

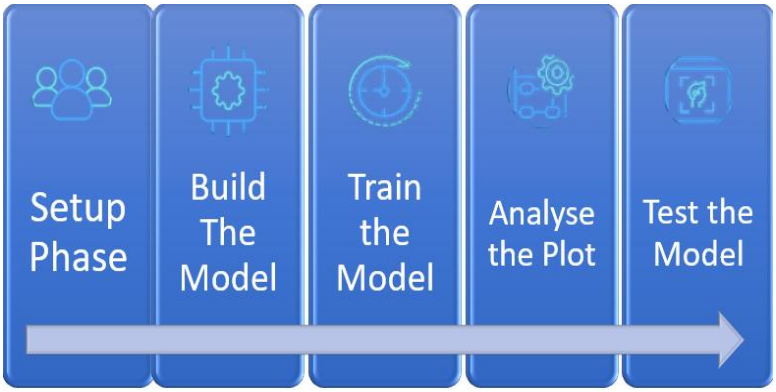


Fig 1 – Block diagram of the system

II VARIOUS FACE MASK DETECTION TECHNIQUES.

2.1 MACHINE LEARNING

Machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it learn for themselves. The process of learning begins with observations or data, such as examples, direct experience, or instruction, in order to look for patterns in data and make better decisions in the future based on the examples that we provide. The primary aim is to allow the computers learn automatically without human intervention or assistance and adjust actions accordingly.

2.2. DEEP LEARNING

Deep learning is a subset of machine learning. Deep artificial neural networks are a set of algorithms that have set new records in accuracy for many important problems, such as image recognition, sound recognition, etc., In deep learning, a convolutional neural network (CNN) is a class of deep neural networks, most commonly applied to analyzing visual imagery. The Convolutional Neural Networks (CNNs) are a category of Neural Networks that have proven effective in areas such as image recognition and classification. CNN have been successful in identifying animals, face masks, objects and track signs apart from powering vision in robots and self-driving

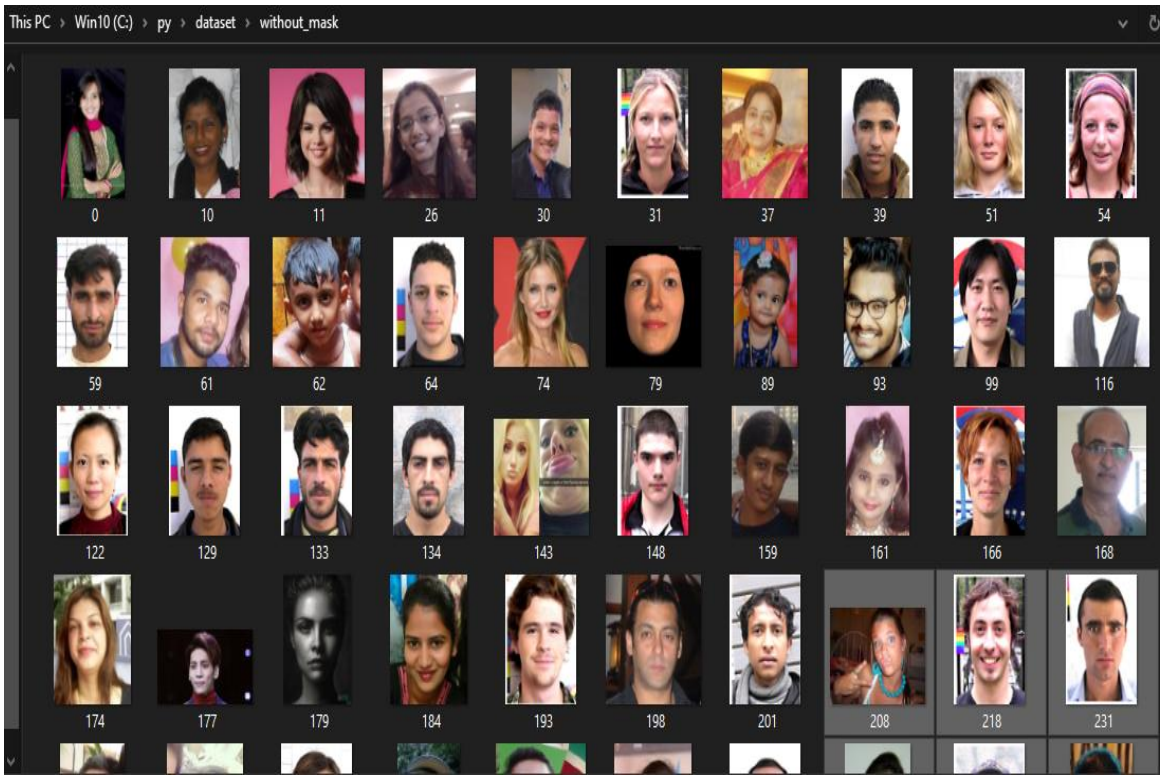
cars. CNNs use relatively little pre-processing compared to other image classification algorithms. This means that the network learns the filters that in traditional algorithms were hand-engineered. This independence from prior knowledge and human effort in feature design is a major advantage. They have applications in image and video recognition, recommender systems, image classification, medical image analysis, and natural language processing.

2.3. IMAGE RECOGNITION

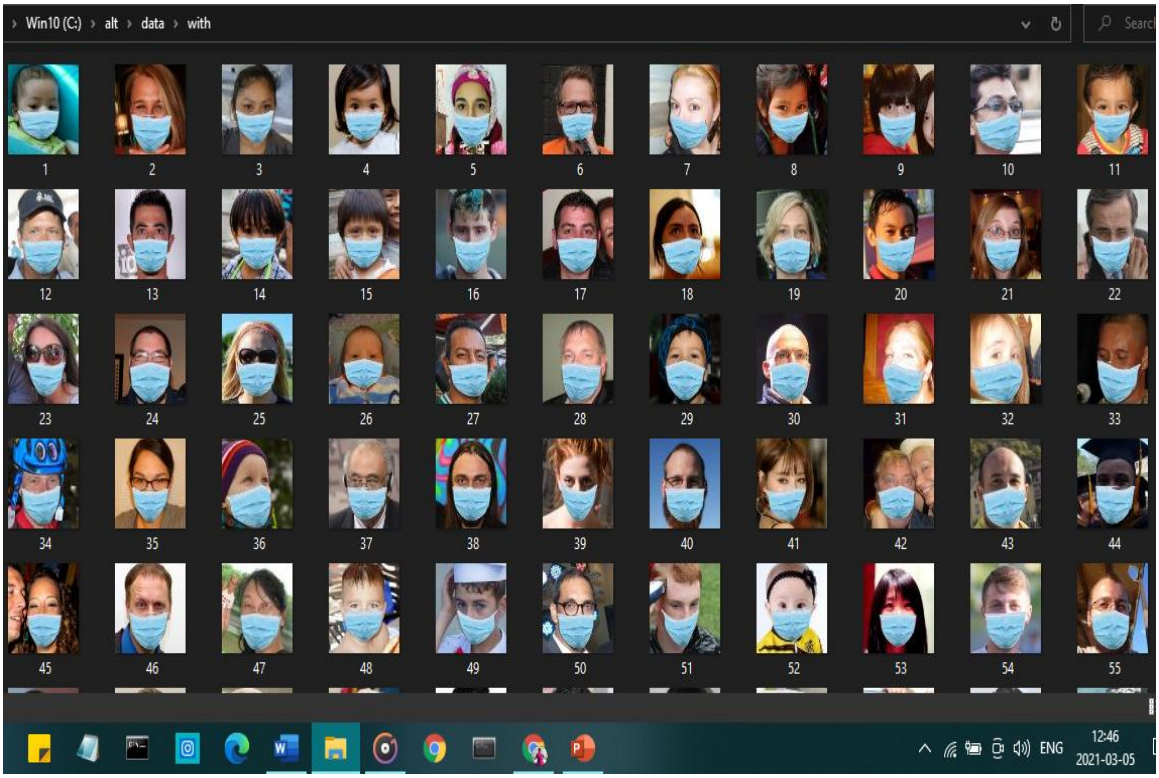
Image recognition refers to the task of inputting an image into a neural network and having it output some kind of label for that image. The label that the network outputs will correspond to a pre-defined class. There can be multiple classes that the image can be labelled as, or just one. If there is a single class, the term "recognition" is often applied, whereas a multi-class recognition task is often called "classification". A subset of image classification is object detection, where specific instances of objects are identified as belonging to a certain class like animals, cars, or people.

III METHODOLOGY

Convolution leverages three important ideas that motivated computer vision researchers: sparse interaction, parameter sharing, and equivariant representation. Let's describe each one of them in detail.



"Fig.1. Sample data set used Dataset without Mask"

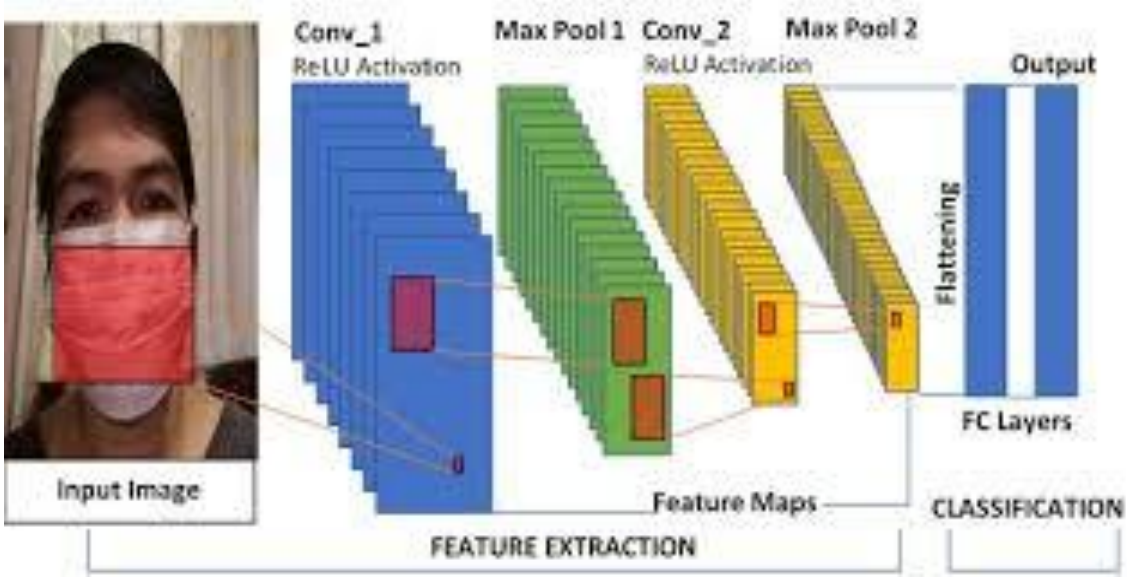


"Fig.2. Sample data set used to Dataset with Mask"

Trivial neural network layers use matrix multiplication by a matrix of parameters describing the interaction between the input and output unit. This means that every output unit interacts with every input unit. However, convolution neural networks have *sparse interaction.* This is achieved by making kernel smaller than the input e.g., an image can have millions or thousands of pixels, but while processing it using kernel, we can detect meaningful information that is of tens or hundreds of pixels. This means that we need to store fewer parameters that not only reduces the memory requirement of the model but also improves the statistical efficiency of the model.

If computing one feature at a spatial point (x1, y1) is useful then it should also be useful at some other spatial point say (x2, y2). It means that for a single two-dimensional slice i.e., for creating one activation map, neurons are constrained to use the same set of weights. In a traditional neural network, each element of the weight matrix is used once and then never revisited, while convolution network has *shared parameters* i.e., for getting output, weights applied to one input are the same as the weight applied elsewhere.

Due to parameter sharing, the layers of convolution neural network will have a property of *equivariance to translation*. It says that if we changed the input in a way, the output will also get changed in the same way.



"Fig.4. Example of convolution neural networks"

IV. RESULTS AND DISCUSSION

The ANACONDA PROMPT is opened. In that, the destination of our python file is opened. "C:\ py\". Now the program is run by using the syntax "python detect_video.py". All the libraries required will be opened and the Live Video Stream will start.

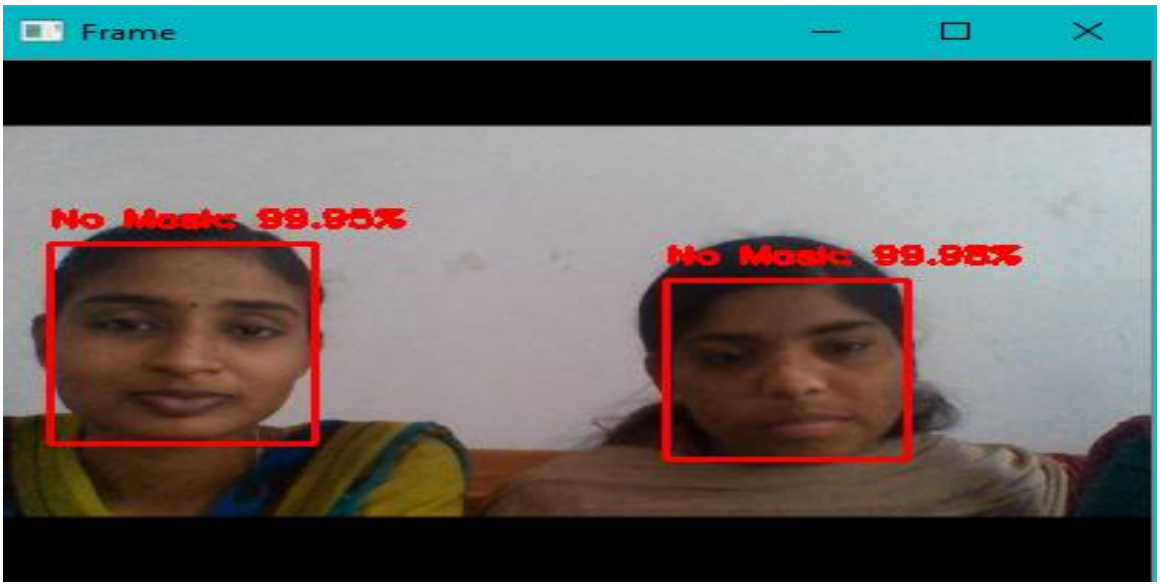
```
Select Anaconda Prompt (python) - python  detect_video.py

(base) C:\Users\ArokkiaDoss>cd C:\

(base) C:\>cd py

(base) C:\py>python detect_video.py
2021-03-23 12:15:18.705590: I tensorflow/stream_executor/platform/default/dso_loader.
2021-03-23 12:16:24.250594: I tensorflow/compiler/jit/xla_cpu_device.cc:41] Not creat
2021-03-23 12:16:24.326891: W tensorflow/stream_executor/platform/default/dso_loader.
2021-03-23 12:16:24.364843: W tensorflow/stream_executor/cuda/cuda_driver.cc:326] fai
2021-03-23 12:16:24.664404: I tensorflow/stream_executor/cuda/cuda_diagnostics.cc:169
2021-03-23 12:16:24.681557: I tensorflow/stream_executor/cuda/cuda_diagnostics.cc:176
2021-03-23 12:16:24.736885: I tensorflow/core/platform/cpu_feature_guard.cc:142] This
 use the following CPU instructions in performance-critical operations:  AVX2
To enable them in other operations, rebuild TensorFlow with the appropriate compiler
2021-03-23 12:16:24.836608: I tensorflow/compiler/jit/xla_gpu_device.cc:99] Not creat
[INFO] starting video stream...
(1, 1, 200, 7)
2021-03-23 12:16:39.955728: I tensorflow/compiler/mlir/mlir_graph_optimization_pass.c
```

"Fig.5. Testing the model"

The Face Detector Model obtained is of 11,219 KB. The time took by the model to be built is 175s. The accuracy of the training set is 99.69% and the validation set is 100% and loss for the training set is 8.27% and for the validation set is 7.35%. All the images will be read as Grayscale images for increasing the speed of execution.

4.1. OUTPUT 1: TWO PEOPLE WITHOUT MASK

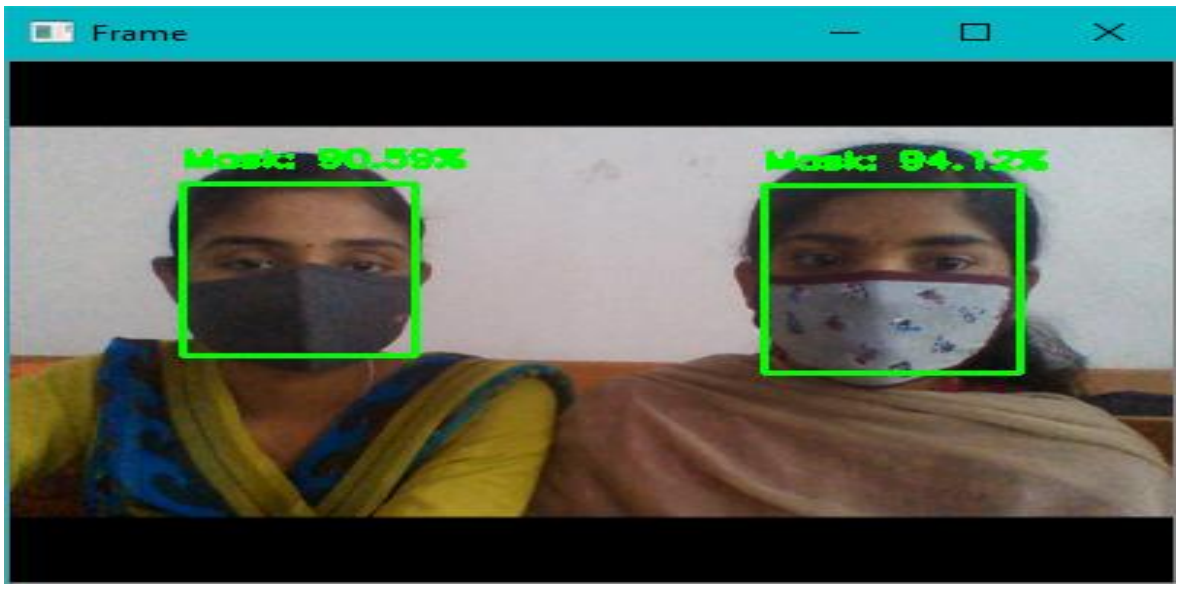
Both people Infront of the webcam are not wearing mask so it is indicated as a red color rectangular box around their faces and also with accuracy of how much are they not wearing a mask.



"Fig. 6. Output1 People Without Mask"

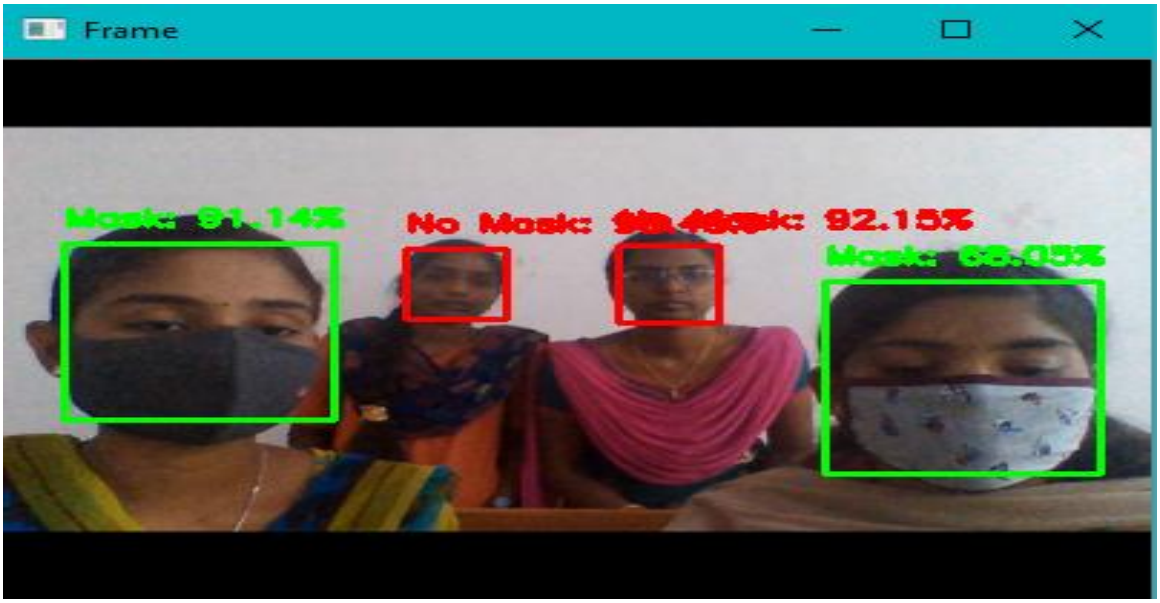
4.2 OUTPUT 2: TWO PEOPLE WITH MASK

The second trial is with two people wearing masks, it result is ontained as a green rectangular box along with the percentage of how properly are they wearing the mask.



"Fig. 7. Output2 People With Mask"

This is for four people with two wearing mask and the other to without mask. This is the combined output of 1 and 2. Indicating the people with mask in green box and the people without mask in a red box along with the accuracy.



"Fig. 8. Output People With Mask and without Mask"

V.CONCLUSION

In the grid-connected mode and the islanded mode, the single-stage control of the micro-grid based on photovoltaic cells is introduced. The proposed control scheme makes it possible to control the photovoltaic field in the MPPT independently of the presence or absence of the network without using a special boost converter for the photovoltaic field. The analysis is only done in simulation from MATLAB/Simulink. The performance of the system looks to be satisfactory when connected with the grid.

REFERENCES

[1] Y. Liu, A. A. Gayle, A. Wilder-Smith, and J. Rocklöv, "The reproductive number of covid-19 is higher comparedto sars coronavirus,"Journal of travelmedicine, 2020.

[2] Y. Fang, Y. Nie, and M. Penny, "Transmission dynamics of the covid-19outbreak and effectiveness of governmentinterventions: A datadriven analysis,"Journal of medical virology, vol. 92, no. 6, pp. 645–659, 2020.

[3] N. H. Leung, D. K. Chu, E. Y. Shiu, K.-H. Chan, J. J. McDevitt, B. J. Hau, H.L. Yen, Y. Li, D. KM, J. Ipet al.,2019,"Respiratory virus shedding in exhaled breath andefficacy of face masks."

[4] S. Feng, C. Shen, N. Xia, W. Song, M. Fan, and B. J. Cowling, "Rational use of face masks in the covid19pandemic,"The Lancet Respiratory Medicine, 2020.

[5] A. Kumar, A. Kaur, and M. Kumar, "Face detection techniques: areview,"Artificial IntelligenceReview, vol. 52,no. 2, pp. 927–948, 2019.D.-H. [6] Lee, K.-L. Chen, K.-H. Liou, C.-L. Liu, and J.-L. Liu, "Deep learning and controlalgorithms of direct perception for autonomous driving,2019

[6] C. Szegedy, W. Liu, Y. Jia, P. Sermanet, S. Reed, D. Anguelov, D. Erhan,V. Vanhoucke, and A. Rabinovich, "Going deeper with convolutions,"2015.

[7] [K. He, X. Zhang, S. Ren, and J. Sun, “Deep residual learning for imagerecognition,” 2016 IEEE Conference on Computer Vision and PatternRecognition (CVPR), pp. 770– 778, 2016

[8] . K. Li, G. Ding, and H. Wang, “L-fcn: A lightweight fully convolutionalnetwork for biomedical semantic segmentation,” in 2018 IEEE InternationalConference on Bioinformatics and Biomedicine (BIBM), Dec2018, pp. 2363–2367

[9] X. Fu and H. Qu, “Research on semantic segmentation of high-resolutionremote sensing image based on full convolutional neural network,” in2018 12th International Symposium on Antennas, Propagation and EMTheory (ISAPE), Dec 2018, pp. 1–4.

[10] S. Kumar, A. Negi, J. N. Singh, and H. Verma, “A deep learningfor brain tumormri images semantic segmentation using fcn,” in2018 4th International Conference on Computing Communication andAutomation (ICCCA), Dec 2018, pp. 1–4.

[11] Tumuluru,Lakshmi Ramani, B., Saibaba, C.M.H., Venkateswarlu, B., Ravinder, N. OpenCV algorithms for facial recognition,International Journal of Innovative Technology and Exploring Engineering,Volume 8, Issue 8, 1 June 2019, Pages 927-933

[12] Malathi, J., T. Satya Nagamani, and KNVSK Vijaya Lakshmi. "Survey: Image forgery and its detection techniques." Journal of Physics: Conference Series. Vol. 1228. No. 1. IOP Publishing, 2019.

[13] Krishnaveni, G., B. Lalitha Bhavani, and NVSK Vijaya Lakshmi. "An enhanced approach for object detection using wavelet based neural network." Journal of Physics: Conference Series. Vol. 1228. No. 1. IOP Publishing, 2019.

[14] Satapathy, Sandeep Kumar, et al. "Deep learning based image recognition for vehicle number information." International Journal of Innovative Technology and Exploring Engineering 8 (2019): 52-55.

[15] Pathak, Mrunal, Vinayak Bairagi, and N. Srinivasu. "Multimodal Eye Biometric System Based on Contour Based E-CNN and Multi Algorithmic Feature Extraction Using SVBF Matching."International Journal of Innovative Technology and Exploring Engineering [Volume-8 Issue-9, July 2019

[16] .Dudi, B., and Dr V. Rajesh. "Medicinal Plant Recognition Based On CNN And Machine Learning." International Journal Of Advanced Trends In Computer Science And Engineering, ISSN (2019): 2278-3091.

[17] Kishore, P. V. V., et al. "Indian classical dance action identification and classification with convolutional neural networks." Advances in Multimedia 2018 (2018).