# Face Mask Detection

**Using Machine Learning & Deep Learning**

## Project Report

Affiliated to GGSIP University, New Delhi
Approved by AICTE & Council of Architecture

**Submitted by**


| Name | University Roll No. |
|---|---|
| Abhishek Aswal | 43318002717 |
| Deepak Singh | 42918002717 |
| Mayank Goyal | 35118002717 |
| Saiyam Jain | 41218002717 |


**Under The Guidance Of**


Ms. Upasna Joshi

Assistant Professor

Department of Computer Science & Engineering

# CONTENTS

# 1. INTRODUCTION

Corona Virus was originated in Wuhan, China at the end of 2019. Since then, it has been spreadinglike a wild fire in a forest. Millions have been affected and around 1,668,356 have unfortunatelypassed away as on 18th of December 2020, almost a year since this virus came to existence. Peoplewho have this illness can take up to 2 weeks to cure, with the risk of having to suffer additionalmedical problems caused by it. Children and old people have proved to be at the highest risk tocontract the disease, which may even result in death. Hence, it has been made a priority to containthe virus than to cure it. The virus spreads through the air, transmitted by one person to another notonly by touch, but also by speaking and coughing. The concern was put forward to WHO (WorldHealth Organization) which suggested that face masksand social distancing is the answer to it,until a cure is invented. Putting a face mask on can reduce the risk of getting infected by a greatextent, not only to the one wearing it but also to the others that he comes in contact with. Wearingmasks every time we go out is something we can do with little effort that can effectively save lives,andthatispreciselywhyitis insomuch demandatthispointoftime.

In thispaper,wepropose aFace Mask Detection projectwhich consistsof 2phases,namelytraining and deployment. The first stage detects human faces, while the second phase uses deeplearning to firstly, identify the ROI(Region Of Interest) being the person's face and secondlyclassify the facesdetected in the first stage aseither'Mask' or 'No Mask' facesand drawsboundary of colors either green or red, depending on the output. The project takes JPG and PNGfiles as inputs, but it has also been tested on videos. The project can give accurate results if set upwith a CCTV camera to track people without masks to ensure the safety and wellbeing of others,thushelp controllingthespreadofthevirus.

We have also created a website which allows anyone to either run the code online directly or download the android application through which face mask detection can be started.

# 2. Background of the study

### Objectdetection.

Object detection is a computer vision technique that allows you to locate and locate objects inan image or video. With such identification and localization, object detection is used to countobjects in a scene and to locate and track their exact locations, while all are labeled correctly.The algorithm generates an axis-aligned boundary box showing alistof objectcategories intheimageandthepositionandlevelofeachinstanceofeachobjectcategory.

### CNN

CNN plays an important role in computer vision prototype recognition because of its superiorspatialcapabilityExtractioncapacityandlowcomputationalcost.CNNusesdecisionkernelst o interact with the original Image or feature maps to remove high-end features. However, howto properly design a never-ending network neural Architecture is still a fundamental question.The installation network allows you to find out the proposal network. The best combination ofkernels. To train very deep neural networks, K. Heet Al and others proposed residual network(Resnet), which can learn identity mapping from the previous layer. The object detector isusually set Mobile networks (mobile net) are mobile or embedded devices whose computingresources are very limited [29]. Proposed. It uses in-depth discernment to capture features andchannel wise resolutions according to channel numbers.Therefore the computational cost ofmobilenetismuchlowerthannetworksthatusestandardresolutions.

### Machinelearning

Machine learning algorithms are used in a wide variety of applications, such as email filteringand computer vision, where it is difficult or infeasible to develop conventional algorithms toperform theneeded tasks.Machinelearning isclosely related to computational statistics,which focuses on making predictions using computers. Data mining is a related field of study,focusing on exploratory data analysis through unsupervised learning. In its application acrossbusinessproblems,machinelearningisalsoreferredtoaspredictiveanalytics.

### DeepLearning

Deep learning methods aim at learning feature hierarchies with features from higher levels ofthe hierarchyformedbythe compositionoflowerlevelfeatures.Automaticallylearningfeatures at multiple levelsof abstraction allow asystem to learn complex functionsmappingthe input to the output directly from data, without depending completely on human-craftedfeatures. Deep learning allows computational models that are composed of multiple processinglayerstolearnrepresentationsofdatawithmultiplelevelsofabstraction.

### MobileNetV2

MobileNetV2isastateoftheartformobilevisualrecognitionincludingclassification,object

detection and semantic segmentation. This classifier uses Depth wise Separable Convolutionwhich is introduced to dramatically reduce the complexity cost and model size of the network,and hence is suitable to Mobile devices, or devices that have low computational power. InMobileNetV2,anotherbestmodulethatisintroducedisinvertedresidualstructure.Non-linearity in narrow layersisdeleted.KeepingMobileNetV2asbackbone forfeatureextraction,best performances areachievedforobject detectionandsemanticsegmentation.

### HTML

The HyperText Markup Language, or HTML is the standard markup language for documents designed to be displayed in a web browser. It can be assisted by technologies such as Cascading Style Sheets (CSS) and scripting languages such as JavaScript.

Web browsers receive HTML documents from a web server or from local storage and render the documents into multimedia web pages. HTML describes the structure of a web page semantically and originally included cues for the appearance of the document.

### CSS

Cascading Style Sheets (CSS) is a style sheet language used for describing the presentation of a document written in a markup language such as HTML. CSS is a cornerstone technology of the World Wide Web, alongside HTML and JavaScript.

CSS is designed to enable the separation of presentation and content, including layout, colors, and fonts. This separation can improve content accessibility, provide more flexibility and control in the specification of presentation characteristics, enable multiple web pages to share formatting by specifying the relevant CSS in a separate .css file which reduces complexity and repetition in the structural content as well as enabling the .css file to be cachedto improve the page load speed between the pages that share the file and its formatting.

### Android Studio

Android Studio is the official integrated development environment (IDE) for Google's Androidoperating system, built on JetBrainsIntelliJ IDEA software and designed specifically for Android development. It is available for download on Windows, macOS and Linux based operating systems or as a subscription-based service in 2020. It is a replacement for the Eclipse Android Development Tools (E-ADT) as the primary IDE for native Android application development.

### Javascript

JavaScript often abbreviated as JS, is a programming language that conforms to the ECMAScript specification. JavaScript is high-level, often just-in-time compiled, and multi-paradigm. It has curly-bracket syntax, dynamic typing, prototype-basedobject-orientation, and first-class functions.

Alongside HTML and CSS, JavaScript is one of the core technologies of the er 97% of websites use it client-side for web pagebehavior often incorporating third-party libraries. All major web browsers have a dedicated JavaScript engine to execute the code on the user's device.

# 3. LiteratureSurvey

Deep learning techniques are useful for big data analysis and include applications in computervision, design and speech recognition. After reading Z. Wang, G. Wang, (2020), “Masked facerecognition dataset and application we recognize that this work will focus on some of the mostcommonly implemented intensive learning architectures and their applications. Auto-encoder, goodneural networks, Boltzmann machines, Deep Trust networks are the networks presented in detail.Deeplearningcanbeusedin un-enhancedlearningalgorithms to processunpluggeddata.

Previously, Khandelwal in his research work (2020) had stated in his work about a deep learningmodel that binaries an image as amask is used or notmask. 380 images had amask and 460imageshad no maskandtheseimages wereusedinthetrainingoftheMobileNetV2model.

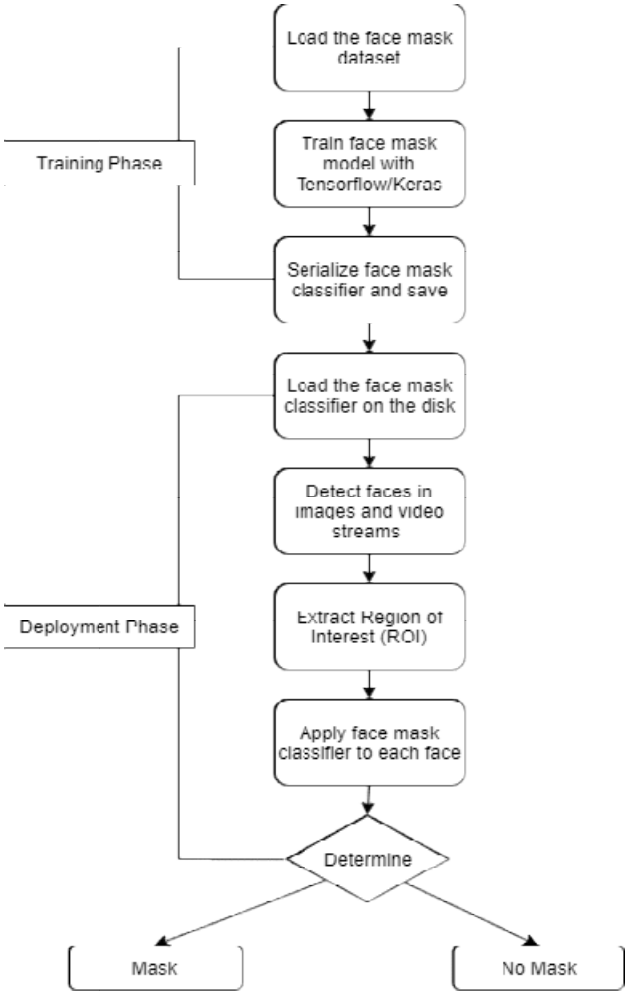
Qin B. and Li D. has done a face mask recognition project that focuses on capturing real-timeimages indicating whether a person has put on a face mask or not. The dataset was used for trainingpurposes to detect the main facial features (eyes, mouth, and nose) and for applying the decision-making algorithm. Putting on glasses showed no negative effect. Rigid masks gave better resultswhereas incorrect detections can occur due to illumination, and to objects that are noticeable out oftheface.

# 3. SYSTEMARCHITECTURE

This system aims at classifying whether a person is wearing a mask or not by taking input fromimages real time streaming videos. We have taken a total of 3847 images in our Face MaskDetection Dataset belonging to two labels i.e. with mask: 1917 images and without mask: 1930images.Theclassificationoftheimages isdonebytrainingthemodelin2phases:

Phase 1: Training- Training the model on the dataset using Tensorflow&Keras with classifier likeMobileNetV2isusedtogenerateatrained model.

Phase2: Deployment - Loading the trained model and applying detector over images/live videostream



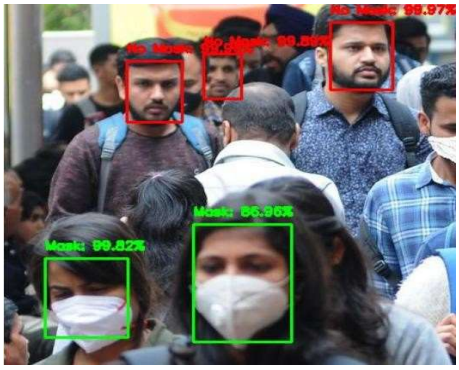
# 4. Results

We created a face mask detector using Deep Learning, Keras, Tensorflow and OpenCV. We trainedit to distinguish between people wearing mask and people not wearing a mask We have usedMobileNetV2classifierwiththeADAMoptimizerfor thebestresult.

**Someimagesof withmaskdataset**

**Someimagesof withoutmaskdataset**

### TestOutputs




**OutputofFaceMaskDetectorinUploadedImage**

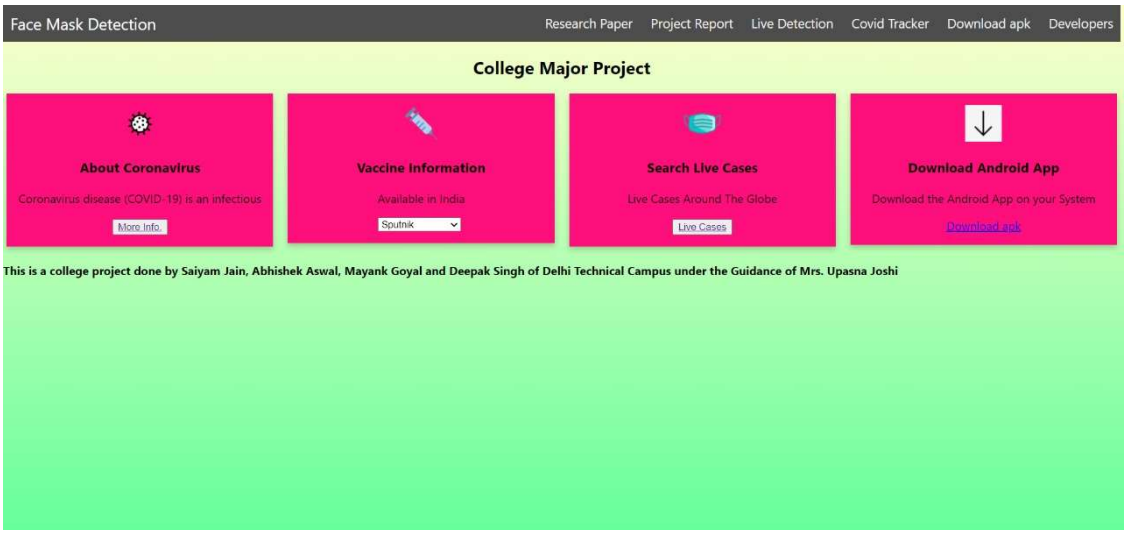
Theaccuracy ofthemodeliscalculatedtobe98%.

It isobservedthatperformanceofADAMoptimizeris goodinbothtrainingand testing.


**Accuracy/LossPlot**

# Website

The website can be accessed by the urlhttps://mgoyal1903.github.io/Covid-Website/ where a person can either run the code directly online or download the application. The development of the website was important so that our project can reach out to people to be put in good use for the society.



# 5. SUMMARY

As the technology are blooming with emerging trends the availability so we have novel face maskdetector which can possibly contribute to public healthcare. The architecture consists of Mobile Netas the backbone it can be used for high and low computation scenarios. In order to extract morerobust features, we utilize transfer learning to adopt weights from a similar task face detection,which is trained on a very large dataset. We used OpenCV, Tensorflow, Keras ,Pytorch and CNN todetect whether people were wearing face masks or not. The models were tested with images andreal-timevideostreams.Theaccuracyofthemodelisachievedand,theoptimizationofthemodelisacontinuousprocessandwearebuildingahighlyaccuratesolution by tuning thehyperparameters. This specific model could be used as a use case for edge analytics. Furthermore, theproposedmethodachievesstate-of-the-artresultsonapublicfacemaskdataset.Bythedevelopment of face mask detection we can detect if the person is wearing a face mask and allowtheir entry wouldbeofgreathelp to thesociety.

# 6. REFERENCES


[1] S.Feng,C.Shen,N.Xia,W.Song,M.Fan,andB.J.Cowling,“Rationaluseoffacemasksinthecovid-19pandemic,”TheLancetRespiratoryMedicine, 2020.

[2] Y. Fang, Y. Nie, and M. Penny, “Transmission dynamics of the covid-19 outbreak andeffectiveness of government interventions: A data-driven analysis, “Journal of medicalvirology,vol. 92,no. 6,pp.645–659, 2020.

[3] Z. Wang, G. Wang, B. Huang, Z. Xiong, Q. Hong, H. Wu, P. Yi, K. Jiang, N. Wang, Y.Peietal.,“Maskedfacerecognitiondatasetandapplication”arXivpreprintarXiv:2003.09093, 2020.

[4] Z.-Q. Zhao, P. Zheng, S.-t. Xu, and X. Wu,“Object detection with deep learning: Areview”, IEEE transactions on neural networks and learning systems, vol. 30, no. 11, pp.3212–3232, 2019.

[5] Qin B. and Li D. , Identifying face mask wearing condition using image super-resolutionwithclassificationnetworktopreventCOVID-19.doi:10.21203/rs.3.rs-28668/v1

[6] Erhan, D., Szegedy, C., Toshev, A., and Anguelov, D. (2014). “Scalable object detectionusing deep neural networks,” in Computer Vision and Pattern Recognition Frontiers inRoboticsandAI

[7] R. Girshick, J. Donahue, T. Darrell, and J. Malik, “Rich feature hierarchies for accurateobject detection and semantic segmentation,” in Proceedings of the IEEE conference oncomputer visionand patternrecognition, 2014.

[8] A.Kumar,A.Kaur,and M.Kumar,“Facedetectiontechniques:areview,”ArtificialIntelligence Review, vol. 52,no. 2, pp. 927–948, 2019.D.-H. Lee, K.-L. Chen, K.-H. Liou,C.-L. Liu, and J.-L. Liu, “Deep learning and control algorithms of direct perception forautonomousdriving, 2019.


.