

FACE MASK DETECTION USING DEEP LEARNING

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Abstract -The COVID-19 pandemic is causing a worldwide health crisis so the effective protection method is wearing a face mask in open zones as per the World Health Organization (WHO). The COVID-19 pandemic constrained governments across the world to force lockdowns to forestall infection transmissions. Reports show that wearing face covers while at work plainly diminishes the danger of transmission. An effective and financial methodology of utilizing AI to establish a protected climate in an assembling arrangement. A half breed model utilizing profound and old style AI for face cover discovery will be introduced. A face cover recognition dataset comprises of with veil and without cover pictures, we will utilize OpenCV to do continuous face discovery from a live stream through our webcam. We will utilize the dataset to fabricate a COVID-19 face cover finder with PC vision utilizing Python, OpenCV, and Tenser flow and Keras. We will likely distinguish whether the individual on picture/video transfer is wearing a face cover or not with the assistance of PC vision and profound learning.

Key Words: OpenCV, Tenser flow, Keras, Computer vision, Deep learning.

1. INTRODUCTION

Due to the COVID-19, the wearing of a face cover without trying to hide is getting more normal. The plague of Covid can be tracked down everywhere in the world. Individuals used to wear a mask to shield their wellbeing from air contamination before Covid-19. Others, who are hesitant about their appearance, conceal their sentiments from the overall population by concealing their countenances. Scientists found that wearing a face cover lessens COVID-19 transmission. Covid (otherwise called Covid) is another epidemic infection that has as of late struck human wellbeing. Coronavirus has been proclaimed an overall pandemic by the World Health Organization (WHO) in 2020 because of its quick spread. The Covid pandemic has brought about uncommon degrees of objective collaboration. Man-made consciousness (AI) in light of AI and profound learning can help battle Covid-19 from an assortment of points. Man-made intelligence empowers subject matter experts and clinicians to assess monstrous amounts of information to appraise COVID-19 scattering and fill in as an early notice part for COVID-19. To handle and foresee new ailments, the clinical consideration framework requires

sponsoring for arising advancements like counterfeit cognizance, IoT, large information, and AI. The AI's force is being manhandled to more readily comprehend sickness patterns and to screen and rapidly distinguish defilements in the Covid-19 pandemic. These principles and laws were established because of the extraordinary expansion in cases and passings in different zones. Notwithstanding, the way toward screening enormous gatherings of individuals is getting progressively troublesome. Any individual who isn't wearing a face cover is recognized during the testing time frame. 10 We present a cover face acknowledgment model that depends on PC vision and profound learning in this paper. The proposed model can be utilized related to perception cameras to obstruct COVID-19 transmission by permitting the situation of individuals who aren't wearing face covers to be resolved. With OpenCV, Tenser Stream, and Keras, the model joins profound learning and traditional AI systems. To incorporate extractions, we utilized profound trade sneering and consolidated it with three old fashioned AI computations. We found an association between them to track down the most consistent estimation that accomplished the best exactness while utilizing a minimal measure of assets.

2. LITERATURE SURVEY

P. A. Rota, M. S. Oberste, S. S. Monroe, W. A. Nix, R. Campagnoli explained that the The succession of the total genome of SARS-CoV was resolved, and the underlying portrayal of the viral genome is introduced in this report. The genome of SARS-CoV is 29,727 nucleotides long and has 11 open understanding casings, and its genome association is like that of other Covids.

In this paper Mamata s kalas mean to carry out the Haar-Classifer for Face identification and following dependent on the Haar Feature.

Ana Rita Soares, Ruben Afonso, Joao Lampreia, Jorge Joao, Veronica C. Martins, Moises Piedade and Susana Cardoso studied the Stage Integrating Magneto resistive Sensors and Micro fluidics. Stage Integrating Magneto resistive Sensors and Micro fluidics studied an AI approach to automatically identify and check blood cells from a near picture dependent on YOLO calculation is introduced. To improve precision, the method employed KNN and IOU based method to eliminate multiple counting of a similar article.

Y. Fng, Y.Nie, and M.Penny used the established helpless exposed irresistible recovered model. directed the

affectability analysis to distinguish the key factor, plotted the pattern bend of effective conceptive number (R), and performed information fitting after the reproduction, reenacted the spread elements of Covid infection 2019 (COVID-19) episode and effect of various control steps, directed the affectability examination to distinguish the key factor, plotted the pattern bend of successful conceptive number (R), and performed information fitting after the reproduction.

3. RELATED STUDIES

3.1 MACHINE LEARNING

AI (ML) is the investigation of PC estimations that progress over the long haul because of training. It is viewed as a part of fake cognizance. Without being expressly modified to do as such, AI computations develop a mathematical model dependent on model data, known as "planning data," to settle on assumptions or decisions. AI calculations are utilized in an assortment of uses, for example, email filtering and PC vision, where it is troublesome or difficult to perform straightforward computations to finish the essential undertakings. A computational bit of knowledge, which rotates around making expectations utilizing PCs, is firmly connected with AI. The investigation of mathematical smoothing out brings techniques, speculations, and application zones to the field of computerized reasoning. Data mining is a connected space of examination that centers around exploratory information investigation utilizing independent learning. Artificial intelligence is frequently alluded to as a foreknowledge assessment when applied to showcase concerns. Artificial intelligence approaches are ordinarily separated into three classes depending on the idea of the "sign" or "info" accessible.

- The framework is given model information sources and their optimal yields by an "instructor," and the objective is to acquaint itself with a general rule that associates contribution to yields.
- Unsupervised learning: The learning estimation isn't evaluated, so it is left to its self gadgets to find structure in its information. Independent learning might be an objective all by itself (discovering covered up designs in information) or a necessary 14 chore (incorporate learning).
- Reinforcement learning: A structured programming works together with a specific environment to accomplish a particular objective (like driving a vehicle or playing a game against an enemy). The product is given the criticism that intently takes after motivators as it investigates its anxiety space, which it endeavors to improve.

3.2 COMPUTER VISION

Computer vision is an interdisciplinary research area that studies how computers can interpret visual images or videos at a high level. Computer vision tasks provide strategies for collecting, manipulating, analyzing, and interpreting digital images, and it aims to understand and automate tasks that the human visual system can

perform. and the extraction of high-dimensional data from the real world to generate numerical or symbolic knowledge, such as decisions, In this context, understanding refers to the conversion of visual representations (retinal input) into world descriptions that make sense to thought processes and can evoke effective action. The disentangling of symbolic knowledge from image data using models built with the help of geometry, physics, statistics, and learning theory can be seen as image comprehension. The theory behind artificial systems that extract knowledge from images is the subject of computer vision, a scientific discipline. Video loops, multiple camera views, and multi-dimensional data from a 3D scanner or medical scanning system are all examples of image data. Computer vision is a scientific discipline that aims to apply its theories and models to the Computer vision is an interdisciplinary area that studies how machines can be programmed to interpret visual images or videos at a high level.

- The automated retrieval, interpretation, and comprehension of useful 15 information from a single image or a series of images is the subject of computer vision. It entails the development of a theoretical and algorithmic foundation for automatic visual comprehension. Computer vision is a scientific discipline that studies the principle behind artificial systems that extract knowledge from images. Video loops, multiple camera views, or multi-dimensional data from a medical scanner are all examples of image data about the hypothesis behind fake frameworks that separate data from pictures. The picture information can take numerous structures, for example, video arrangements, sees from various cameras, or multi-dimensional information from a clinical scanner.

3.3 DEEP LEARNING

Hierarchies of features from more raised levels of the movement framed by the design of lower level features are among the profound learning methods that focus on taking in. Programmed learning highlights at different degrees of consideration empower a framework to learn complex limits arranging the commitment to the yield straightforwardly from information, as opposed to depending totally on human-made highlights. Significant learning estimations endeavor to abuse the jumbled design of data transport to find incredible depictions, frequently at different levels, with more elevated level learned features portrayed just as lower-level features. The PC will learn obfuscated thoughts by building them out of more straightforward ones on account of the request for thoughts. On the off chance that we attract a chart to show how these thoughts are based on top of each other, the guide would be intricate, with a few layers. Therefore, we allude to this way to deal with AI as significant learning. Profound learning rules in issue spaces where the data sources (and, shockingly, yield) are basic. That is, rather a few sums in an even course of action, they are pictures of pixel data, records of text data, or archives of sound data. Profound learning permits computational models comprised 16 of different planning layers to learn data portrayals with shifting levels of thought.

3.4 OpenCV

OpenCV (Open Source Computer Vision Library) is a free PC vision and AI programming library. OpenCV was intended to give a typical framework to PC vision applications and to make it simpler for business items to incorporate machine insight. Since OpenCV is a BSD-authorized program, organizations can without much of a stretch utilize and adjust the code. The library contains more than 2500 improved calculations, including a wide scope of exemplary and front-line PC vision and AI calculations. These calculations can be utilized to perceive and recognize faces, distinguish objects, characterize human conduct in pictures, control camera developments, track moving items, extricate 3D models of articles, and then some. They can likewise be utilized to make 3D point mists from sound system cameras, fasten pictures together to make a high-goal image of a whole scene, and find individuals related pictures from a picture data set, screen eye developments, perceive view and overlay it with increased reality, etc. OpenCV has a client base of more than 47 thousand individuals and has gotten more than 18 million downloads. Organizations, research establishments, and government offices all utilize the library. The library is utilized by various new businesses, including Applied Minds, Video Surf, and Zeiter, just as notable partnerships like Google, Yahoo, Microsoft, Intel, IBM, Sony, Honda, and Toyota. From sewing together road see photographs in Israel to recognizing interruptions in reconnaissance video in China, helping Willow Garage robots in exploring and getting objects, distinguishing pool suffocating mishaps in Europe, running vivid craftsmanship in Spain and New York, and examining runways for flotsam and jetsam in Turkey, The gathering has finished the entirety of the undertakings. From assessing marks on products in manufacturing plants throughout the planet to fast face location in Japan, OpenCV has a wide assortment of utilizations. It runs on Windows, Linux, Android, and Mac OS and 17 incorporates C++, Python, Java, and MATLAB programming dialects interconnections When MMX and SSE guidelines are free, OpenCV is utilized for constant vision applications. The advancement of a full-included CUDA and OpenCL interface is in progress. There are more than 500 calculations and ten fold the number of capacities that make or backing them. OpenCV is a C++ program with a format interface that effectively incorporates STL holders.

3.5 TENSERFLOW

TensorFlow is an open source dataflow and differentiable programming library for tasks. It's a notable mathematical library that is regularly utilized in AI applications including neural organizations associations. TensorFlow is Google Brain's second-age stage, which is utilized for both revelation and advancement. TensorFlow 1.0 was delivered on February eleventh. In contrast to the reference execution, which runs on single gadgets, TensorFlow can run on an assortment of CPUs and GPUs (with optional CUD and SYL extensions for all around helpful figuring on representations getting ready units). Tensorflow can be utilized on 64- cycle Linux, macOS, Windows, and portable stages like Android and iOS. It is

versatile that designing thinks about the simple plan of estimations through an assortment of stages (CPUs, GPUs, TPUs), just as from work territories to gatherings of staff to portable and edge gadgets. Tensorflow takes its name from the exercises that such neural associations direct on multidimensional information groups known as tensors. Jeff Dean revealed at the Google I/O Conference in June 2016 that TensorFlow was referred to in 1,500 vaults on GitHub, just 5 of which were from Google. Not at all like Theano and other Deep Learning-centered numerical libraries, TensorFlow was expected for use in both pivotal work and continuous systems, similar to the pleasant Deep Dream task and Rank Brain in Google search. It can work on single CPU structures, GPUs, for example, those utilized in cell phones, and huge scope circulated systems including a few gadgets.

3.6 KERAS

Keras is an API intended for individuals, not machines. Keras follows best practices for decreasing psychological burden: it offers steady and straightforward APIs, it limits the quantity of client activities needed for basic use cases, and it gives clear and significant mistake messages. It likewise has broad documentation and engineer guides. Keras contains various executions of ordinarily utilized neuralnetwork building squares like layers, goals, initiation capacities, analyzers, and a large group of instruments to make working with picture and text information simpler to improve on the coding important for composing profound neural organization code. The code is facilitated on GitHub, and local area support gatherings incorporate the GitHub issues page, and a Slack channel. Keras is a moderate Python library for profound discovering that can run on top of Thanos or Tensorflow. It was created to make carrying out profound learning models as quick and simple as feasible for innovative work. It runs on Python 2.7 or 3.5 and can consistently execute on GPUs and CPUs given the hidden structures. Keras was developed and maintained by François Chollet, a Google engineer using four guiding principles:

1. Modularity: A model can be perceived as a succession or a chart alone. Every one of the worries of a profound learning model are discrete parts that can be consolidated arbitrarily.
2. Minimalism: The library gives barely enough to accomplish a result, no nonsense and expanding comprehensibility.
3. Extensibility: New parts are deliberately simple to add and use inside the system, proposed for specialists to preliminary and investigate groundbreaking thoughts.
4. Python: No different model documents with custom record designs. Keras is intended for moderation and seclusion permitting you to rapidly characterize profound learning models and run them on top of a Thanos or TensorFlow backend.

4. PROPOSED SYSTEM

Using PC vision and profound learning calculations, the proposed systems recognize the individual on a picture/video transfer wearing a face cover using the OpenCV, Tensor stream, Keras, and PyTorch libraries.

Methodologies include:

1. Create a model for deep learning (MobileNetV2).
2. Detect objects in images or a live video stream using a mask detector.

FLOW CHART

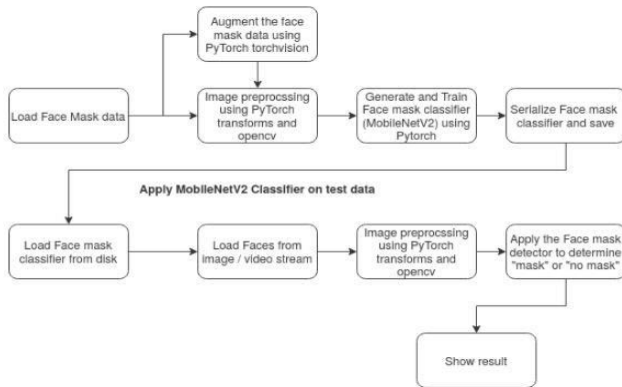


Fig 4.1 Flow chart of the Face Mask Detection using Deep Learning

DATA AT SOURCE

Most of the pictures were augmented by OpenCV. The arrangement of pictures were at that point marked "cover" and "no veil". The pictures that were available were of various sizes and goals, most likely removed from various sources or from machines (cameras) of various goals.

DATA PREPROCESSING

Preprocessing ventures as referenced beneath was applied to every one of the crude info pictures to change over them into clean forms, which could be taken care of to a neural organization AI model. Resizing the input image (256 x 256)

1. Applying the color filtering (RGB) over the channels (Our model mobileNetV2 supports 2D 3 channel image)
2. Using the standard mean to scale and normalize pictures.
3. Cropping the image in the centre with a pixel size of 224x224x3
4. Converting them to tensors (Similar to NumPy array)

Deep Learning Frameworks There are many choices for implementing this deep learning network.

1. TensorFlow
2. Keras
3. PyTorch
4. Caffe
5. MxNet

6. Microsoft Cognitive Tool Kit

We're using PyTorch because it's based on Python, which means that anyone with a basic understanding of Python can get started creating 22 deep learning models, and it also has the following advantages over other deep learning frameworks:

1. Data Parallelism
2. It would appear that a Framework. MobileNetV2 expands upon the thoughts from MobileNetV1, utilizing profundity shrewd divisible convolution as proficient structure blocks. However, V2 introduces two new features to the architecture:

- i) Bottlenecks between layers that are linear
- ii) Bottleneck-to-bottleneck links that aren't as long.

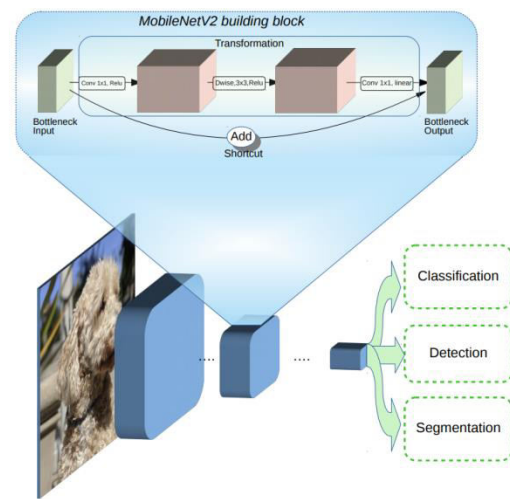


Fig 4.2 Mobile net V2

Rather than characterizing/building our own model in Pytorch, we can use TorchVision's models library to construct the MobileNetV2 model. The ImageNet dataset is used to calculate the loads of each model layer. In the loads channels, you can see cushioning, phases, portion size, input channels, and yield. MobileNetV2 was chosen as the basis for developing a model that could be sent via text message 23 A completely linked layer that has been modified to include four layers. Successive layers were built on top of the MobileNetV2 model.

The layers:

- Linear layer with Re Luactivation function
- Dropout Layer
- Linear layer with Softmax activation function with the result of values.
- Average pooling layer with 7x7 weights the final layer of softmax work generates two odds, one for "cover" and the other for "not veil". Face mask detection in a webcam stream. The stream is used to see whether the person in the webcam is wearing a face veil or not.

4.3.1 The process is two-fold

1. To recognize the people in the webcam

2. Sort the faces into groups based on their masks

4.3.1.1 Identify the face in the web cam

A pre-trained model from the OpenCV system was used to recognize the faces. Images from the internet were used to train the model.

4.3.1.2 Open CV provides 2 models for this face detector

1. The initial Caffe implementation in floating-point 16 format.
2. Tensorflow was used to create an 8-bit quantized version. This face mask detector uses the Caffe model.

Person detection methods based on deep learning have ignited a lot of discussion. As a result, we devised our own algorithm to solve the problem. Data collection is an essential part of our work on face mask recognition address the variety of face masks worn by employees The face mask detection algorithm 24 detects the presence of a mask using a combination of face detection models. Faces are extracted from camera feeds and then run via a mask detection model.

5. SOFTWARE IMPLEMENTATION

5.1 DATASET



Fig 5.1 Collected Dataset

6. RESULT AND CONCLUSION

Two datasets are used to train, validate, and evaluate the model. The system achieves accuracy of up to 95.77 percent with optimized accuracy, which reduces the cost of error, according to dataset 1. Max Pooling is one of the most important factors in achieving this level of precision. It gives the internal representation rudimentary translation invariance while also reducing the number of parameters the model must learn. This sample-based discrimination process reduces the dimensionality of the input representation, which is an image. The optimal number of neurons is 64, which is not too high. The use of a large number of neurons and filters can result in poor results. The optimized filter values and pool size aid in filtering out the key portion (face) of the image in order to correctly detect the presence of a mask without over fitting.

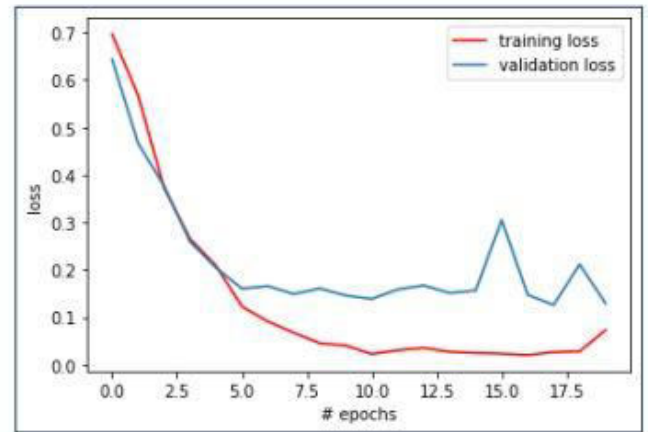


Fig.6.1 Epochs vs Loss corresponding to dataset

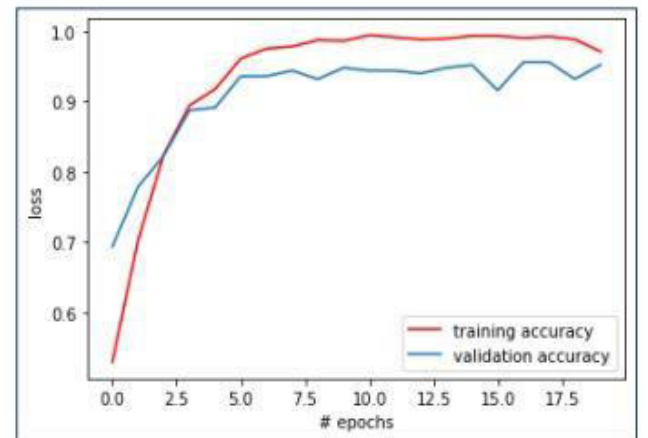


Fig 6.2 Epochs vs Accuracy corresponding to dataset



Fig 6.3 Real time face mask detection

At the beginning of this chapter, we briefly discussed the work's motivation. The model's learning and success role was then demonstrated. The approach has achieved a reasonable level of accuracy using simple machine learning methods and simplified techniques. It can be used for a wide range of purposes. Given the Covid-19 crisis, wearing a mask could become mandatory in the near future. Many public service providers will require customers to wear masks properly in order to receive services. The implemented model would make a significant contribution to the public health 38 care system. It could be extended in the future to detect whether or not an individual is wearing the mask properly. The next step in this project is to create a mask detector with some unique features, such as detecting whether the mask is virusprone or not (i.e., whether the mask is surgical, N95, or not), and so on.

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