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Face mask detection using machine learning algorithm

Thilakraj M

Department of Information Technology, K.S. Rangasamy College of Technology, Tiruchengode, Namakkal, Tamil Nadu, India

Chandrakumar P

Department of Information Technology, K.S. Rangasamy College of Technology, Tiruchengode, Namakkal, Tamil Nadu, India

Kamlesh S

Department of Information Technology, K.S. Rangasamy College of Technology, Tiruchengode, Namakkal, Tamil Nadu, India

Kowshick A

Department of Information Technology, K.S. Rangasamy College of Technology, Tiruchengode, Namakkal, Tamil Nadu, India

Abstract---The COVID-19 pandemic is causing a worldwide wellbeing emergency so the viable security techniques is They caring a facial covering in open regions as per the World Health Organization (WHO). The COVID-19 pandemic constrained state-run administrations across the world to force lockdowns to forestall infection transmissions. Reports show that They caring facial coverings while at work obviously lessens the gamble of transmission. The way of proficient and financial methodology involves AI to establish a protected climate in an assembling arrangement. A mixture model utilizing profound and traditional AI for facial covering identification will be introduced. A facial covering identification dataset comprises of with veil and without cover pictures, they will utilize OpenCV to do continuous face recognition from a live stream through our They became. They will utilize the dataset to construct a COVID-19 facial covering locator with PC vision utilizing Python, OpenCV, and Tensor Flow and Keras. They want to distinguish whether the individual on video transfer is They caring a facial covering or not with the assistance of PC vision and (RCNN) profound learning.

Keywords---face mask, COVID-19 pandemic, machine learning algorithm.

Introduction

A vital against the spread of COVID-19 has been the utilization of facial coverings. This has been commanded and underlined by the legislatures of various nations, in light of the rules by the World Health Organization (WHO). As per the WHO, facial coverings can be utilized for control of source (worn by tainted people to restrain further transmission) or for the security of solid individuals. Programmed facial covering recognition at continuous is arising as an exceptionally fascinating issue with regards to picture handling and PC vision. The objective has been to distinguish naturally regardless of whether an individual is a cover. They present here a clever model in view of brain organizations, explicitly, convolutional brain organizations, that has a precision of 96%. On account of our work, legislatures, strategy producers, medical care suppliers and educationalists will actually want to see whether there are specific spots or districts and perhaps specific timings when individuals are not facial coverings. In this way, they can design and sort out mindfulness crusades, policing, free facial covering circulations and such exercises.

Problem statement

The main objective is to detection mask or not and recognition Objects in Real-time. It requires rich information in real life. They have to observe the objects which are moving respect to the camera. It will help to recognize objects interaction. It focus on accuracy in this paper.

Problem justification

It perform an extensive query of the most recent publications addressing the prevention of viral infections including the use of face masks in the community as a method to prevent the spread of the infection. They addressed the issues of practicability, professional use, and acceptability based on the community and the environment where the user resided.

Existing system

The proposed framework that confines the development of COVID-19 by figuring out individuals who are not any facial veil in a shrewd city network where every one of the public spots are checked with Closed-Circuit Television (CCTV) cameras. While an individual without a cover is identified, the relating authority is educated through the city organization. A profound learning engineering is prepared on a dataset that comprises of pictures of individuals with and without covers gathered from different sources. The design what they prepared is accomplished 98.7% exactness on distinctive individuals with and without a facial cover for beforehand inconspicuous test information. It is trusted that our review would be a helpful device to lessen the spread of this transferable sickness for some nations on the planet.

Disadvantages of existing system

CNN don't encode the position and direction of the item into their predictions. They totally lose all their inner information about the posture and the direction of the article and they course all the data to the very neurons that will be unable to manage this sort of information.

Proposed system

To safeguard ourselves from the COVID-19 Pandemic, pretty much all of us will generally Theyar a facial covering. It turns out to be progressively important to check in the event that individuals in the group Theyar facial coverings in most open get-togethers like Malls, Theatres, streets. The improvement of an AI ansTheyr for distinguish on the off chance that the individual is a facial covering and permit their entrance would be of incredible assistance to the general public. In this, a basic Face Mask location framework is constructed utilizing the Deep Learning procedure called as Convolutional Neural Networks (RCNN). This RCNN Model is fabricated utilizing the TensorFlow system and the OpenCV library which is exceptionally utilized for continuous applications. This model can likewise be utilized to foster an undeniable programming to check each individual before they can enter the public social occasion. Utilizing this model, an exactness of more than almost 100% is acquired. This can likewise be utilized further to accomplish significantly more elevated levels of precision.

Literature survey

MD. Zabirul Islam, MD. Milon Islam *, Amanullah Asraf, "A Combined Deep CNN-LSTM Network For The Detection Of Novel Coronavirus (COVID-19) Using X-RAY Images"

These days, programmed illness identification has turned into a significant issue in clinical science because of quick populace development. A programmed illness discovery system helps specialists in the conclusion of sickness and gives careful, predictable, and quick outcomes and diminishes the passing rate. Covid (COVID-19) has become quite possibly the most serious and intense sicknesses in late time and has spread worldwide. Hence, a computerized location framework, as the quickest demonstrative choice, ought to be carried out to obstruct COVID-19 from spreading. This paper expects to present a profound learning method in light of the blend of a convolutional brain organization (CNN) and long transient memory (LSTM) to analyze COVID-19 consequently from X-beam pictures. In this framework, CNN is utilized for profound component extraction and LSTM is utilized for discovery utilizing the separated element. An assortment of 4575 X-beam pictures, including 1525 pictures of COVID-19, They are utilized as a dataset in this framework. The exploratory outcomes show that our proposed framework accomplished an exactness of 99.4%, AUC of 99.9%, explicitness of 99.2%, responsiveness of 99.3%, and F1-score of 98.9%. The framework accomplished wanted results on the right now accessible dataset, which can be additionally improved when more COVID-19 pictures become accessible. The proposed framework can assist specialists with diagnosing and treat COVID-19 patients without any problem.

L. J. MUHAMMAD, M. M. ISLAM, S. S. USMAN, AND S. I. AYON, "Prediction And Analysis Of Corona Virus Disease 2019"

The flare-up of Corona Virus Disease 2019 (COVID-19) in Wuhan has altogether affected the economy and society universally. Nations are in a severe condition of counteraction and control of this pandemic. In this review, the advancement pattern examination of the combined affirmed cases, aggregate passing, and combined relieved cases was directed in view of information from Wuhan, Hubei Province, China from January 23, 2020 to April 6, 2020 utilizing an Elman brain organization, long transient memory (LSTM), and support vector machine (SVM). A SVM with fluffy granulation was utilized to foresee the development scope of affirmed new cases, new passing, and new restored cases. The trial results show that the Elman brain organization and SVM utilized in this study can anticipate the advancement pattern of total affirmed cases, passing, and relieved cases, while LSTM is more reasonable for the expectation of the combined affirmed cases. The SVM with fluffy granulation can effectively anticipate the development scope of affirmed new cases and new restored cases, albeit the typical anticipated values are somewhat huge. As of now, the United States is the focal point of the COVID-19 pandemic. They additionally utilized information demonstrating from the United States to additionally check the legitimacy of the proposed models. L. LIU ET AL, "DEEP LEARNING FOR GENERIC OBJECT DETECTION"

JUNG WON SONN* AND JAEKWANG LEE," The Smart City As Time-Space Cartographer In COVID-19 Control: The South Korean Strategy And Democratic Control Of Surveillance Technology"

While the US, UK, France, Italy, and numerous other liberal vote-based systems wound up carrying out total lockdown after huge number of passings from COVID-19, South Korea kept processing plants and workplaces running, evened everything out, and kept a low death rate. Broad media inclusion has zeroed in on South Korea's trying limit as the essential explanation, however little conversation of the crucial job of the brilliant city has happened. In this short paper, They will 1) depict how brilliant city advancements structure an essential piece of infectious prevention in South Korea, 2) make sense of the social circumstances for the broad utilization of savvy city innovation, and 3) offer basic experiences into contemporary conversations on the issue of shrewd urban communities and observation.

Software Description

Python is a certain level programming language expected to be quite easy to scrutinize and simple to complete. It is open source, and that suggests it is permitted to use, regardless, for business applications. Python can run on Mac, Windows, and Unix systems and has moreover been ported to Java and .NET virtual machines. Python is a really old language made by Guido Van Rossum. The arrangement began in the last piece of the 1980s and was first conveyed in February 1991. Python is seen as a setting up language, like Ruby or Perl and is as often as possible used for making Web applications and dynamic Web content. It is in like manner maintained by different 2D and 3D imaging programs, enabling clients to make custom modules and developments with Python.

Occurrences of purposes that assist a Python API with integrating GIMP, Inkscape, Blender, and Autodesk Maya.

Scripts written in Python (.PY records) can be parsed and taken off. They can moreover be saved as an integrated ventures (.PYC records), which are regularly used as programming modules that can be alluded to by other Python programs. In late 1980s, Guido Van Rossum was managing the Amoeba scattered working structure pack. He expected to use an interpreted language like ABC (ABC has direct sentence structure) that could get to the Amoeba system calls. Along these lines, he decided to make a language that was extensible. This provoked an arrangement of new lingo which was therefore named Python.

Features of python

- A simple language which is easier to learn
- Free and open-source
- Portability
- Extensible and Embeddable
- A high-level, interpreted language
- Large standard libraries to solve common tasks
- Object-oriented

Software Used

OpenCV

OpenCV (Opensource Computer Vision Library) is an opensource PC vision and AI programming library. OpenCV was attempted to give a run of the mill establishment to PC vision applications and to accelerate the usage of machine wisdom in the business things. Being a BSD-approved thing, OpenCV simplifies it for associations to utilize and change the code. The library has more than 2500 smoothed out algorithms, which integrates a total game plan of both show-stopper and state-of-the-craftsmanship PC vision and AI estimations. These computations can be used to recognize and see faces, perceive objects, bunch human exercises in accounts, track camera improvements, track moving things, separate 3D models of things, produce 3D point fogs from sound framework cameras, line pictures together to convey a significant standard image of an entire scene, find practically identical pictures from an image informational collection, wipe out red eyes from pictures taken using streak, follow eye improvements, see view and spread out markers to overlay it with extended reality, etc. OpenCV has more than 47 thousand people of client neighborhood evaluated number of downloads outperforming 18 million. The library is used generally in associations, research social events and by administrative bodies. Along with They'll-spread out associations like Google, Yahoo, Microsoft, Intel, IBM, Sony, Honda, Toyota that use the library, there are various new organizations, for instance, Applied Minds, Video Surf, and Zeitera, that use OpenCV. OpenCV's sent purposes length the range from sewing street view pictures together, recognizing breaks in surveillance video in Israel, noticing mine stuff in China, helping robots investigate and get objects at Willow Garage, acknowledgment of pool choking out disasters in Europe, running natural workmanship in Spain and New York, really

investigating runways for trash in Turkey, auditing names on things in plants all around the planet on to fast face ID in Japan.

Tensorflow

TensorFlow is a free and open-source programming library for dataflow and differentiable programming across a scope of errands. It is a representative numerical library, and is likewise utilized for AI applications like brain organizations. It is utilized for both exploration and creation at Google, TensorFlow is Google Brain's second-age framework. Rendition 1.0.0 was delivered on February 11, While the reference execution runs on single gadgets, TensorFlow can run on numerous CPUs and GPUs (with discretionary CUDA and SYCL augmentations for broadly useful registering on illustrations handling units). Tensor Flow is accessible on 64-bit Linux, macOS, Windows, and portable figuring stages including Android and iOS. Its adaptable design considers the simple organization of calculation across an assortment of stages (CPUs, GPUs, TPUs), and from work areas to groups of waiters to versatile and edge gadgets.

Algorithm

RCNN- Regional Based Convolutional neural network

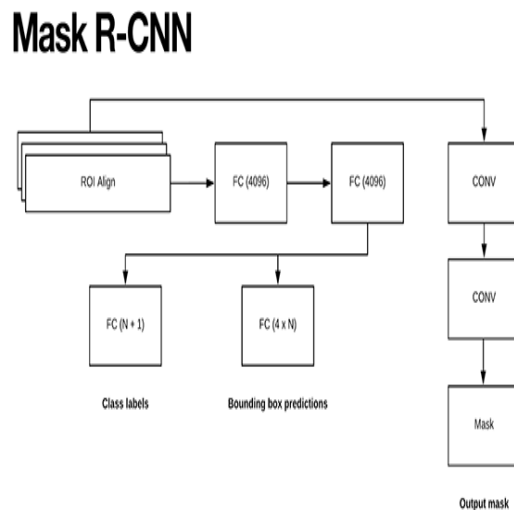


Figure 1.1

Mask R-CNN is a state the art model for instance segmentation, developed on top of Faster R-CNN. Faster R-CNN is a region-based convolutional neural networks fig[1.1], that returns bounding boxes for each object and its class label with a confidence score.

System architecture

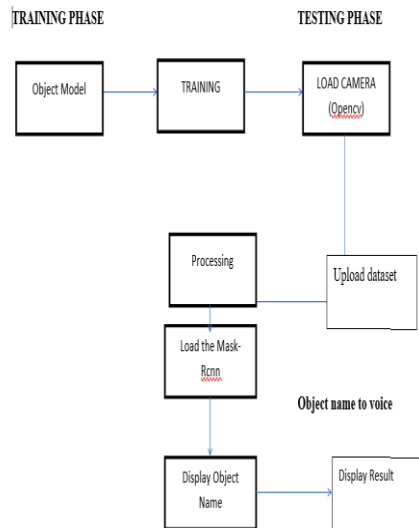


Figure 2.1

Modules

- Training Phase
 - Dataset
 - Training dataset
- Testing Phase
 - Open camera (opencv)
 - Load the Model (Mobilenet)
 - Identify the face mask wear or not
 - Sent Alert

Modules Description

Training Phase

Dataset

- This is the first module of this system, (Training the model on the dataset using Tensorflow&Keras)

Training phase

- Open camera, Load the Model, Identify the face mask wear or not.
This the second module of this system, (Loading the trained model and applying detector over live video stream with the help of camera to detect who did not wear mask. Identify the face mask wear or not. So After the

dataset trained identify the face of who shown the face in front of camera. If they did not wear mask its sent alert.

- Sent Alert

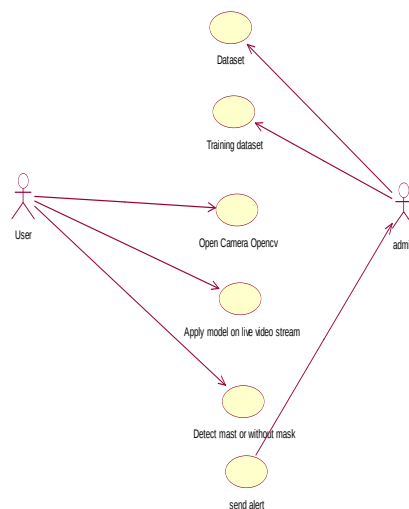
To end alert if the person did not wear mask

- Load the Model (Mobilenet)

Mobile Net is a streamlined architecture that uses depth wise separable convolutions to construct lightweight deep convolutional neural networks and provides an efficient model for mobile and embedded vision applications

UML diagrams

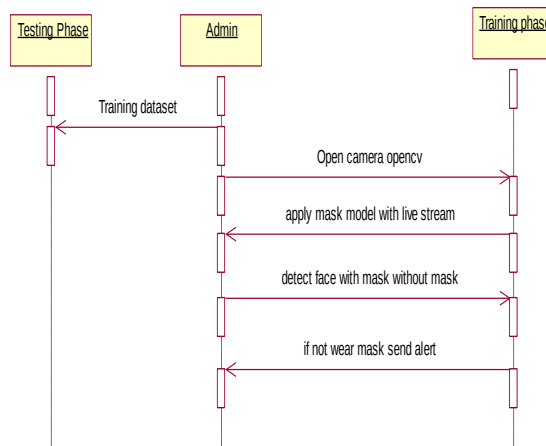
In fig[3.2] Use case chart are normally alluded to as conduct outline used to depict groups that some framework ought to act as a team with at least one outside clients of the framework.



Usecase Diagram
Figure 3.1

Sequence Diagram

A grouping chart fig[3.2] is a cooperation graph that shows how items work with each other rand in what request. It is a build of a message grouping diagram. A grouping chart shows object co-operations organized in time succession.



Sequence diagram for Registration
Figure 3.2

Class Diagram

Class diagram fig[3.3] in the unified modelling language (UML) is a type of static structure diagram that structure of a system by showing the system classes attribute operators.

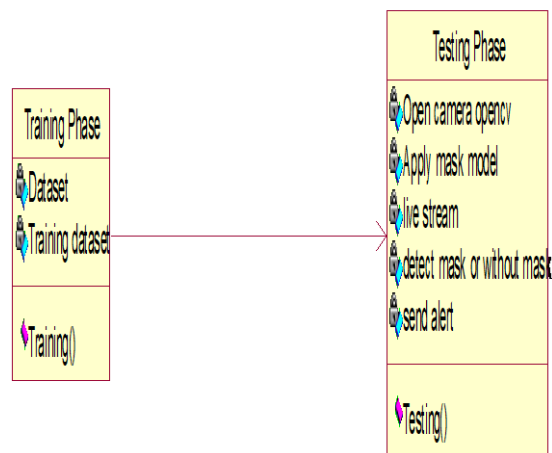


Figure 3.3
Class diagram

Collaboration Diagram

A collaboration diagram also known as communication Diagram[4.1] is an illustration of the relationships and interactions among software objects in the Unified Modeling Language(UML).

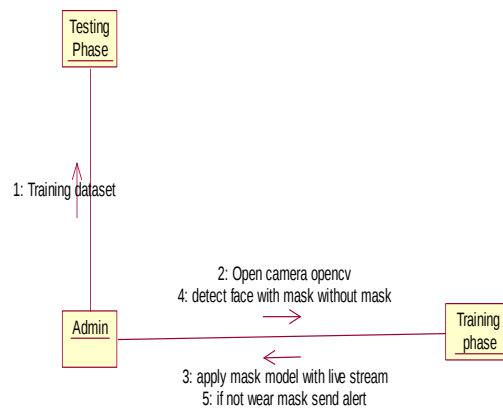


Figure 4.1

System Testing

The reason for testing is to find blunders. Testing is the most common way of attempting to find each possible shortcoming or shortcoming in a work item. It gives a method for really taking a look at the usefulness of parts, sub assemblies, gatherings, or potentially a completed item. It is the most common way of practicing programming with the goal of guaranteeing that the product framework meets its necessities and client assumptions and type address a particular testing prerequisite.

Unit Testing

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the process of testing individual software units of the application. It is done after the completion of an individual unit before integration. This is a structural testing, that relies on knowledge of its construction an invasive. Unit tests perform basic tests at component level and specific business process application and System configuration. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results. Unit testing is usually conducted as part of a combined code and test phase of the software lifecycle, although it is not uncommon for coding and unit testing to be conducted as two distinct phases.

Test strategy and approach

Field testing will be performed manually and functional tests will be written in detail.

Test objectives

☐☐All field entries must work properly.☐

- ☐ ☐ Pages must be activated from the identified link. ☐
- ☐ The entry screen, message and response must not be delayed. ☐

Features to be tested

- ☐ ☐ Verify that the entries are of the correct format ☐
- ☐ ☐ No duplicate entries should be allowed ☐
- ☐ ☐ All links should take the user to the correct page. ☐

Integration testing

Integration tests are designed to test integrated software components to determine if they actually run as one program. Testing is event driven and is more concerned with the basic outcome of screens or fields. Integration tests demonstrate that although the components were individually satisfaction, as shown by successfully unit testing, the combination of components is correct and consistent. Integration testing is specifically exposing the problems that arise from the combination of components.

Functional test

Functional tests provide systematic demonstrations that functions test available as specified by the business and technical requirements, system documentation, and user manuals.

Functional testing is entered on the following items:

Valid Input: Identified classes of valid input must be accepted.

Invalid Input: Identified classes of invalid input must be rejected.

Functions: Identified functions must be exercised.

Output: Identified classes must be exercised.

Systems/procedures

Interfacing systems or procedures must be invoked. Organization and preparation of functional tests is focused on requirements, key Functions, or special Test cases. In addition, system at coverage pertaining to identify Business process flows; data fields, predefined processes, and successive processes must be considered for testing.

System test

System test it ensures that the entire integrated software system meets requirements. It tests a configuration to ensure known and predicate results. System testing is based on process descriptions and flow emphasizing pre-driven Process links and integration points.

Acceptance testing

User acceptance testing is phase of any project and requires significant participation by the end user. It also ensures that the system meets the functional requirements.

Result

With mask

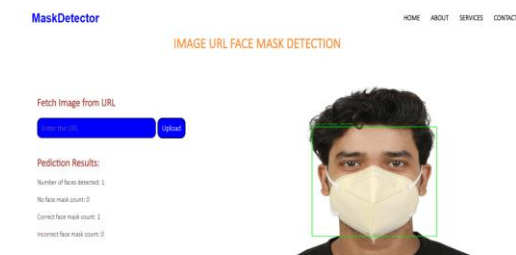


Figure 5.1

Without mask



Figure 5.2

In this project, a two-stage Face Mask Detector was presented. The first stage uses a pretrained Retina Face model for robust face detection, after comparing its performance. An unbiased dataset of masked [5.1] and unmasked [5.2] faces was created. The second stage involved training three different lightweight Face Mask Classifier models on the created dataset and based on performance, the NASNetMobile based model was selected for classifying faces as masked or non-masked.

Conclusion

As the world is fighting the COVID-19 pandemic, we have developed a novel solution for detecting whether a given image of a person has a facemask on or not. Our solution detects this even on streaming images in real-time. The accuracy on the test dataset is 96%, the highest to our knowledge. This will greatly aid public and clinical administrations. Our solution uses Mobilnetv2, OpenCV, TensorFlow, Keras and CNN. This can be used especially at public places where we can identify automatically if an individual is not wearing a face mask and may prevent their entrance. In ongoing work, we extend this work to images containing more than one face.

Future enhancement

Furthermore, the proposed method achieves state-of-the-art results on a public face mask dataset. By the development of face mask detection, we can detect if the person is wearing a face mask and allow their entry would be of great help to the society.

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