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Real-Time Face Recognition System with Enhanced Security Features using Deep Learning

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Abstract: Identification of people and mask detection has long been a captivating topic, in terms of research and business. This topic has received increasing attention in recent phases due to the speedy advancement of Artificial Intelligence (AI). Nowadays, a lot of applications, including phone unlocking systems, criminal identification systems, and even home security systems, use face recognition as a common technique. Due to the fact that this method only requires a facial image instead of other dependencies like a key or card, it is more secure. Face detection and face identification are often the first two elements of a human recognition system. Even during COVID-19, it is considered the best way to stop the spread of the COVID-19 virus is by wearing a face mask. The risk of contracting the virus can be reduced by almost 70% only by wearing a face mask. In order to promote community health. This Study aims to produce a highly precise and real-time method that can effectively recognize people and identify non-mask faces in public. When a person stands in front of the device, this application detects the human face automatically using detection, extraction, and recognition algorithms. The proposed work applies the Viola-Jones algorithm for face recognition and the YOLOv5 algorithm for mask detection and classification. When the proposed work is tested, this shows higher accuracy in mask detection which is 92.8%.

Introduction

Face Recognition nowadays is one of the most important biometric research fields for many purposes. Security is one of the major concerns in all potential fields. Face recognition includes the detection of the face, its position, image pre-processing etc. First, we must understand that face detection and face recognition are two distinct things, although both depend on one another. Face detection is the technique by which the system identifies faces in digital images & videotape streaming irrespective of the source while face recognition is the relating of a given face with a given name in digital images. Face recognition is a core component of the human sensory system and a common human activity, developing a similar computational model for this becomes challenging. The primary benefit of the facial recognition system is that it can be used without human intervention and at a distance to identify the face (Howell et al., 2022). In high-security locations like banks, government buildings, and public places like malls, parks, railway stations, and bus stops, this kind of technique is necessary.

There are three main steps come under face recognition system such as face detection, feature extraction, and face matching. The identified and reused face is matched with a database of recognized faces to identify the person (Kortli et al., 2020). The most common approaches for facial identification are feature

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analysis, neural networks, Eigen faces, and autonomous face processing. Although facial recognition technology has improved tremendously, improvements are still needed to demonstrate accuracy and dependability.

The Viola-Jones object recognition and detection framework was presented by Michael Jones and Paul Viola in 2001. The inspiration behind the development of this framework was the difficulty of face detection using traditional techniques. All though this technique may also be used to recognize and detect various objects. This technique is powerful and gives optimal recall and precision value. For feature selection, it makes use of AdaBoost classifier and Hear-like features.

From year 2019 to 2022, the world has been overrun by Coved 19 virus. According to numerous studies, COVID-19 spreads mostly through social interaction with infected people and through droplets and aerosol transmission. Therefore, several methods, including quarantine and lockdown are recommended by the majority of governments to prevent the increase of COVID-19 infection. Thus to stop the spread of COVID-19, it has been determined that encouraging people to correctly wear protective face masks is an urgent and effective option.

Face mask detection is the process of checking if a person is wearing a mask or not. In order to train efficient classifiers for detection and recognition, using hand-crafted features and traditional machine learning techniques, the initial study on face detection was carried out in 2001 (Campbell et al., 2022). This approach has problems with a complex feature design and subpar detection accuracy. There are many algorithms used for face detection which include SVM, PCA, KNN, CNN and many other than come YOLO which outperform these algorithms. YOLO directly enhances and optimizes detection performance by training on whole photos. This integrated model has various advantages over customary item identification methods. First and foremost, YOLO operates quickly and selects representations of adaptable things. When tested on creative images and trained on real-world images, YOLO greatly surpass detection methods like KNN and SVM.

Background Details

Face Recognition System

Identification of faces helps analyze a person's face traits in order to recognize them. In security, and management systems, it has grown in popularity. Researchers first looked at the possibility of employing computers that could recognize human faces in the early 1960s, which is when the technology first gained popularity. Simple methods like the alignment of templates, which compared an unknown face's traits to a predefined set of prototypes, were utilized by early facial recognition systems. These early systems had drawbacks because of their reliance on present templates and inability to adapt to changes in stance, lighting, and face expression. As time passed on, experts in this area created elaborate facial recognition algorithms using artificial intelligence and machine learning methods. Face recognition technology is now used for an extensive spectrum of tasks, from unlocking cell phones to detecting suspects in crime. As consequently, research is always being done to enhance the reliability, equity, and openness of face recognition systems.

Face Mask Detection

The method of figuring out whether someone is wearing a mask or not is known as face mask detection. The implementation of facial mask recognition technology has been encouraged by the requirement to impose public health regulations related to the COVID-19 pandemic. But there are several restrictions and issues with the technology. One of the main issues is that the effectiveness of face mask recognition system can be impacted by elements like position, and obstacles, that may render it hard for the system to differentiate between a face shield and other facial items, regardless of these difficulties, facial mask recognition technology is going to continue to play a significant role in initiatives aimed at improving public health, with researchers constantly search for ways to boost its precision and consistency (Pebrianto et al., 2022).

Viola Jones Algorithm

It is a face recognition algorithm. Paul Viola and Michael Jones proposed this in 2001. For a real-time face recognition application, this system can be executed effectively because it is very precise and efficient. It has an accuracy rate of 95%. Figure 1 shows the process involved in Viola Jones algorithm.

YOLOv5

It is an object detection algorithm which is released in 2020 and is considered one of the most accurate algorithms. It uses CNN to perform object detection. As YOLOv5 is a single-stage object detector. Speed is considered one of the key features of it. The CSP-Darknet53 serves as the foundation for YOLOv5. Its accuracy is 95.76%. The process of YOLOv5 is shown in Figure 2.

Literature Review

Table 1 comprises the literature review on the basis of various research papers published over the years on the algorithms related to face recognition and mask detection system.

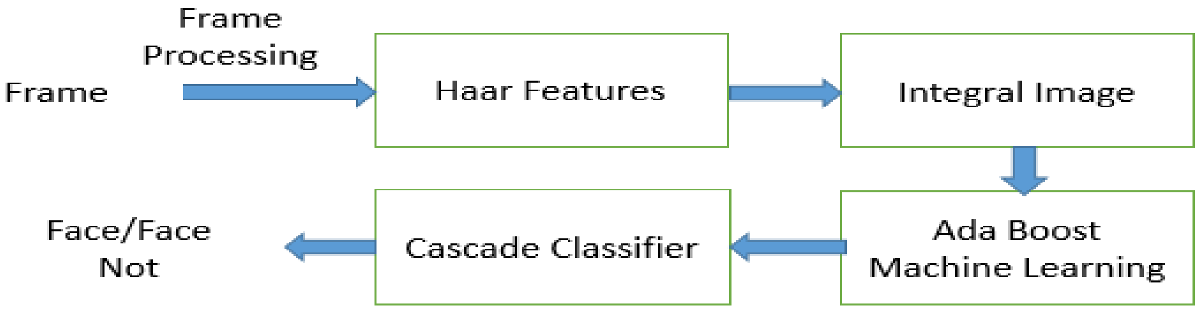

Figure 2. Process of Viola Jones

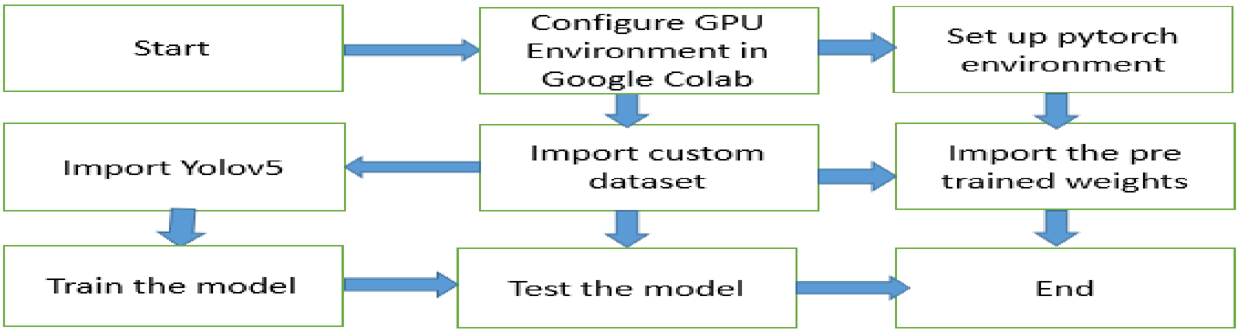

Figure 1. Process of YOLOv5

Table 1. Literature review

Sl No.	Author(s)	Algorithms used	Application work with Accuracy (A)	Limitation/Drawback
1.	Leo et al., 2018	SVM	Expression-Invariant 3D Face Recognition System A-94.39%	1. It does not perform well with the large dataset. 2. Performs poorly with noisy dataset.
2.	Peng et al., 2021	Principal Component Analysis (PCA)	In this paper PCA is being used in face recognition A-90%	It is poorly written. It only uses the linear combination of the features of data.
3.	Suyal et al., 2022	K- Nearest Neighbor (KNN)	KNN is used for object detection.	1. High memory is needed since all of the training data must be stored. 2. Given that it stores all of the training data, it is computationally expensive.
4.	Hussain et al., 2022	Deep CNN, MobileNetV2	This paper is based on MobileNet technology and Deep CNN A -97%	1. A lot of training data is needed. 2. Training process takes a long time. 3. MobileNetV2 uses the deep separable convolution that may affect the training efficiency.
5.	Jiang et al., 2021	YOLOv3	Real-Time Face Mask Detection Method Based on YOLOv3 A - 75%	Large localization error and lower recall
6.	Indulkar et al., 2021	YOLOv4	This paper discussed social distancing and mask detection using YOLOv4 during COVID 19 A - 98.81%	Large localization error and lower recall but 10% better performance than YOLOv3.

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7.	Shatnawi et al., 2018	Eigen faces	It shows how the measurement of different face distance impact Eigenvalues.	1. Its sensitivity to head position and lighting conditions in an image is a disadvantage. 2. Finding the eigenvectors and eigenvalues on PPC takes a lot of time.
8.	Upendra et al., 2021	Opencv	Opencv is used for real time face recognition A - 98%	1. The facial recognition software.is particularly sensitive to position changes. 2. Different angles or head motions can change the texture of a person's face, resulting in an incorrect image.
9.	Kaur et al., 2017	Viola Jones	It uses performance-based analysis based on Viola-Jones.	1.Only allows binary categorization 2. When facing the target, it works best. 3. Extremely high or low exposure for brightness makes the model sensitive.
10.	Pranav et al., 2020	CNN	This paper uses CNN for evaluation of faces in real time A-97.25%	The position and orientation of objects are not encoded by the model.
11.	Solomon et al., 2019	Image Processing	The proposed work mainly focuses on the challenges faced in the face recognition system.	1. Ageing affects the recognition of face. 2.Variation in facial expression may reduce the efficiency of the model.
12.	Gupta et al., 2023	AlexNet, and Neural Network Sensor	This paper is based on the COVID-19 pandemic where mask becomes compulsory and to detect it various Machine Learning techniques is used. A - 98.39%	The usage of big convolution filtering increases the complexity of the model.
13.	Nagoriya et al., 2020	Raspberry pi, and ResNet	Live Facemask Detection System. A- 96.02%	It uses the deep complex network that takes weeks to train the model, making it practically inefficient for solving real-life problems.
14.	Horvat et al., 2022	YOLO, and YOLOv5	Localization and classification of image and its comparative study using YOLOv5 are discussed.	It has trouble identifying tiny images among a collection of photographs.
15	Chaudhari et al., 2018	Viola Jones	Viola Jones and Neural Network being discussed in this paper for face detection	It is sensitive to high or low image brightness.

Materials and Methodology

Details of Images Dataset

This paper consists of pictures with various dimensions and angles. In a customized dataset adding real time images during execution. They all are in jpg format with a system space of 289 MB. Further in this paper, face images and videos for face mask detection are being collected from various sources like Kaggle to test and train the system, containing 1400 images of which 1167 are training images and 233 are testing images and 371 videos which 250 are training images and 121 are testing images as given in Table 2. They all are in jpg format with a system space of 530 MB (Deepak, 2021).

Table 2. Total images in the dataset

Dataset	Training Images	Testing Images
images	1167	233
videos	250	121

Table 3 shows the dataset distribution in different dimension. It is in pixel format. The maximum width and minimum width of the image is 608 and 194 respectively. The maximum height and minimum height of the of the image dataset is 612 and 193 respectively.

Table 3. Shows the dataset Distribution

Image Dataset	
Maximum height	612
Maximum width	608
Minimum height	193
Minimum width	194

Sample Images

1. Face Recognition

Figure 3. Sample image for Face recognition from customized dataset

2. Face Mask Detection

Figure 4. Shows the sample images of people wearing mask and without masks (Deepak, 2021)

Proposed System

The process of establishing requirements such as a system's architecture, components and modules, interfaces, and data is known as systems design. Face recognition technology helps recognise human faces in digital images and video frames (Bansal et al., 2022). Object detection technology seeks out occurrences of objects in digital photos and movies. The proposed system is depicted in the Figure 5. The system has three stages: Face detection, Feature Extraction, Face Matching.

Face Detection and Acquisition of Face Data Stage

In Figure 5, the face recognition system begins by detecting faces in a provided image. The focus of this step is to identify whether the incoming image has human faces or not (Kortli et al., 2020). Face detection may be difficult owing to variations in illumination and face expression. Pre-processing procedures are utilized to aid in the development of a more definitive face recognition system. The Viola-Jones is used for detecting and locating the human facial image. Furthermore, using YOLO techniques, the face detection stage can be utilized to classify films and images (Natarajan et al., 2022).

Feature Extraction

Figure 5 shows the second level of the Facial Recognition Framework. This step's primary purpose is to isolate the face features from the face images discovered during the detection stage. A face is represented in this level by a "signature," which is a

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collection of characteristics vectors that reflect prominent facial features like the mouth, nose, and eyes with their geometric dispersion. The size, shape, and structure of each face distinguishes it.

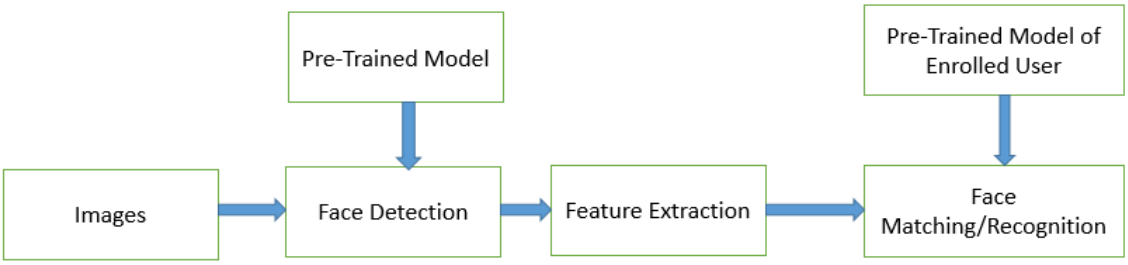

Figure 5. It shows the framework for Real-time Face Recognition in image systems

Face Recognition

This is the third level of the Face Recognition Framework (Figure 5). The backdrop features extracted throughout the feature extraction procedure are considered and compared to well-known faces stored in a given database at this stage. Identification and verification are the two main functions of facial recognition. In the identification process, a face is then compared to other faces to decide which one is the most likely match (BattaL et al., 2022). A face is then compared to a trained face in the database throughout the identification process to determine whether it should be approved or rejected.

Algorithm used for Face Recognition System

Viola Jones

The Viola-Jones technique, devised in 2001 by Michael Jones and Paul Viola, is an object-recognition system that detects visual elements in real time. The Viola-Jones Algorithm has two stages: Training, Detection. Training happens before detection, but we will talk about detection first for clarity's sake. Viola-Jones identifies frontal faces better than sides, above, or downwards faces since it was developed for them. Before detecting a face, the image is changed to grayscale since it is more convenient to work with and consumes fewer processing resources After detecting the person's face in the grayscale image, the Viola-Jones method detects its location on the coloured image. The four fundamental ideas that underpin the Viola-Jones algorithm are discussed below: i) Haar-like characteristics, ii) Integral pictures to accelerate feature calculation iii) AdaBoost learning to choose features iv) Classifier cascade for quick rejection of windows without faces.

Haar-like features

Haar-like wavelets are picture features that are used in the Viola-Jones object detection system. These are simple rectangular features computed as the difference between the sums of pixel intensities in two adjacent rectangular parts of an image. Haar-like characteristics are used as input to this classifier, with the concept that particular patterns of Haar-like features are more likely to be present in positive cases than in negative examples. Each feature defines a group of rectangles in the image window. A rectangle can be either white or black in colour. The feature value is derived by subtracting the sum of white pixel values from the total of black pixel values. The feature value will be around zero for "flat regions", i.e., where all the pixels have the same value. A large feature value will be obtained in the regions where the pixels in the black and white rectangles are very different. The classifier then evaluates each window to determine whether it contains the object of interest or not. Overall, the use of Haar-like features is a key aspect of the Viola-Jones framework, allowing for efficient and accurate object detection in a broad range of applications. As shown in Figure 6, features A and B have great importance in face detection as: The area around the eyes is darker than the area around the cheeks. The eye area is darker as compared to the nose area.

Integral Images for accelerating feature computation

Integral images are a major component of the Viola-Jones object-identification system, used to expedite the computation of Haar-like features. A 2D matrix called an integral picture holds the whole sum of the pixel intensity values in the input image. Each element of the integral image is the summation of all the pixels in the input image to the top and left of that element, allowing the integral image to be effectively computed with just one pass over the input image. Because each feature can be computed as a simple arithmetic operation on the integral image, independent of its size or placement within the image, Haar-like features can be computed quickly (Amodeo et al., 2022). Overall, the use of integral images is a crucial optimization in the Viola-Jones technique that enables quick object recognition and efficient computation of Haar like features.

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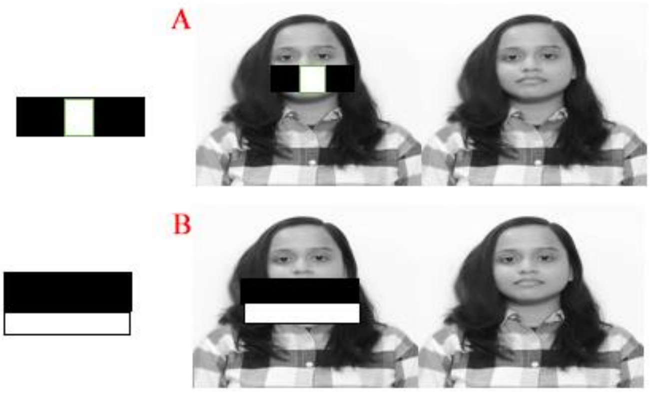

Figure 6. Types of Haar-like Features used in detection of face

Ada Boost learning for feature selection

The Viola-Jones object detection framework uses the machine learning technique AdaBoost (Adaptive Boosting) for feature selection. AdaBoost aims to increase the precision and effectiveness of the object detection algorithm by choosing a small subset of informative features from a large number of available features. In the Viola-Jones framework, with each weak classifier trained on a single Haar-like feature, AdaBoost is used to integrate the weak classifiers into a strong classifier. The AdaBoost technique works by reweighting the training instances after each iteration in order to focus on the poorly classified cases, while iteratively selecting the most helpful feature and adding it to the strong classifier. In general, AdaBoost learning is an important stage in the Viola-Jones object identification framework since it enables the selection of instructive Haar-like features and enhances the object detection algorithm's efficacy and accuracy.

Cascade of classifiers for fast rejection of windows without faces

The Viola-Jones object detection methodology relies on a cascade of classifiers to swiftly eliminate image windows that are unlikely to contain a face. Figure 7 depicts the working of the cascade classifier. This makes the method more effective and quick by allowing it to concentrate its computation on a limited group of image windows that are more likely to contain a face. The Viola-Jones framework's classifier cascade consists of a succession of steps, each with a set of weak classifiers. AdaBoost is used to train the weak classifiers on a set of positive and negative examples, and each classifier evaluates the input image window using a unique Haar-like feature. During detection, the image window is passed through each stage of the cascade, with each stage using a different set of weak classifiers to evaluate the window. If the window fails to pass a stage, it is immediately rejected and the algorithm moves on to the next window.

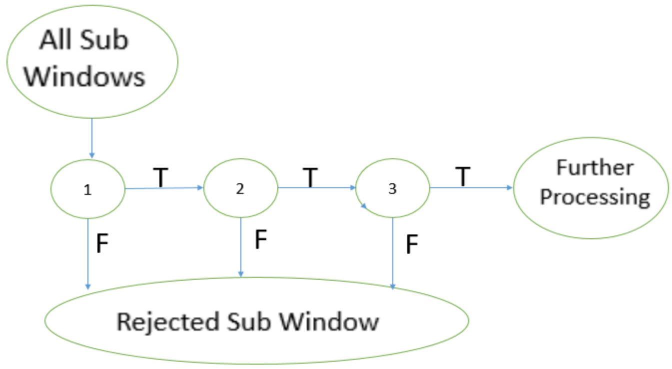

Figure 7. Working of Cascade Classifier

Proposed Work

The objective of the suggested work is to create an object detection model that is both efficient (Y-axis) and quick (X-axis) to infer. Preliminary results show that YOLOv5 efficiently surpasses other state-of-the-art methods for this purpose. The aforementioned graph demonstrates that all YOLOv5 variations train faster than EfficientDet. The fastest YOLOv5 model, YOLOv5x, processes images at a rate that is many times quicker while maintaining a comparable level of accuracy when compared to the Efficient Det D4 model. Figure 10 shows the performance of all variants of YOLOv5 algorithm.

To train the dataset

ret.frame ← read the video frame from webcam

frame ← resize the video frame

frm ← [frame] takes single video frame

results ← self.model (frm)

labels.cord ← store labels and coordinates of object detected in the results

Plot bounding boxes and label onto the frame according to the label value for that frame

Proposed Algorithm

img ← Read img from webcam

imgs ← Resize the image

Convert the image from BGR to RGB format

face_currentframe ← face_recognition.face_locations(imgs)

encode_currentframe ← face_recognition.face_encoding(imgs,faces_currentframe)

encode_listknown ← for each image in dataset face.recognition.find_encoding

for each image in dataset (encode_currentframe, face_currentframe)

matches ← face_recognition.compare_faces(enocde_listknown, encode_face)

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facedis ← face_recognition.face_distance(encode_listknown,encode_face)
matchIndex ← np.argmin(face_dis)
if matches[matchesIndex] then
create bounding box for displaying the face with label

Table 4. Notations and descriptions used in the proposed algorithm

Notations	Description
img	to read image as input
imgs	store the resized image in proper format
face_currentframe	store location of each face
encode_currentframe	to store encodings(measurements) of face
matches	store result of matching the similarities between two faces
encode_listknown	list of encodings of each face in the dataset
matches	store result of matching the similarities between two faces
facedis	to store the Euclidean distance of each face encoding
matchIndex	to store the minimum value around the axis and name the best match

Algorithm Used for Face Mask Detection System

YOLOv5: (You Only Look Once)

Process Involve YOLOv5 for Face Mask Detection

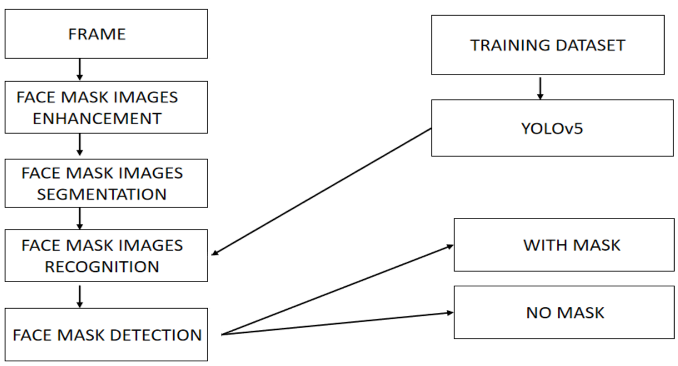

Figure 6. Flow chart for face mask detection using YOLOv5

YOLO-Face- Scheme Detection

The major element of the YOLO-Face scheme's detection network YOLOv5 is an object identification method, is briefly detailed in this section. This method enhances the efficacy of face detection technologies dramatically (BattaL et al., 2022). Prediction of classes: By only determining whether the two classes face and non-face exist or not, this technique reduces the multi-label classification problem to a binary classification problem (Sapakova et al., 2022). The model, which is based on an object detection network, employs a multi-part loss function to reduce output error.

The architecture of the proposed system is depicted in Figure 11. In the proposed detection system, there are 24 convolutional layers before 2 completely connected layers. Switching 1x1 convolutional layers help to decrease the features region from earlier layers (Natarajan et.al.,2022). We pre-train the convolutional layers for the ImageNet classification procedure at half the resolution (224x224 input image), and then double the quality for detection.

The image's characteristics are extracted by the first convolutional layer. While the network's fully connected layers anticipate the output's locations and probability, this architecture was based on the GoogLeNet model for categorizing images. In our network, 24 convolutional layers come before 2 completely linked layers. Other than Google Net's inception modules, we only employ 1x1 reduction layers accompanied by 3x 3 convolutional layers. We also create a fast iteration of YOLO with the intention of enhancing object identification speed. Instead than using 24 convolutional layers, Fast YOLO uses nine convolutional layers and fewer filters in each layer.

Results & Discussion

Stimulation Setup

Table 5 demonstrates the system requirements used to develop the MCNN. A 64-bit OS and an Intel(R) Core(TM) i5 processor with 8 GB of RAM make up the hardware setup. The codes were run on Google Colab for GPU and were created in Anaconda (jupyterlab) version (64-bit). As an operating system, Windows 11 Home is used.

Table 5. Stimulation setup

Name	Specification
Processor	Intel Core i5, 64
RAM in system	8 Gigabyte
System Type	64 bit OS
Software used	Anaconda (jupyterlab)(64 bit)
Setup	Google Colab
OS	Windows 11 Home

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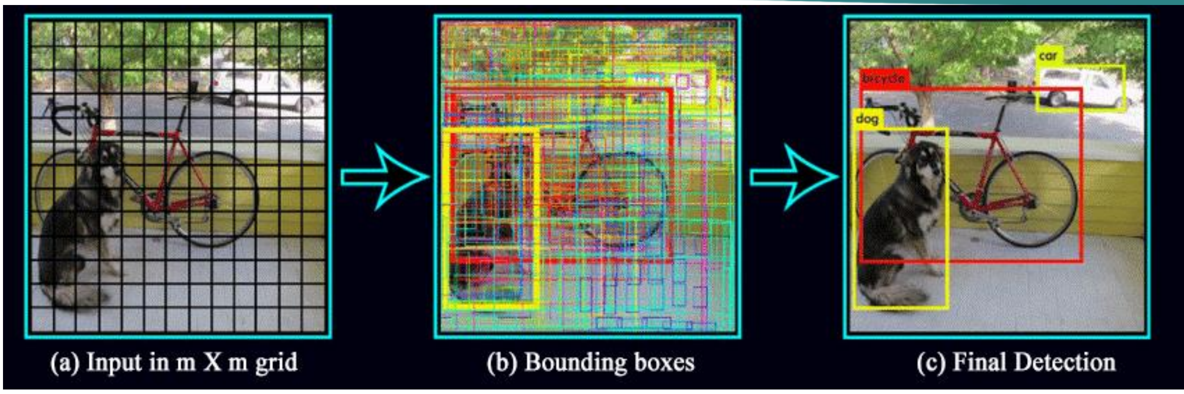

Figure 9. By using the yolo approach, the above image is separated into an m X m grid. Grid cell is responsible for detecting the object when any object falls inside it (a). Each grid cell predicts the bounding boxes (b) and confidence scores and its class probability (c) is observed (Redmon et al., 2015)

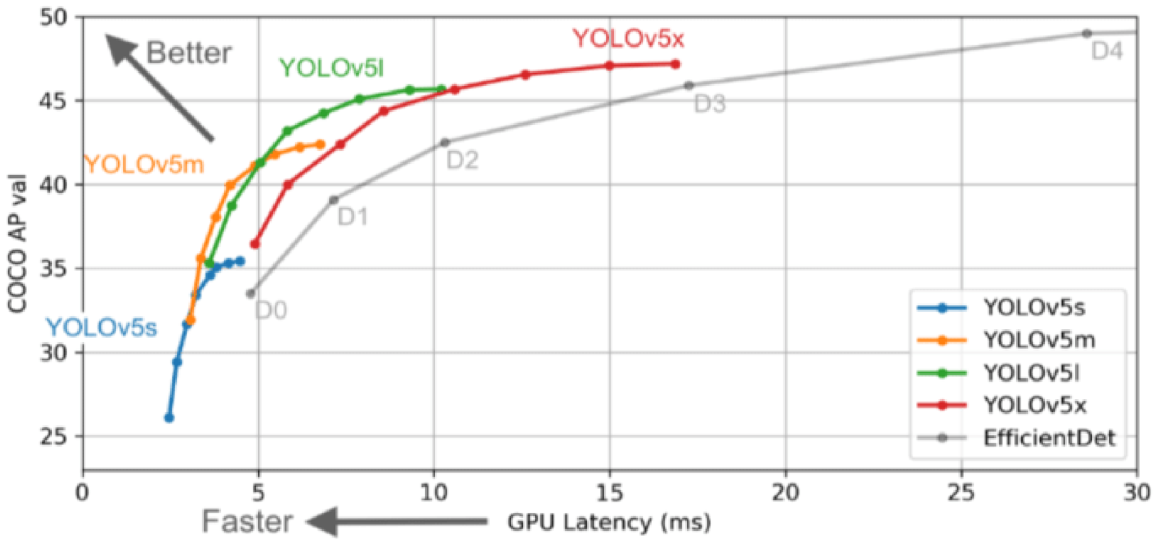

Figure 10. Performance of all variants of YOlOv5 algorithm

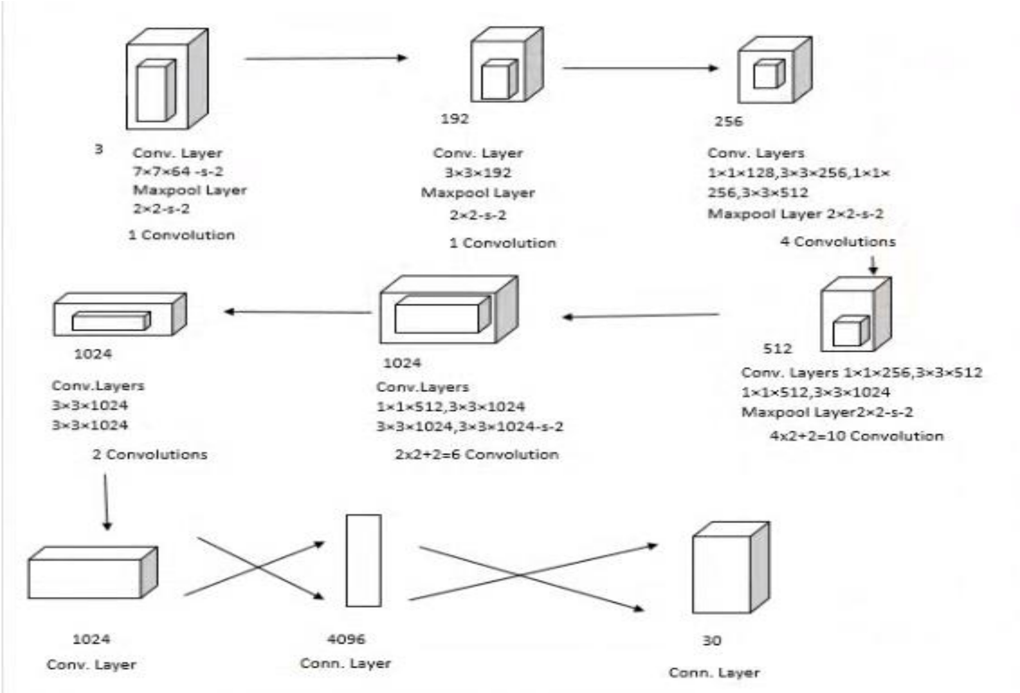

Figure 11. Architecture of proposed system

Results

Figure 12 displays a plot of precision on training and validation datasets over training epochs. The graph's X-axis shows how many epochs there have been. The Y-axis of the graph contains a representation of the precision value. The model's accuracy after 10 iterations was 86.78%, while the validation's precision was 82.09%. The model's precision at 20 epochs is 87.94%, and its validation is 87.49%. Model accuracy has been observed to be 88.27% at 30 epochs, and validation precision to be 88.17%.

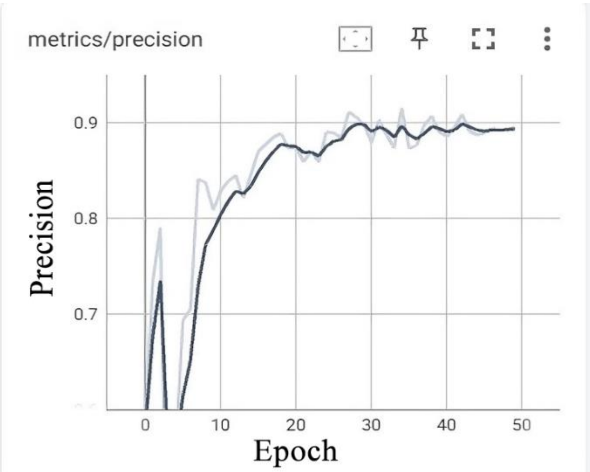

Figure 12. Precision of model on training and validating sets

Figure 13 displays a plot of recall on training and validation datasets over training epochs. The graph's X-axis shows how many epochs there have been. The Y-axis of the graph contains a representation of the recall value. The model's recall after 10 iterations was 72.78%, while the validation's recall was 73.09%. The model's recall at 20 epochs is 77.94%, and its validation is 77.49%. Model recall has been observed to be 81.27% at 30 epochs, and validation recall to be 82.17%.

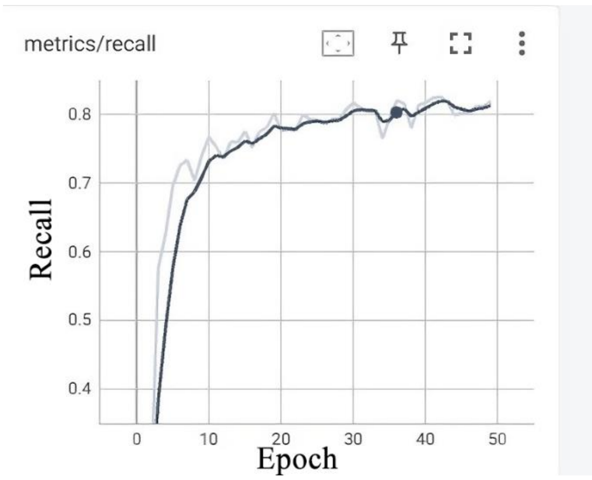

Figure 13. Recall for training and validating sets

Evaluation Technique

The accuracy of a classification model refers to its ability to identify the class labels of a given collection of input data. It is described as the proportion of cases that were correctly categorized to all of the occurrences in the dataset (Srivastava et al., 2021). The proportion of real positive examples (i.e., occurrences that fall into the positive class) among all cases the model has classified as positive indicates how well a binary classification model is described by its precision (Li et al., 2022). The ability of a binary classification model to properly identify every instance of a positive class in a dataset is determined by recall. Other names for it include sensitivity and true positive rate. The accuracy of Viola Jones for face recognition system is 91%. However, the precision and recall are 88.17% and 82.1% respectively as shown in Table 6. The graphical representation of result (precision and recall) is shown in Figure 14. The output for the given input is depicted in Table 7.

Table 6. The value of two parameters Precision and Recall of Yolov5 for face mask detection

Parameters	Value
Precision	88.17 %
Recall	82.1%

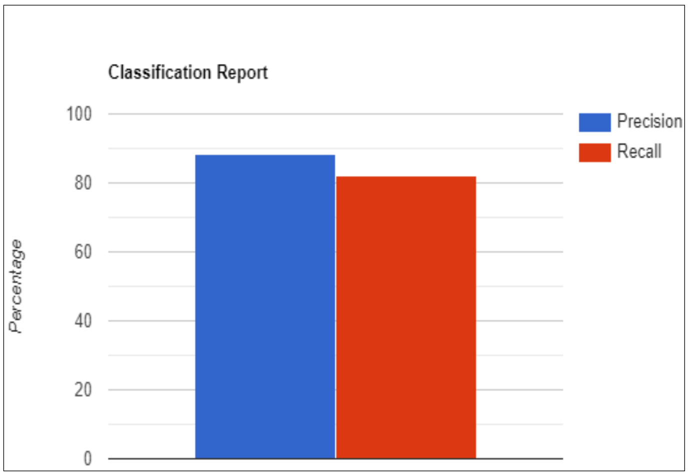

Figure 14. The graphical representation of the of the precision and recall of the proposed work

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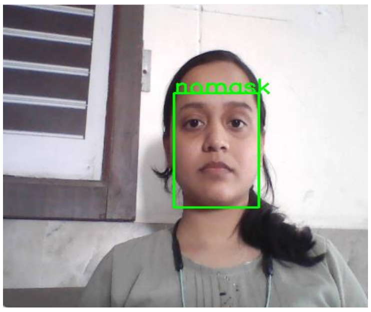
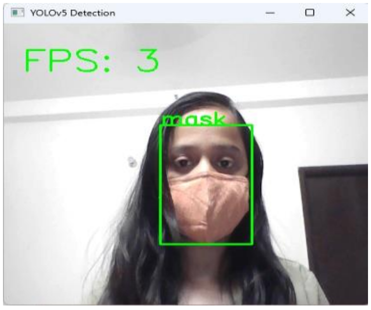
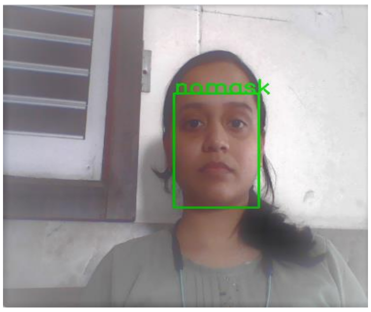
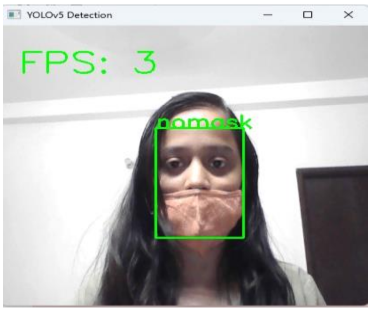
Table 7. The output obtained from the proposed work

Input	Output
Face Recognition	
Face Mask Detection(Without Mask)	
With Mask	
Improper Lightening	
Improper wearing of Mask	

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Comparative Analysis

Table 8. Comparison of algorithms

Algorithms	Precision	Recall
SVM (Rana et al.,2016)	72.7	70
PCA (Grogan et al.,2021)	72	73
KNN (Schenkel et al.,2019)	82.7	68.50
PROPOSED WORK (YOLOV5)	88.17	82.1

Table 8 compares different algorithms depending. Figure 15 shows the graphical representation of the comparison of the algorithms. It has been found that YOlOv5 gives improved results as compared to other state-of-art algorithms. For this, we have taken images as well as videos to extract the precision. From this we have seen that YOLOv5 gives a high precision percentage rather than SVM which has a precision of 72.7% and a recall value is 70 percent (Rana et al., 2016), Principal Component Analysis (PCA) which has a precision of 72% and a recall value of 73% (Grogan et al., 2021), KNN has a precision value of 82.7% and recall value of 68.50% (Schenkel et al., 2019). While the proposed work has precision and recall values are 88.17 and 82.1 respectively.

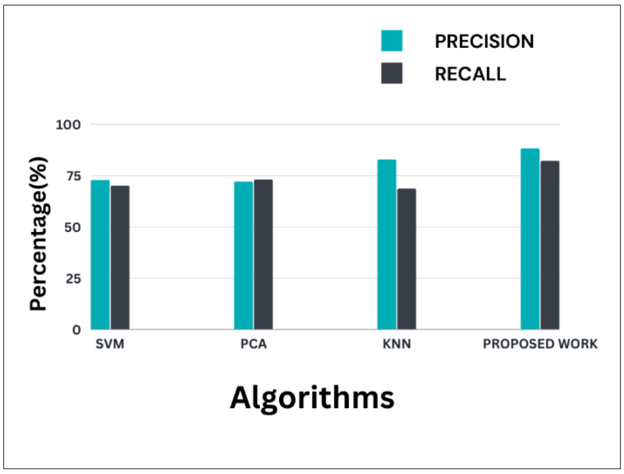

Figure 15. The graphical representation of the precision and recall of proposed work (YOlOv5) in comparison with the most likely used algorithms

Conclusion

In this study, multiple picture recognition algorithms were evaluated using the same data set, and the accuracy rate was measured on a number of folds. Face recognition can be utilized to accomplish improbable and difficult applications after it has been accomplished effectively in a variety of settings. Unknown people can be identified using this approach. Future studies will focus on algorithm recognition. The data collection includes images with different variations, such as photos with or without light, with or without spectacles, or with or without a smile. Using the provided data set, the Algorithm has produced various accuracy rates with regard to various folds.

The study covers a variety of algorithms by Viola Jones that could be used to build a facial recognition system. We've evaluated a few of them and talked about their advantages and disadvantages. This method recognizes facial expressions to a respectable degree and can therefore be applied to security applications. In the results section, the accuracy rate has been compared and examined. The graphs and result tables make it obvious that Viola Jones highest accuracy (91%) when compared to all other classifiers.

This paper proposes is based on YOLOV5 for application to recognize faces whether wearing masks or not, they only need to stand in front of the camera, people can be identified, if recognition success and an alert message will appear which will show whether they are allowed to enter the room or not, this approach is no longer required to use the human crowd control, greatly saving time and waste. This experiment has a success rate of about precision (88.17) %and recall (82.1%) and for comparison, we use some other traditional machine learning models. There is a photo of the person who is well known who is also wearing a mask but not covering their nose. We think that this design can successfully reduce exposure distances and execute effective surveillance because of COVID-19's worldwide influence. Though testing our success rate is 85.5%.

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