Chemical Protected Face Detection using Machine Leaning

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Abstract

The suggested system consists of the following steps: acquiring CCTV photos, processing those images, locating faces in the images, extracting information from those images, and recognising faces. Principal component analysis (PCA) and convolutional neural network (CNN) are the two feature extraction technologies we employ. We employ K-nearest neighbour (KNN), decision trees, random forests, and CNN. Applying these algorithms to the dataset of more than 40K real-time photos recorded at various conditions, including light intensity, rotation, and scale for simulation and performance evaluation, results in the recognition. Finally, we were able to recognise faces with over 90% accuracy and a minimum amount of computation time. A face shield, an item of personal protective equipment (PPE), aims to protect the wearer's entire face (or part of it) from hazards such as flying objects and road debris, chemical splashes (in laboratories or in industry), or potentially infectious materials (in medical and laboratory environments). Depending on the type used, a face shield may protect its wearer from a physical hazard, chemical splashes, or biological hazards.

Key: Chemical, Protected, Face, Detection, Machine Leaning, chemical splashes.

Introduction

In order to accomplish the necessary security, today's organisations must employ a number of individuals who have received specialised training. Human error, however, compromises safety. Today, closed-circuit television (CCTV) serves a variety of functions in daily life. Simple passive monitoring has been converted into an integrated, intelligent control system thanks to the

advent of video surveillance. For safe access control, financial transactions, and other uses, consider face detection's newest applications. Faces, palms, and fingerprints are examples of biometric systems that have lately become more significant.

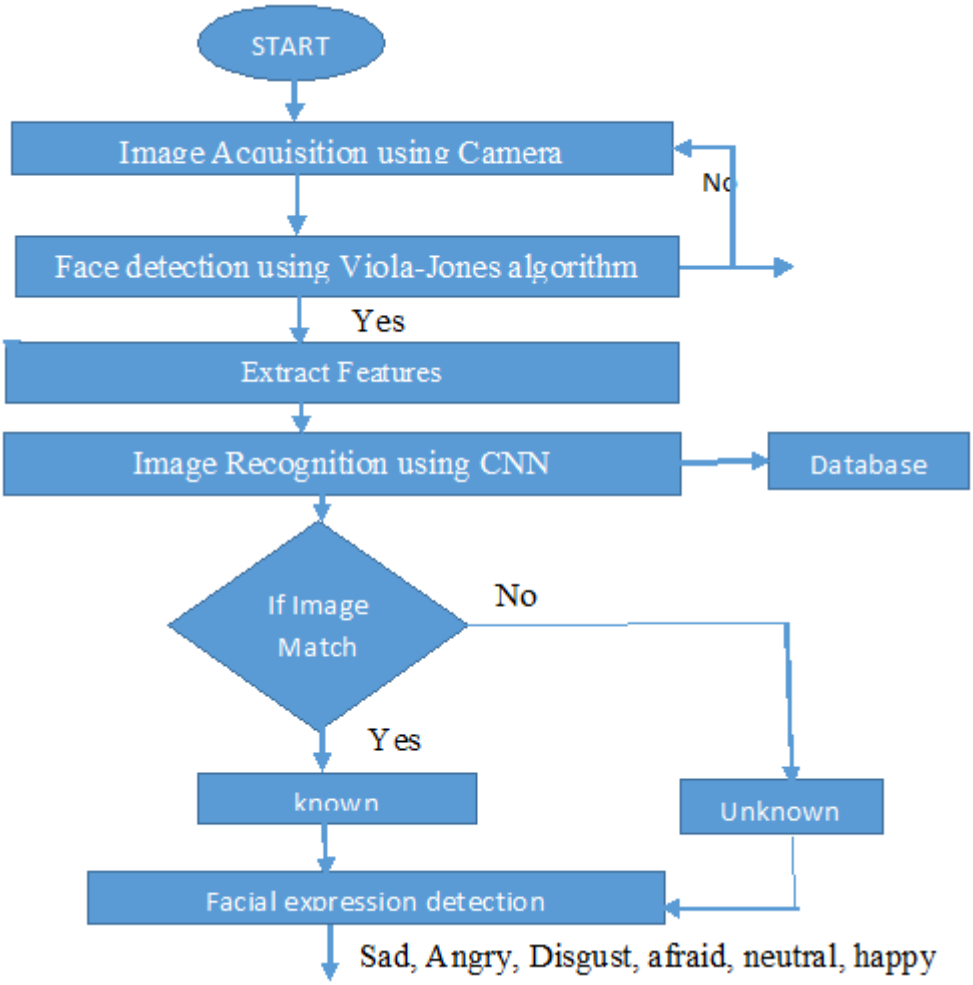

Fig.1: Face Detection using Machine Leaning Flow Chart.

Biometrics is now a commercially feasible technology thanks to developments in microelectronics and vision systems. A crucial component of biometrics is facial recognition. Human basics are matched to contemporary data in biometrics. An effective algorithm is developed and used to implement the face characteristics, and certain modifications are made to the current algorithm model. Computerised face recognition may be used for a number of practical purposes, such as criminal identification, security measures, and authentication. The processes of a facial recognition system normally start with face detection, where the face of the input image is found, and then the image process cleans the face image for simple recognition.

Geometric Methods for Face Detection

Early on in the development of computer vision, researchers looked at a variety of algorithms that retrieved visual properties and made use of geometrical constraints to understand the capabilities of all aspects. Due in part to the extremely constrained processing resources. Computer vision has been made feasible in the early computers thanks to the reduction of information from the extraction of functionality [6, 7].

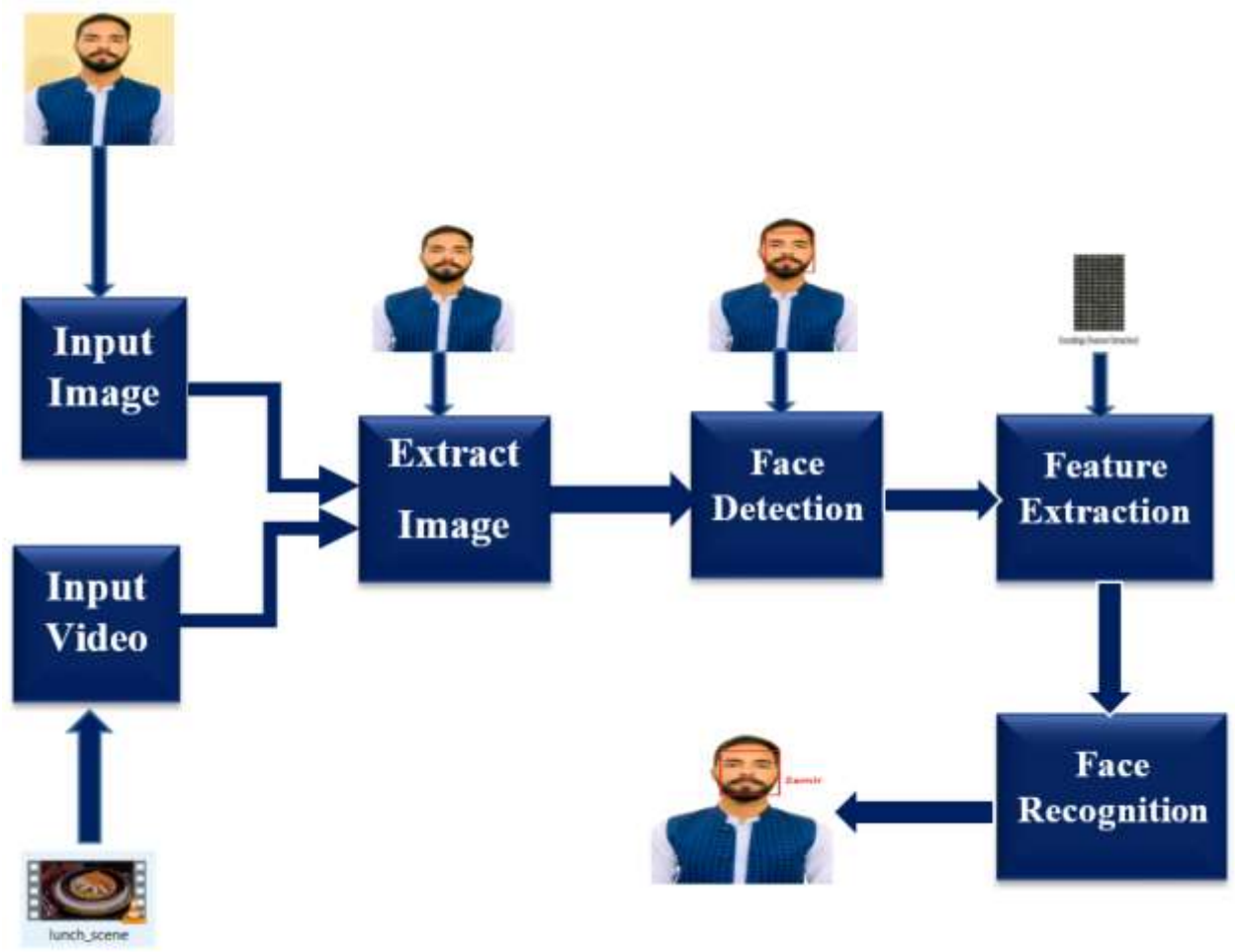

Fig.2: Face Detection using Machine Leaning Process.

Template-Based Face Detection [8]

The majority of face identification techniques are model-based and directly use pixel intensity to encode facial pictures. The majority of these face image characterization methods, whether they are neural networks or other processes, employ probabilistic models. These models' parameters can be manually tweaked or automatically altered by test photographs.

Simple Templates

These algorithms provide erroneous results if another skin color is present in the image (such as on the arms and hands) when employing a skin-based technique. Many studies attempted to address this by using findings from the skin color matching of basic models. These models range from a few ovals that correspond to the perception of the entry edge to correlation models for the areas of skin colour and skin colour (such as lips, hands, or eyes). However, these methods can increase the speed while simultaneously improving the resilience of color detectors.

Face Recognition algorithms

The technology of face recognition is currently being taken into account in machine learning and artificial intelligence. It is crucial to several social security application processes. The issue of facial recognition is now being solved by several studies and techniques. Combining cat swarm optimization (CSO), particle swarm optimization (PSO), and genetic algorithm (GA) was suggested by Vive and Guddeti [9]. Many other people have been motivated to work similarly by this hybrid method. SVM, higher-order spectral (HOS), and random transformation (RT) were merged by Ali et al. [10].

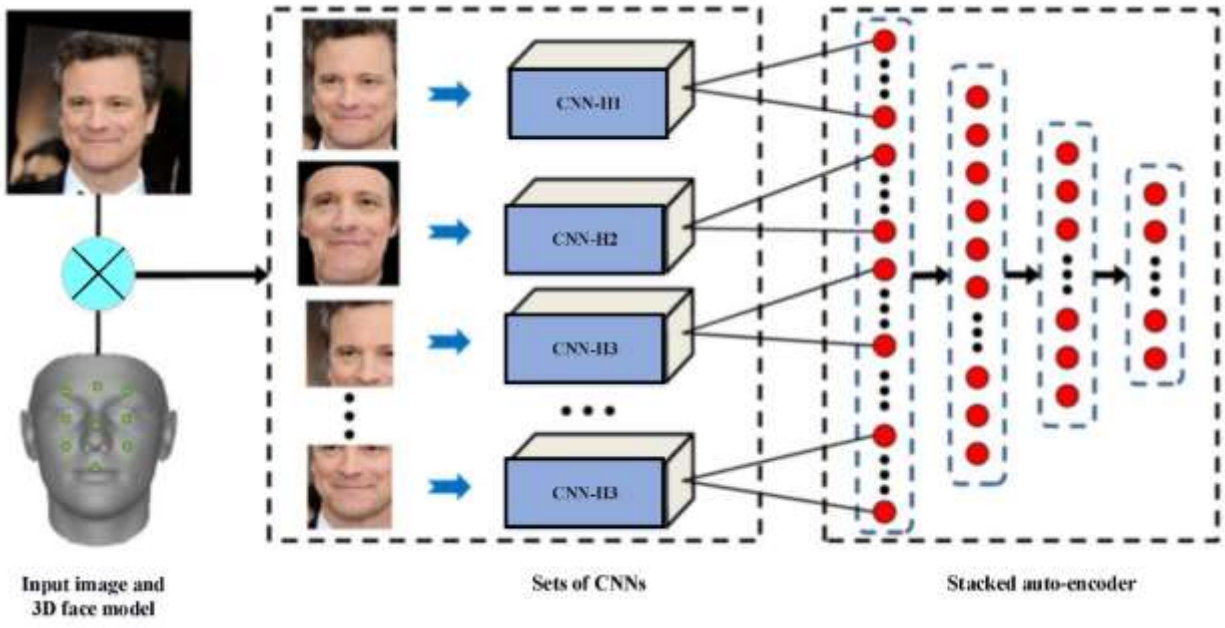

Fig.3: Face Detection using Machine Leaning Method

Iterative Closest Point-Based Alignment

The alignment approach's [11, 12] goal is to convert the point cloud by determining the translation and rotation parameters iteratively based on the nearest iterative point. When both point clouds are aligned, the mean square error of the clouds is at its lowest.

As a result, the distance between point clouds is minimized by translating and rotating one of the point clouds in relation to the others, as well as by measuring the distance between each point in the original point clouds once per second and averaging all of the measurements. The necessity for an initial alignment of the convergence track is a significant drawback of the alignment strategy based on the nearest iterative point. Another drawback of this technique is how expensive it is to compute.

Simulated Annealing-Based Alignment

It is a method for doing local research that is based on a stochastic process [13]. Hill-climbing differs from simulated annealing in that it has the ability to calculate a solution that is even worse than the one being used at the moment. It is more likely that you will find a solution since simulated annealing is not constrained by local minima. For simulated annealing, which is used to construct the transformation matrix utilised for an alignment between two 3D faces, six parameters are needed (three for each translation, rotation, and reference to a 3D coordinate system). This method aligns facial image in three stages: (1) initial level alignment, (2) approximate level alignment, and (3) final level alignment.

Face Detection

The next step after getting the image from the camera is to detect the face from the images by the Viola–Jones algorithm that distinguishes the face and no face regions. Then, for further processing, the face region is extracted.

Face Detection Using Viola–Jones Algorithm

Viola–Jones algorithm is the first algorithm that provides competitive object detection rates in real-time. It provides robustness with high detection rates, easy for real-time applications as it can process two frames per second. After applying this, different classification techniques are used to recognize the image. The main steps include the following :(1) Hear feature(2)Integral image(3)Ada boost training(4)Cascading classifiers

ROI Extraction and Resizing

The face detected by the Viola–Jones technique is extracted and resized as a 40×40 image, then used by various feature extraction techniques to find the features.

Features Extraction from Detected Face Images

We have used the principal component analysis (PCA) technique to extract features of the face in order to detect the face in later steps.

This is a machine learning approach for solving classification and regression problems. It makes use of ensemble learning, a technique used for solving difficult problems by combining many classifiers. Many decision trees make up a random forest algorithm. The random forest algorithm's produced "forest" is trained via bagging or bootstrap aggregation. Bagging is a meta-algorithm that enhances accuracy by grouping them together.

Decision Tree

For classification and regression, the decision tree is a nonparametric supervised learning approach. The objective is to learn basic decision rules from data characteristics to construct a model that predicts the value of a target variable. It is a flowchart like tree structure in which each internal node represents an attribute test, each branch indicates the outcome, and each leaf node (terminal node) carries a class label.

K-Nearest Neighbor

We have used 5, 10, and 15 eigenvectors as our features. The dataset is created with these vectors, and the new face image will pass through all the steps of PCA. Then, we will calculate its distance with the features of other images in the dataset, and the nearest one will be our prediction. We have used the Manhattan distance formula to calculate distance as it is more accurate. The Manhattan distance formula is here, z is for the dataset, and b is for the test image. Then we will check which instance in the dataset has the minimum distance with the test image, which will be our prediction.

Results

Convolutional neural networks consist of convolutional layers, pooling layers, and, at the end, a fully connected layer. A CNN has a much different architecture than a simple neural network. It has an input layer, a convolutional layer, a max-pooling layer, and at the end, a fully connected neural network. KNN is a lazy algorithm, and it checks all the instances in the dataset for prediction while CNN recognizes in very little time from its model. The other reason is that we have used 41,320 images for 90 classes for PCA, and for CNN, we have used ten classes and 30 images per class, and we obtained good accuracy compared to PCA. We collected more than 41,320 images. We will enhance this system by making it a complete security system. We recognize a single face from the image; our next step is to recognize multiple faces in a live-streaming video.

Conclusion

We have developed a framework for automatic face recognition based on CCTV images using different machine learning algorithms in this work. One of the objectives of this work is to

collect more than 40,000 face images and compare the performance of algorithms to obtain the highest recognition accuracy. We have implemented different algorithms and have obtained high accuracy for CNN. CNN is much more reliable than PCA with DT, RF, and KNN.

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