Face identification in a video file based on hybrid intelligence technique -review

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Abstract. With the advancement in technology, the importance of facial recognition in the video camera or in the images has increased due to its effectiveness in criminal identification and the identification of wanted people by using different algorithms and theories, where different hybrid and non-hybrid techniques have been developed to recognize the face through its features. In this paper, the most important technologies that have been developed in the field of face detection are revealed, as the paper provides a detailed explanation of the most prominent systems that have been developed in this field in terms of time, accuracy, results and databases used for this purpose.

Keywords: face recognition, SVM, Firefly, PSO, KLT, video detection

1. Introduction

Recently, the process of identifying people accurately and clearly has become an important requirement in the field of face detection, whether in industry, trade, health, security, or protection. Methods of identification by card, fingerprints or iris have become classified as traditional and inaccurate methods and with the great and tremendous development in the fields of artificial intelligence the importance of getting to know people using the face has increased because of this method of high accuracy in identifying faces.

There are many advantages to face recognition, using artificial intelligence methods such as neural networks and machine learning techniques [19], including: (1) improving security by helping to track down criminals. (2) The possibility of automatic recognition as it allows recognition through the face, which increases accuracy and saves time, finally (3) easy to integrate, because it can be combined with other techniques to identify the face, which raises the level of security.

Face detection systems are used [20] to track face movements and convert movements into an electronic database using the tracking camera where this data can be used to produce realistic animation games and movies, and it can also be used to help people with autism by understanding the feelings of these people where the program reads emotions on the human
face and also Face detection techniques can be used to find the speaking person by reading the lips.

In recent times, face detection is no longer limited to images, but video processing has become a problem in this field for detecting human images and tracking their movement, because the video file plays an important role in monitoring and tracking the movements of people in addition to searches for criminals. [21]

Currently, there is a great need for the primary processing of information in video files, as tracking objects through video files play an important role. A video file is a form of animation that combines many animations and sounds for realistic moments as they appear sequentially and continuously during playback or filming of the video file. Tracking people in the video file faces many problems that affect the ability to discover people seen in the file, and these problems may be [39]

1. Change brightness in place and time
2. The possibility of expansion and reduction, due to the movement of people within the video, which sometimes leads to outside the frame of the camera
3. The rotation of the person in relation to the camera in all three axes
4. The possibility of a person interfering with other objects while photographing or tracking the video file
5. The presence of distorted and unclear objects in the video file, as during filming the video can be exposed to natural conditions that cause noise such as winter and snow.

Facial recognition plays a major role in the field of information technology. In this paper, a comprehensive summary will be presented:
1. Define the process of facial recognition and how it works
2. The most important techniques and algorithms used for facial recognition
3. A summary of hybrid and facial recognition systems

2. Methods for identification

2.1. Face Detection
The process of detecting faces in a human visual perspective is easy, but when faces are exposed using computers, the subject is considered difficult to qualify [21]
Face detection [22] is a computer technology that uses fields that define the face for the people in the image [24], and face detection is also defined as the process by which faces are identified in the visual scene. [25]

There are many techniques used to detect faces, the most famous of which are viola jones algorithm (see figure 1). viola jones algorithm is the first, fastest and strongest method for detecting faces in real time and is faster than any other technique and is characterized by a high accuracy estimated at 95% for about 17 frames in the second. [26,1] Paul Viola and Michael Jones [1] began developing this algorithm in 2001 as it is a framework for identifying organisms and revealing their characteristics. Although it is old, it has proven its effectiveness and divides the stages of this algorithm into two stages (training and detection).
Viola-Jones algorithm is able to better detect front-ends from the side or high up and down as it defines a square around the face and searches inside it.
2.2 Feature Extraction
Due to the huge increase in the number of databases and their contents, we are now dealing with hundreds of multi-feature databases, which led to the number of features becoming similar and greater than the number of observations stored in the databases, and certainly working on it requires great time and effort. (Feature extraction) where the data set equals the dimension after the variables used to represent it.
The aim of features extracting is to reduce the number of features in the database by extracting a new common feature from the original features. So the extracted feature should summarize most of the features present [28]
One of the most popular methods used to features extraction are PCA and Kanade-Lucas-Tomasi algorithm.

2.3 Feature Selection
Feature Selection is the study of algorithms to choose the appropriate feature that contributes well in predicting sound and valuable results, and in case that there is an inappropriate feature in the data used, the accuracy of the models is reduced because the system has been made based on features that have no relationship. [31]

2.3.1 Swarm intelligent
Swarm intelligent is an artificial intelligence (AI) discipline, inspiration from the collective behaviour of social insects such as ants, termites, bees, and wasps, as well as from other animal societies such as flocks of birds or schools of fish. [32]
The most well-known and researched nature-inspired and swarm intelligence methods is particle swarm optimization (PSO) algorithm. And Firefly Algorithm (FA)

2.3.1.1 Firefly algorithm
It is an algorithm based on swarms, as it has gained a wide popularity in a short time and has many applications, studies indicated that it is subject to early convergence. In order to make the algorithm more effective, adjustments are made to it, and these adjustments are for
persistent problems. In addition, this algorithm can be hybridized with other algorithms. [33,34]

### 2.2.1.2 PSO algorithm

It is an algorithm that was discovered by Reynolds and Heppner [30] and it is easy. This algorithm is used to solve optimization problems, to be used in image processing [29] and machine learning [23], and it is a method by which the maximum and minimum for a given job are, algorithms that have two main phases: exploration and exploitation.

### 2.4 Classification

The classification process is the final stage in identifying a person and it is the process of identifying and verifying a person by matching pictures. A Hybrid artificial intelligence method are used for the process of matching and identifying the person. By combining the neural network with the methods of swarm, PSO and Firefly.

### 3. Related work

With the rapid development of artificial intelligence in recent years, personal recognition using face gains more and more attention. Compared with traditional card recognition, fingerprint recognition, and iris recognition. There are various methods implemented in case of Personal Identification in a Video File. Enhancements in these existing methods can be done after a review of such existing methods. Below is a detailed summary of previous studies on this topic.

Face detection technology is one of the most important and first applications in the field of business using computers as it dates back to more than fifty years since in the mid-nineties and early 2000 the field witnessed great progress [4,5,6,7]

Marami and Tefas (2010) [17] suggested an algorithm to detect the face using the Particle Swarm Optimization on the image. The algorithm uses the SVM method to search for the face accurately and quickly. BioID dataset as it supports this approach and experimental results have proven that this algorithm works perfectly and that it can be combined with any face detection method to improve performance.

Wong et al (2011) [15] proposed a new algorithm to assess the quality of the image as it is through this algorithm, they determined when the image resembles the probabilistic model. This algorithm consists of five steps which are as follows: normalize the image based on the number of pixels and then extract the correction and normalization factor and then extract the characteristics each part down to the calculation of local possibilities and then studying the overall quality of these points.

Davis et al. (2011) [48] proposed a system for facial recognition through video surveillance, where the face is detected using the Viola-Jones’ method and then extracts local features as the feature is created from differences in angles and lengths ratios as the system works in real-time. The features of the iris, nostrils, and ears were used. The process of extracting the iris and nostrils is easy if the face is in the front view. And the features of the ear are difficult to extract because they are not full cross lines. The results showed that one of the important results was to improve the accuracy of the OpenCV face detector, due to the combination of Viola-Jones’ method with the analysis of skin color information. The system has also proven itself capable of detecting features even when lighting is poor.
Paul, Haque, & Chakraborty (2013) [42] presented a comprehensive and summary study of the image processing process obtained from the surveillance camera, which is difficult to review because of its low resolution. Then they created a classification of all available object detection techniques, background subtraction, optical flow, and temporal and spatial filtering. In addition, object detection and object classification methods were compared in terms of accuracy and computational time. Researchers provided a guide for data sets for surveillance research such as KTH, Weizmann human action, PETS dataset, and in the end, the applications of the intelligent monitoring system were summarized as counting people, identifying people, tracking them, and detecting pedestrians on the road. and gender classification.

Tofighi et al. (2014) [13] presented in their paper a new way to improve the performance of face detection, as it consists of two parts: face detection and recognition of the face that was discovered. This method works to discover the face through segmentation of the skin color and then recognize the face through several steps, which is to reduce the dimensions through the Principal Component Analysis PCA, then feature selection by choosing the appearance through the Linear Discriminant Analysis LED and finally the classification using K-Nearest Neighbor (K-NN) or Support Vector Machine (SVM).

Kodinariya (2014) [41] proposes a hybrid system for facial recognition using a merger strategy, as the proposed system works in two modes: training and classification. The training phase includes the normalization of the face and the extraction of the appropriate features that help to discover the face using the method of basic components analysis and analysis of independent components, and then these features are trained using the reverse diffusion neural networks to divide the space in the different categories of the face, then the classification process comes by classifying a new face image by reference. For face categories that were obtained during the training phase, then the proposed system is tested on the ORL database and other databases, as the results showed that the proposed system has high accuracy compared to other face recognition systems. see figure 2.

![Figure 2. Hybrid Multi-Feature for proposed Face recognition system.](image)

Shieh et al. (2014) [18] designed a system for real-time face recognition see figure3, through the use of the PCA algorithm, as this method effectively reduced time and provided approximately 60% of samples compared to other methods that are less effective. This approach takes a method (SVMPSO) to improve the validity of systems for face recognition,
and it is considered an ideal classifier as it SVM works as a PSO laxative or to solve classification problems and results show that this method simplifies features effectively with high accuracy in classification.

Figure 3. real-time face recognition system.

Putro et al. (2015) [9] suggested a system for classifying adult images using the Viola-Jones algorithm, as it is considered to be of high speed and efficiency. This system works by determining the percentage of the face area in the image, the position of the face, and the skin color. Each classification also contains supporting components such as the image size, pixel size in the image, and distance. The disadvantage of the face to the center of the method is the inability to determine the face if it is in the wrong way or if the face is straight.

Farfade et al. (2015) [10] proposed a method for discovering faces that depends on deep learning. Deep Dense Face Detector (DDFD) method does not require clarification of the features as it is able to detect faces from several directions. Through the use of RCNN and other face detection methods, where results showed that this method is able to achieve similar results without the need to clarify milestones.

Figure 4. Comparison of face detector, DDFD, with different R-CNN face detectors by Farfade et al. (2015).
Mannan et al. (2015) [11] proposed an automated system for detecting face expressions using a hybrid approach that uses both geometric and appearance features where appearance features are used as Local Directional Number descriptions to extract appearance features while geometric features are a historical point. Expression is recognized using SVM with resolution merging level. This method was tested on a Cohn-Kanade database and obtained an approximate recognition rate of true 96.36%.

Mohanraj et al. (2016) [49] proposed a hybrid facial recognition scheme in the video with different highlights and a difference in position, as the system uses a light adaptation filter to model the retina in order to review it for face detection. In the proposed system, the SIFT model was modified by using a fixed feature locator to mark the main points. The system was implemented and validated on a set of databases (YouTube Celebrity Dataset people, Extended Yale B database, MIT_INDIA Dataset) where the results are shown the method gives the accurate results and takes lesser time for face recognition.

Heshmat et al. (2016) [12] introduced a new and simple way to discover faces in videos with the ability to recognize people within a video through a database set for a number of people see figure 5, through three steps follows bellow:

- First step: skin-like regions detection in CIE-Luv color space
- Second step: Face detection based on skin-like areas
- Final step: face verification, by comparing each face with the faces in the database, then the system is tested on the database where the system has proven its effectiveness in identifying faces

![Diagram of the proposed system](image)

Figure 5. the proposed system.
Chhabra and Pandey (2016) [43] proposed a new, more reliable way to take face recognition into a genetic account. In the beginning, people are obtained that can be visualized through the valley focuses, then the facial sites that can be visualized are created from the genetic calculation through the eye. In addition, the lighting can be reduced by changing their graphs where an estimate of the cohesion of the competing face is calculated. In the end, face verification of people by measuring the symmetry with the different elements of the face, as through this method, it is possible to distinguish the slanted face, the face under a shadow and bad lighting, or if the person wears glasses. Then she examines the strategy of extracting the elements, as each system has benefits and downsides. Strategies based on splitting shading are used for skin detection and face recognition. A hybrid model has been proposed for the facial recognition frame, to obtain a high resolution of discrimination, as the accuracy is very sloppy when the face is in the forward position.

Dabhi and Pancholi (2016) [1] presented in their paper a method for discovering people in a manner that minimizes computation time with the possibility of achieving very high detection accuracy this approach used in face detection is approximately 15 times faster than previous methods.

Hazim et al. (2016) [3] introduced a system that recognizes the face using appearance-based methods Where the work steps were divided as follows: (1) face detection using Viola-Jones method is used to detect and crop faces in each database (MUCT, Face94, and Grimace) the feature in these databases shown in figure 6. (2) feature extraction and dimension reduction by using PCA-LDA (3) Square Euclidean Distance leads to find image similarity.

| Database | Format | Individuals | Image Size |
|----------|--------|-------------|------------|
| MUCT     | RGB    | 276         | 480 * 640  |
| Face94   | RGB    | 153         | 180 * 200  |
| Grimace  | RGB    | 20          | 180 * 200  |
| ORL      | Gray   | 40          | 92 * 112   |
| FERET    | Gray/RGB | 1999     | 256 * 384  |
| UMIST    | Gray   | 20          | 92 * 112   |
| Indian   | RGB    | 40          | 640 * 480  |

**Figure 6.** Face Databases Features [3]

Mahdi et al. (2017) [35] proposed a system for detecting faces in the video camera in real time, through two steps: (see Figure 7)

(1) Face detection During this step, the system identifies and tracks the faces of people (A) face recognition. During this step, face recognition is done through an existing database This system can be activated in the places of criminals and suspects, or in sensitive places or in prohibited places where this system works for example in simple lighting conditions.
H. Jiang and E. Learned (2017) [37] suggested three benchmark data sets, as the results indicated their effectiveness, which comes from the unity of the region proposal network. It is possible to use multiple layers of convolutional within the PRN without a burden and although the Faster RCNN is designed to detect general objects, it is able to discover the face when properly reformulated on the face detection tools where its performance can be enhanced by studying human patterns.

Ali Salem et al. (2017) [38] presented a hybrid model to know the approximate number of people in the image. The model combines two algorithms, namely DE and ELM, to perform the identification task and to evaluate the effectiveness of the system. A number of problems have been used and 3 databases have been used (PETS_2009, Mall, and Chunxi_Road dataset image) where they have achieved success that exceeds the accurate 97.0%.

Alireza et al. (2017) [45] used the Adaptive neuro-fuzzy inference system (ANFIS), which is based on neural network resolution and decision-making to screen for breast cancer. Whereas 1508 records of cancerous and non-cancer risk factors were used, and they were classified into levels according to their importance, and then they were confused by the subtractive clustering method in order to enter them in the same order. The data were divided into two groups with varying rates (70% and 30%). Subsequently, the system was tested on real data from the state of Wisconsin, and the results showed an accuracy of 81% (sensitivity = 85.1% and sensitization = 74.5%) and 84.5% (sensitivity = 89.3%, specificity = 79.9%) on Straight. These results indicate the possibility of using the proposed model and achieving high accuracy.

Alzubiady and Salehn (2018) [46] proposed a Personal Identification System by Using Dental Traits, in this system, the dental feature was used because it is more reliable and it is easy to use. It can also identify people before or after death, the (KL) transformation has been adopted in extracting the feature values from the image and adopting two methods of classification, the first is the neural network with Backpropagation (Bp) neural network while the other is a hybrid method used Particle Swarm Optimization (PSO) with a backpropagation neural network. When performing a system efficiency test using the measures (False Acceptance Rate (FAR), Equal Error Rate (EER), Genuine Accept Rate (GAR), False rejection rate (FRR)), the following values were obtained for the hybrid method (GAR =
100%, FAR = 0%, FRR = 6%, RR = 94%). As for the neural network method that spread behind the scales (GAR = 97%, FAR = 3%, FRR = 8%, RR = 89%). These results indicate that the use of a hybrid method increases the accuracy of a classification and makes the system more accurate and efficient.

Faris (2018) [47] proposed a hybrid model that combines particle Swarm optimization and a random weight network, see figure 8. This model aims to identify the problem of predicting floudering in telecom companies where PSO is used to improve the weights of input features simultaneously by assigning random weights to the input features and then evaluating them based on their predictive ability. It automatically determines the importance of the problem’s input features and also learns the model from a training data set to solve the problem of unbalanced distribution (see figure 8). Experimental results on two databases of (DKD Dataset, Local Dataset) showed that the model greatly improves the rate of coverage of floudering clients compared to other modern and advanced classifiers. In addition, one of the advantages of this model is the improvement of the weights of the input features, which help in identification. This feature helps decision-makers to evaluate the features that contribute to the success of their marketing campaigns.

![Figure 8. main processes of the proposed ADASYN-wPSO-NN approach](image)

Vishaka (2018) [8] presented a new system for discovering and tracking human video in real time used to deal with difficult events as this system consists of three main elements, which are human detection, human tracking and detection of false elements, and one of the advantages of this system is that it is through the step of identifying the false elements. We can know the faulty alarm, then the system was combined with the DVR system and different tests showed that the system can work in different conditions such as changing the percentage of light and the presence of stray and other.

Bin Sama et al. (2018) [14] presented a framework for face detection applied to camera monitoring systems where the face algorithm was combined with the classification algorithm through a Gray Wolfe Optimizer system with a Support Vector Machine method. This research also included a hybrid system that integrates both GWO and SVM to identify the face and classification process as my study, the author used many Publicly benchmark databases like Chokepoint, UCSD/Honda, CMU, and YouTube Faces (YTF).

Dawid Polap et al. in (2018) [44] presented a smart home system to diagnose the skin health using artificial intelligence method. This smart homes can be equipped with a variety of motion sensors and cameras which can be used to detect and identify possible disease.
development due to possible diseases such as melanomas that can develop under excessive influence of the sunlight. The proposed approach consists of processing the image and detecting features, and then classify them by artificial intelligence method Convolutional Neural Network are used for classification. The result has shown that the proposed classification method works were able to reach an overall accuracy of 82.4% and precision of 80.4%.

Taloba and Dawood (2019) [2] Summarized that the combination of Viola-Jones algorithm and the constructed composite features to avoid missing or wrong detection of the original face in an effective manner increases accuracy in face recognition, by analyzing experimental results from an FDDB database, which led to the conclusion that the Viola-Jones algorithm contains many problems that must be addressed.

Dey (2020) [16] presented a new technique for face recognition, whereby Principal Component Analysis PCA is used to analyze the content of the data, after which the face features are extracted through the use of the neural network by the firefly (see Figure 9). This rating has been proven successful with a percentage of 99.83% Face recognition rate.

Hakan and Golara (2020) [50] Proposed convex human models for each group of images in order to fit with the proposed samples for them, where the distances in the images are calculated using simple matrix multiples, then the closest image is assigned to the query group and the results showed that this method works more effectively and with less testing time, as the model obtained an acceleration of up to 298 is more than other discriminatory images.

Zheng et al. (2020) [51] They proposed an automatic system for recognizing faces in the videos through the face detection units, aligning it, tracking and identifying the face in multi-shot videos, the process of facial representation to learning the partial space and matching in the process of similarity between them, then the face matching process through the matching tool and similarity metrics where many experiments were conducted. On databases (IJB-B, IJB-S, MBGC, FOCS) that include low-quality and high-quality video, the results showed the ability to discover and link the face in the videos and the process of strong recognition of people's characteristics [52].

4. Literature review of various methods for identification recognition

Table 1. Literature Review of Various Methods for Face identification Recognition.
| No. | Author                  | year | Methodology/technique | Context                                                                 | Data set                     | Result                                                                                           |
|-----|------------------------|------|-----------------------|--------------------------------------------------------------------------|------------------------------|--------------------------------------------------------------------------------------------------|
| 1   | Marami and Tefas        | 2010 | SVM                   | suggested an algorithm to detect the face using the Particle Swarm        | BioID                        | proven that this algorithm works perfectly and that it can be combined with any face detection method to improve performance. |
|     |                        |      |                       | Optimization on the image                                                |                              |                                                                                                  |
| 2   | Wong et al.             | 2011 | video-to-video        | Proposed a new algorithm to assess the quality of the image as it is      | FERET PIE datasets ChokePoint | proposed method has the best overall detecting performance, identifying images which are the most frontal, well-aligned, illuminated and sharp |
|     |                        |      | verification protocol. | through this algorithm that it is determined when the image resembles the  |                              |                                                                                                  |
|     |                        |      |                       | probabilistic model                                                      |                              |                                                                                                  |
| 3   | Davis et al.            | 2011 | Viola-Jones’ method   | proposed a system for facial recognition through video surveillance,      | Real-Time Surveillance       | results were to improve the accuracy of the OpenCV face detector, due to the combination of Viola-Jones’ method with the analysis of skin color information. The system has also proven itself capable of detecting features even when lighting is poor |
|     |                        |      | OpenCV                |                                                                          |                              |                                                                                                  |
| 4   | Paul, Haque, & Chakraborty | 2013 | patio-temporal        | presented a comprehensive and summary study of the image processing      | KTH Weizmann PETS            | the applications of the intelligent monitoring system were summarized as counting people, identifying people, tracking them, and detecting pedestrians on the road. And gender classification |
|     |                        |      | filtering             | process obtained from the surveillance camera                            |                              |                                                                                                  |
| 5   | Tofighi et al.          | 2014 | PCA KNN SVM LED       | presented in the paper a new way to improve the performance of face      | ORL Database                 | Getting a high recognition rate of 93.5% demonstrated an improvement compared to the other known face recognition methods. |
|     |                        |      |                       | detection                                                               |                              |                                                                                                  |
| 6   | Kodinariya              | 2014 | PCA ICA               | proposes a hybrid system for facial recognition using a merger strategy   | ORL Database                 | system gave a detection accuracy of 100%, while the accuracy based on PCA was 94.64% and ICA gave 96.42%. |
| 7   | Shieh et al.            | 2014 | PCA algorithm SVM PSO | designed a system for real-time facial recognition                      | Webcam                       | that this method simplifies features effectively with high accuracy in classification             |
| 8   | Dwisnanto Putro et al.  | 2015 | Viola–Jones Algorithm | designing a classification system to determine adult images and benign    | Adult database               | Percentage of accuracy system are 90%,                                                            |
|     |                        |      | OpenCV AdaBoost 3 key classify | images                                                                 |                              |                                                                                                  |
| 9   | Farfade et al.          | 2015 | Deep Dense Face       | proposed a face detection method based on deep                            | AFLW dataset                 | noted that the detector achieve better results                                                 |
| No. | Authors (Year) | Detector/Learning | Technique | Dataset | Results |
|-----|----------------|-------------------|-----------|---------|---------|
| 10  | Abdul Mannan et al. (2015) | • R-CNN • SVM | presented a new method for fully automatic facial expression recognition using a hybrid combination of geometric and appearance features | Cohn-Kanade (CK+) database | obtained an average emotion recognition percentage of 96.36% using an SVM linear kernel |
| 11  | Mehul Dabhi and Bhavna Pancholi (2016) | • Viola – Jones Algorithm | Present a detecting face in live image | CMU PIE | 87% efficiency of face detection and approximately 15 faster than any previous approach. |
| 12  | Nawaf et al. (2016) | • Viola – Jones Algorithm • PCA • Support Vector Machines • Linear Discriminant Analysis • Square Euclidean Distance | automatic face recognition system based on appearance-based features | MUCT • Face94 • Grimace | The recognition time was acceptable and takes few seconds. The results show increasing in recognition rates when increase the number of training images |
| 13  | Heshmat et al. (2016) | • CIE-Luv color space • low-pass filter • skin-like pixels and non-skin pixels | provides an efficient method to detect human faces in videos and recognize persons within the video according to a preset database of known persons | preset database | ability to recognize a variety of different faces in spite of different pose, expression, zooming and illumination conditions |
| 14  | Mohanraj et al. (2016) | • AdaBoost algorithm • PCA • Support Vector Machines | proposes a method to enhance the performance of face detection and recognition systems | Youtube Celebrity Dataset • Extended Yale B dataset • MIT_INDIA Dataset | give a recognition rate of 98% and 95.5% in YouTube celebrity and Extended Yale B dataset respectively. |
| 15  | Chhabra and Pandey (2016) | • PCA | proposed a new, more reliable way to take face recognition into a genetic account. In the beginning, people are obtained that can be visualized through the valley focuses, then the facial sites that can be visualized are created from the genetic calculation through the eye. | - | obtain a high resolution of discrimination, as the accuracy is very sloppy when the face is in the forward position. |
| 16  | Alireza et al. (2017) | • Adaptive neuro-fuzzy | used the Adaptive neuro-fuzzy inference system (ANFIS), which is based on neural network | Data base with 1508 records. | Results showed an accuracy of 81% (sensitivity = 85.1% and sensitization = 74.5%) |
| Resolution and decision-making to screen for breast cancer. and 84.5% (sensitivity =89.3%, specificity =79.9% ) on Straight.) |
|---------------------------------------------------------------|
| 17 Mahdi et al. 2017  | KLT  | PCA  | Viola-Jones method |
| proposes a system for detecting faces in the video camera in real time |
| trained database |
| the recognition rate is much higher for the same or nearly same lighting conditions, we found that the accuracy rate is nearly 100%. However, under different lighting conditions, whether extreme, dark or varying, the system has a low rate of 30% or less. |
| 18 H. Jiang and E. Learned 2017  | PRN  | CNN  | RCNN |
| suggested three benchmark data sets, as the results indicated their effectiveness, which comes from the unity of the region proposal network. |
| - |
| it is able to discover the face when properly reformulated on the face detection tools where its performance can be enhanced by studying human patterns. |
| 19 Ali Salem et al. 2017  | Extreme Learning Machine  |
| presented a hybrid model to know the approximate number of people in the image |
| PETS_2009 Mall Chunxi_Road dataset image  |
| achieved success that exceeds the accurate 97.0%. |
| 20 Vishaka et al. 2018  | OpenCV  | Java CV  | ZeroMQ library |
| Present an automated surveillance system for real-time detection, recognition and tracking of persons in video streams from multiple video inputs is |
| MongoDB JDBC driver  |
| the output from system helps in understanding the extent to which video surveillance can play a role in influencing the security of people |
| 21 Bin sama et al. 2018  | Support Vector Machine  | Gray Wolfe Optimizer |
| presented a component-based framework of face processing applied for surveillance system |
| ChokePoint UCSD/Honda CMU YouTube Faces  |
| show a superior performance of the this system over other variant methods. |
| 22 Dawid Polap et al. 2018  | CNN  |
| presented a smart home system which to diagnose the skin health using artificial intelligence method |
| - |
| method works well were able to reach an overall accuracy of 82.4% and precision of 80.4%. |
| 23 Alzubiady and Salehn 2018  | PSO  | KL  | neural network  |
| proposed a Personal Identification System by Using Dental Traits, |
| - |
| obtained for the hybrid method (GAR = 100%, FAR = 0%, FRR =% 6 RR = 94%). As for the neural network method that spread behind the scales (GAR = 97%, FAR =% 3, FRR = 8%, RR = 89% |
| 24 Faris 2018  | PSO  | Neural network  |
| Proposed a hybrid model that combines particle Swarm optimization and a random weight network |
| DKD Dataset Local Dataset  |
| Experimental results on two databases of (DKD Dataset, Local Dataset) showed that the model greatly improves the rate of coverage of floundering clients compared to other modern and advanced classifiers. |
| No. | Authors | Year | Methods | Improvement | Conclusion |
|-----|---------|------|---------|-------------|------------|
| 25  | Ahmed Taloba and Yasser Dawood | 2019 | • Viola–Jones Algorithm  
• KNN classifier  
• Local Binary Pattern  
• Mel Frequency Cepstral Coefficient  
• Difference of Gaussians | improved Algorithm of Viola Jones by modifying the measurement factor using a genetic algorithm | the proposed approach is superior to other ways of face recognition |
| 26  | Dey, Nilanjan | 2020 | • Principal Component Analysis  
• Firefly algorithm | presented a new technique for facial recognition | Case study rating has been proven successful with a percentage of 99.83% Face recognition rate. |
| 27  | Hakan and Golara | 2020 | • CNN  
• SVMs  
• LDA  
• PCC  
• (EPCC) | Proposed convex human models for each group of images in order to fit with the proposed samples for them | model obtained an acceleration of up to 298 is more than other discriminative images. |
| 28  | Zheng et al. | 2020 | • DCNN  
• SSD  
• Hybrid.  
• PCA | They proposed an automatic system for recognizing faces in the videos | ability to discover and link the face in the videos and the process of strong recognition of people’s characteristics. |
| 29  | Ouyanga et al. | 2020 | • LDA  
• PNN | proposed a classification method to solve the problems of facial recognition by relying on the PNN and IKLDA hybrid algorithm | recognition accuracy of 97.22%, 83.8% and 99.12%, across the three datasets, |
5. Conclusion

Based on the previous review we concluded, that the methods used for face detection did not give full and complete accuracy in many applications, and even if they give good detection accuracy, they make the detection system difficult and inflexible under current conditions. On the other hand, hybrid intelligence techniques have proven successful in many applications and have furnished satisfactory results, which encourages the use of these technologies to detect faces and try to build a very flexible system with the same time accuracy in obtaining results.

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