Face recognition with neural network

1. project idea :

It works well in prediction of data that is not well known and widely implemented in areas like face recognition and fingerprint recognition. One deep learning approach used in face recognition is convolution Neural Network CNN. A key feature of this method is the ability to note the characteristic of an image at entry point thus classifying it. using this we can represent face pictures with several coefficients ways instead of having to user the whole picture .neural network are used to recognize the face through learning correct classification of the coefficients calculated by the eigen face algorithm .the network is first trained on the pictures from the face database , and then it is used to identify the face given to it . each object will stored in database as 30 faces

- Summary (detection ,alignment ,feature ,extraction ,matching) as 3 subjects will stored in database as 90 face images .
- at first we capture image /stored it in database and dataset file
- then we made train model to identify the face and know the correct classification
- then we display the video capture to test the result

2. Main function :

- getimagesAndLabel
- insertorupdate
- getprofile

3. similar applications in the market (idea and description)

- karios face recognition :best for finding and detecting features
- animetrics face recognition : best of deep-learning face recognition
- lambda labs :best for face detection, features gender identification
- inferdo face detection :best for face detection with age estimation
- luxand.cloud face detection : best for detecting and comparing human faces
- Microsoft computer vision : best for processing content from images

4. An initial literature review of academic publications relevant to the idea :

Advances in face recognition have come from considering various aspects of this specialized perception problem. Earlier methods treated face recognition as a standard pattern recognition problem; later methods focused more on the representation aspect, after realizing its uniqueness using domain knowledge; more recent methods have been concerned with both representation and recognition, so a robust system with good generalization capability can be built by adopting state-of-theart techniques from learning, computer vision, and pattern recognition. A face recognition system based on recent method which concerned with both representation and recognition using artificial neural networks is presented. This paper initially provides the overview of the proposed face recognition system, and explains the methodology used. It then evaluates the performance of the system by applying two (2) photometric normalization techniques: histogram equalization and homomorphic filtering, and comparing with euclidean distance, and normalized correlation classifiers. The system produces promising results for face verification and face recognition

Face recognition from the real data, capture images, sensor images and database images is challenging problem due to the wide variation of face appearances, illumination effect and the complexity of the image background. Face recognition is one of the most effective and relevant applications of imageprocessing and biometric systems. In this paper we are discussing the face recognition methods, algorithms proposed by many researchers using artificial neural networks (ANN) which have been used in the field of image processing and pattern recognition. How ANN will used for the face recognition system and how it is effective than another methods will also discuss in this paper. There are many ANN proposed methods which give overview face recognition using ANN. Therefore, this research includes a general review of face detection studies and systems which based on different ANN approaches and algorithms. The strengths and limitations of these literature studies and systems were included, and also the performance analysis of different ANN approach and algorithm is analysing in this research --Keywords: Face Recognition, Biometric, Image Processing, Pattern Recognition, Artificial Neural Network

- Structure of Face Recognition System:

the first task of the face recognition system is capturing image by video, camera or from the database and this image is given to the further step of face recognition system

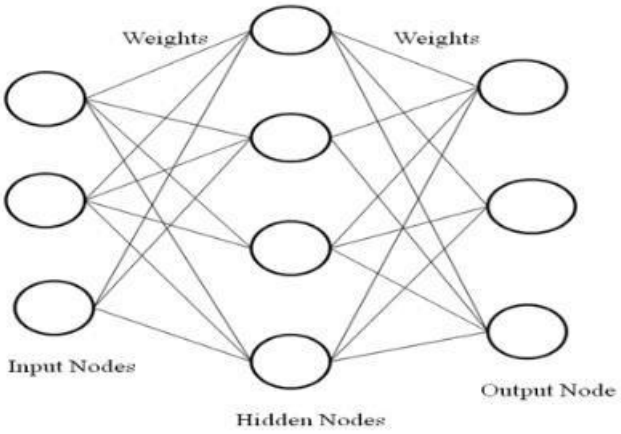
4.1 Face Detection The main function of this step is to detect the face from capture image or the selected image from the database. This face detection process actually verifies that weather the given image has face image or not, after detecting the face this output will be further given to the pre-processing step.

4.2 Pre-processing This step is working as the pre-processing for face recognition, In this step the unwanted noise, blur, varying

lightening condition, shadowing effects can be remove using preprocessing techniques .once we have fine smooth face image then it will be used for the feature extraction process

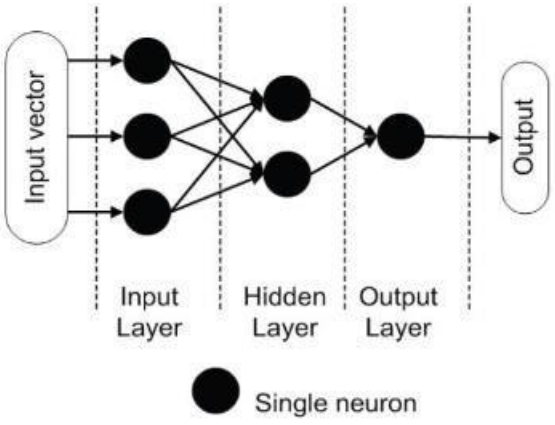
4. 3-Feature Extraction In this step features of face can be extracted using feature extraction algorithm. Extractions are performed to do information packing, dimension reduction, salience extraction, and noise cleaning. After this step, a face patch is usually transformed into a vector with fixed dimension or a set of fiducial points and their corresponding locations.

4.4- Face recognition can be largely classified into two different classes of approaches, the local feature-based method and the global feature-based method. The Human faces can be characterized both on the basis of local as well as of global features global features are easier to capture they are generally less discriminative than localized features local features on the face can be highly discriminative, but may suffer for local changes in the facial appearance or partial face occlusion. Now a day‟s face recognition system is recognize the face using multiple-views of faces, these Multi-view face recognition techniques has proposed by some authors for detecting each view of face such as left, right, front, top, and bottom etc. In this paper we are going to discuss the various methods of Neural Network used in multi-view face recognition system, many researchers has used neural network in face recognition system using different approaches. First, we will discuss the concept of neural network and hot it will be used in face recognition system



2.2.1Topologies of Neural Network :

2.2.1 --A Feed-Forward Network : A feed-forward network is a nonrecurrent network which contains inputs, outputs, and hidden layers; the signals can only travel in one direction. Input data is passed onto a layer of processing elements where it performs calculations. Each processing element makes its computation based upon a weighted sum of its inputs. The new calculated values then become the new input values that feed the next layer. This process continues until it has gone through all the layers and determines the output. A threshold transfer function is sometimes used to quantify the output of a neuron in the output layer. Feedforward networks include linear and non-linear and Radial Basis Function networks



4.2.2-Deep Convolution Neural Networks

has proposed deep convolution neural network method for that they provide details of the algorithm and training process of their proposed face detector, called Deep Dense Face Detector (DDFD). The key ideas are average the high capacity of deep convolutional networks for classification and feature extraction to learn a single classifier for detecting faces from multiple views and minimize the computational complexity by simplifying the architecture of the detector. Author has started by fine-tuning Alex Net [5] for face detection. For this he has extracted training examples from the AFLW dataset [6]. To increase the number of positive examples, he randomly sampled sub-windows of the images and used them as positive examples if they had more than a 50% IOU (intersection over union) with the ground truth. These examples were then resized to 227 × 227and used to fine-tune a pre-trained Alex Net model [5]. For fine-tuning, They used 50K iterations and batch size of 128 images, where each batch contained 32 positive and 96 negative examples. Using this finetuned deep network, it is possible to take either region-based or sliding window approaches to obtain the frontal face detector. In this work author has selected a sliding window approach because it has less complexity and is in-dependent of extra modules such as selective search

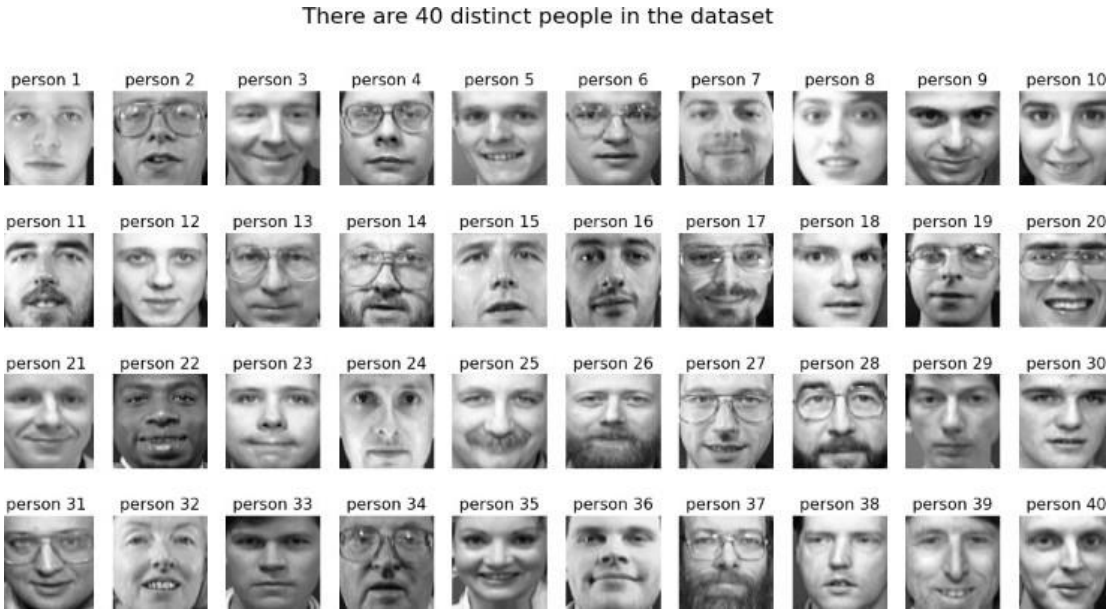
4.2.3- Convolutional Neural Network cascade :

as proposed Convolutional Neural Network Cascade for Face Detection this method has build with very powerful discriminative capability, while maintaining high performance. The proposed CNN cascade operates at multiple resolutions, quickly rejects the background regions in the fast low resolution stages, and carefully evaluates a small number of challenging candidates in the last high resolution stage. To improve localization effectiveness, and reduce the number of candidates at later stages, author has introduced a CNN-based calibration stage after each of the detection stages in the cascade. The motivation of applying the calibration is the most confident detection window may not be well aligned to the face. As the result has generated, without the calibration step, the next CNN in the cascade will have to evaluate more regions to maintain a good result. The overall detection has to increases the result at run time.

This problem generally exists in object detection. He has analysed this problem with CNNs in this work. Instead of training a CNN for bounding boxes regression as in R-CNN, he trained a multi-class classification CNN for calibration. He observed that a multi-class calibration CNN can be easily trained from limited amount of training data while a regression CNN for calibration requires more training data. He observed that the discretization decreases the difficulty of the calibration problem so that he can achieve good calibration accuracy with simpler CNN structures, after calibration the detection bounding box is better aligned to the real face centre. As the result has generated, the calibration nets enable more accurate face localization using coarser scanning windows across fewer scales. The output of each calibration stage is used to adjust the detection window position for input to the subsequent stage. The proposed method runs at 14 FPS on a single CPU core for VGA-resolution images and 100 FPS using a GPU, and achieves state-of-the-art detection performance on two public face detection benchmarks

5. dataset employed in the project :

- https://www.kaggle.com/mloey1/ahcd1
- https://www.kaggle.com/mloey1/ahdd1



6. details of the algorithm :

When it comes to Machine Learning, artificial neural network perform really well. Artificial Neural Networks are used in various classification task like image, audio, words. Different types of Neural Networks are used for different purposes, for example for predicting the sequence of words we use Recurrent Neural Networks more precisely an LSTM, similarly for image classification we use Convolution Neural Network. In this blog, we are going to build basic building block for CNN.

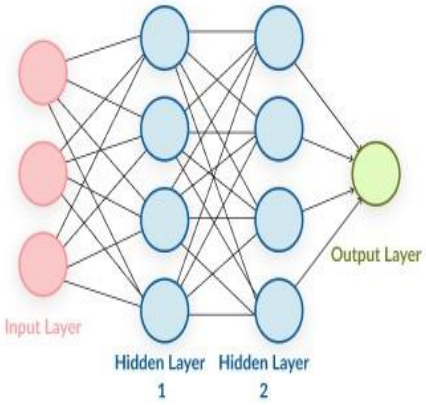
Before diving into the Convolution Neural Network, let us first revisit some concepts of Neural Network. In a regular Neural Network there are three types of layers:

1. **Input Layers:** It's the layer in which we give input to our model. The number of neurons in this layer is equal to total number of features in our data (number of pixels in case of an image).
2. **Hidden Layer:** The input from Input layer is then feed into the hidden layer. There can be many hidden layers depending upon our model and data size. Each hidden layers can have different numbers of neurons which are generally greater than the number of features. The output from each layer is computed by matrix multiplication of output of the previous layer with learnable weights of that layer and then by addition of learnable biases followed by activation function which makes the network nonlinear.
3. **Output Layer:** The output from the hidden layer is then fed into a logistic function like sigmoid or soft max which converts the output of each class into probability score of each class.

- The data is then fed into the model and output from each layer is obtained this step is called feedforward, we then calculate the error using an error function, some common error functions are cross entropy, square loss error etc. After that , we back propagate into the model by calculating the derivatives. This step is called Backpropagation which basically is used to minimize the loss.
- Convolution Neural Networks are neural networks that share their parameters. Imagine you have an image. It can be represented as a cuboid having its length, width (dimension of the image) and height (as image generally have red, green, and blue channels).

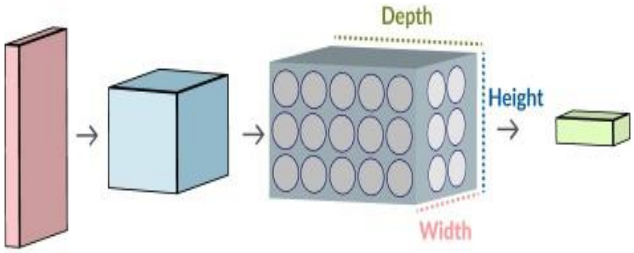
▪ details of the algorithm used and the results of experience :

Unlike a fully connected neural network, in a Convolutional Neural Network (CNN) the neurons in one layer don't connect to all the neurons in the next layer. Rather, a convolutional neural network uses a three-dimensional structure, where each set of neurons analyzes a specific region or "feature" of the image. CNNs filters connections by proximity (pixels are only analyzed in relation to pixels nearby), making the training process computationally achievable. In a CNN each group of neurons focuses on one part of the image. For example, in a cat image, one group of neurons might identify the head, another the body, another the tail, etc. There may be several stages of segmentation in which the neural network algorithm analyzes smaller parts of the images, for example, within the head, the cat's nose, whiskers, ears, etc. The final output is a vector of probabilities, which predicts, for each feature in the image, how likely it is to belong to a class or category.

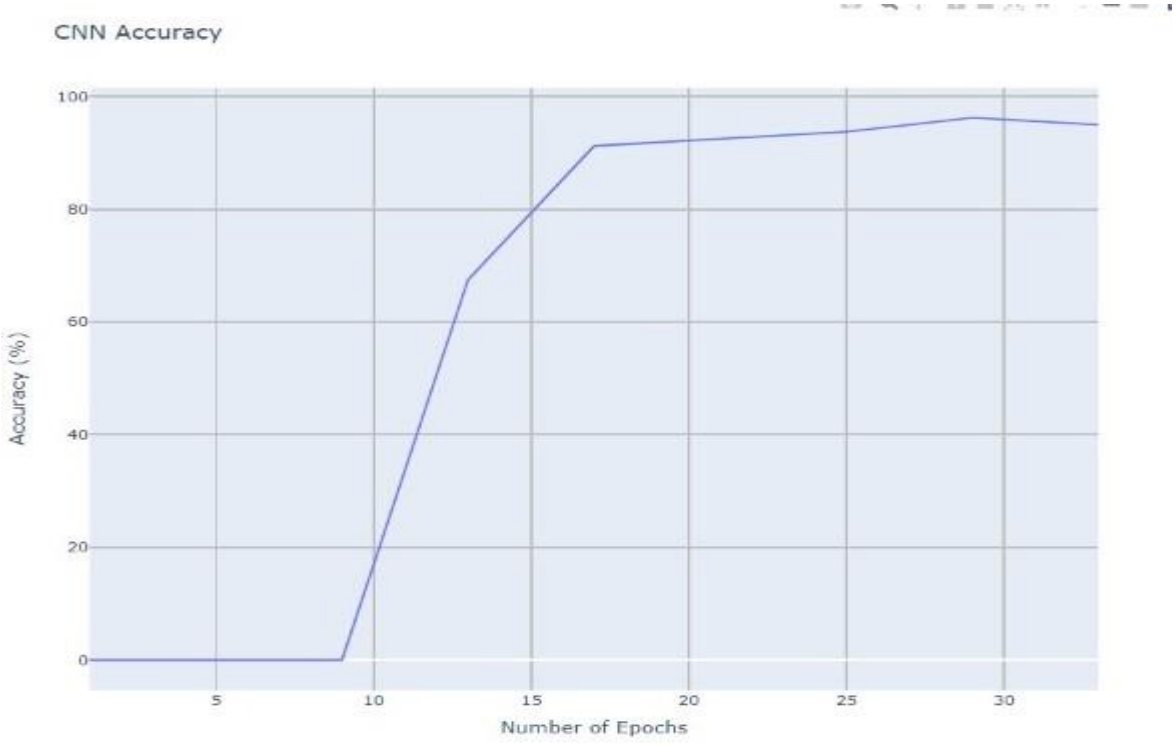


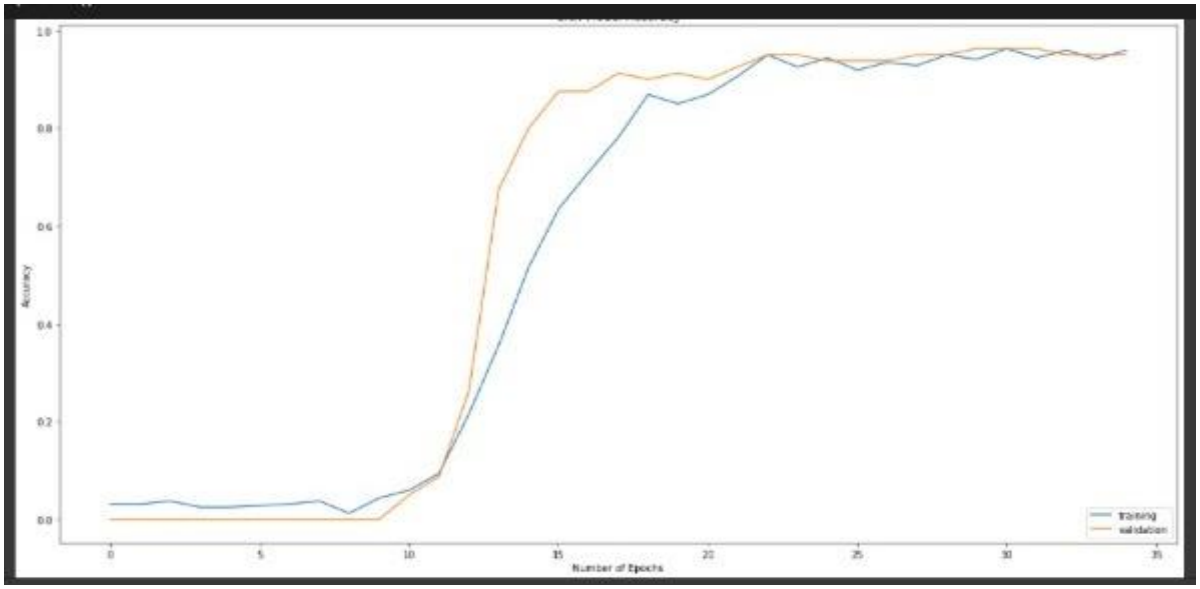
A traditional neural network structure (left)

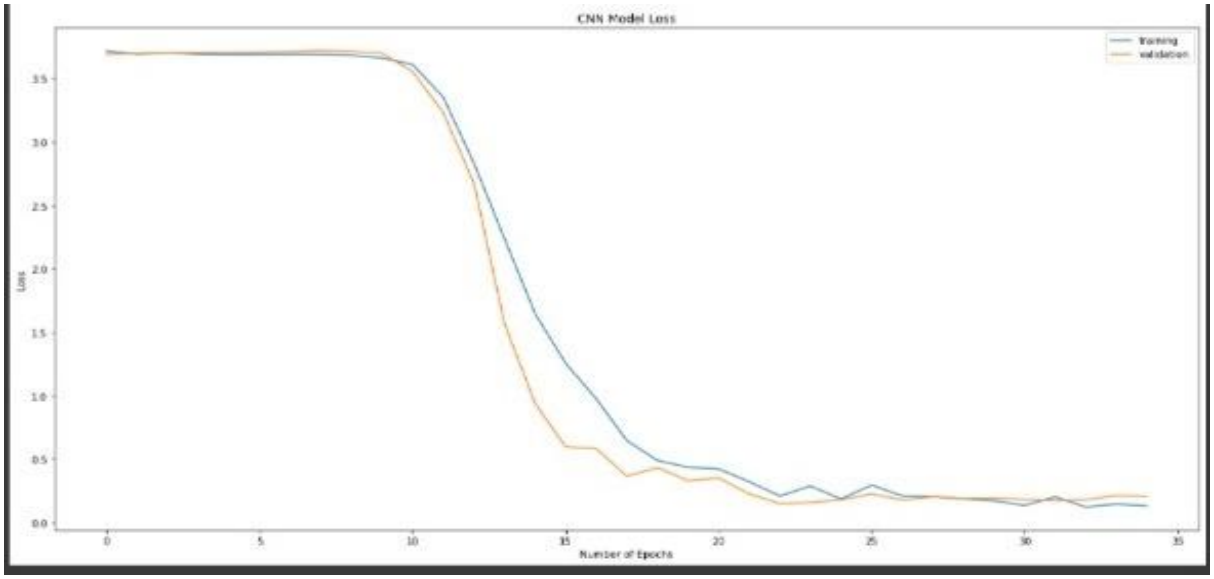
VS.



3-dimensional CNN structure (right)







7. Development platform :

- Anaconda navigator
- visual studio
- python3
- google colab
- using packages : opencv-python , opencvcontrib-python,ect…
- the project can work on windows and also linux .