



Face Detection and Expression Recognition using Neural Network Approaches

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Abstract- Human being often uses a facial expression virtually to convey a lot of evident information visually rather than verbally without effort or delay and also can recognize a hundred of faces in a day through their learned ability and identify familiar faces even after some separation of time. The question arise here: Is it possible to make the computer system intelligent for reliable face detection and recognition like human brain? The answer is yes, it is possible by means of latest technology enhancement tools and intelligent search techniques available, but in computer vision still remains a challenge for today scenario. To automated recognition of facial expression, machine must be use Artificial Intelligence (AI) to understand facial gesture which have ability to take the decision nearly same as like human brain. In many face recognition system the important part is face detection, which is very complex due to its variability present across human faces including colour, pose, expression and emotion etc. This investigation presents a various facial expression studies, modelling techniques, approach and algorithms for general review of facial expression recognition using MATLAB (Neural Network) toolbox.

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Abstract- Human being often uses a facial expression virtually to convey a lot of evident information visually rather than verbally without effort or delay and also can recognize a hundred of faces in a day through their learned ability and identify familiar faces even after some separation of time. The question arise here: Is it possible to make the computer system intelligent for reliable face detection and recognition like human brain? The answer is yes, it is possible by means of latest technology enhancement tools and intelligent search techniques available, but in computer vision still remains a challenge for today scenario. To automated recognition of facial expression, machine must be use Artificial Intelligence (AI) to understand facial gesture which have ability to take the decision nearly same as like human brain. In many face recognition system the important part is face detection, which is very complex due to its variability present across human faces including colour, pose, expression and emotion etc. This investigation presents a various facial expression studies, modelling techniques, approach and algorithms for general review of facial expression recognition using MATLAB (Neural Network) toolbox.

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I. INTRODUCTION

Verbal and non-verbal has two main aspects of human communication. Body movement, facial expression and physiological reaction are the basic units of non-verbal communication [1]. The emotions of human being may be displayed by facial expression. Mehrabian [2] indicated that the verbal part of a message contributes only 7% effect of whole message, the vocal part 38%, while facial expression 55% effect of speaker's messages. In computer system, facial expression recognition has not so easy but it is most important for the purpose of criminal enquiry and authentication in security system. Artificial intelligence has created an intelligent machine which has ability to think, to imagine, to making choice, creating memorizing and under-standing recognizing patterns. The previous approaches which have been used in this field use the simple geometric models but now changed into Science of sophisticated mathematical representation and matching processes [4]. In computer vision according to the various complicati on processes

in the face detection technique is the first part of facial expression recognition that will be performed before recognition system [3]. Recently input sensing device such as PC cameras (web-cam), digital cameras, digital monitoring, intelligent robots and 3G cell phones play an important role in our life. The face detection techniques are used to detect the useful information that are relevant to the face expression and analyses it. Due to several variability present in human faces such as position, pose, expression, skin, color the geometric feather extraction are use to find out distinctive parameters. Over the past decade, several approaches have been proposed for improving the performance of face detection [10-13] and also focus on several algorithms that are used for face detection in literature studies [14-17]. Recently Fuzzy Logic techniques are also introduced with Neural Network that is called Neuro-fuzzy system which has purpose to exploiting the human-like knowledge processing capability [23]. According to individual requirements, systems need to interact with learner to occupy their preference and expectations that can be achieved by making assumption and applied corresponding machine learning algorithms [24]. The rest part of this paper described as follows: Section 2 includes related work on face detection and expression based on Artificial Neural Network (ANN). Section 3 describes the artificial neural networks for face detection and recognition and concluding remarks are given in section 4 and Section 5 presents the future work of the study under reference.

II. RELATED WORK

In present study, the authors present several works where the reader can go through Face detection and expression recognition using neural network. The literature in tabular form is:

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S.NO	Domain	Description	Authors
1.	Back Propagation Algorithm	The authors brief that Artificial Neural Network (ANN) are used to detection of face for video surveillance, in which ANN is trained with multilayer back propagation neural networks (BPNN) for the purpose to achieve a balance between network ability to respond and the ability of given input reasonable response that is similar, but not identical to the one used in the training.	Omaima N. A. AL-Allaf Zoran and Samcovic [5-6]
2.	Multilayer Perception (MLP)	Multiple Layer Perceptions are use to describe unprocessed input image in face detection system to detect a face using Neural Network. Perception learning law gives a step by step procedure for adjusting the weights. They used image processing techniques such as normalization, rotation and position, light conditions improvement to improve the efficiency of detection in comparison with traditional ANN.	Rowley, Marian Beszandes and Milos Oravec [7]
3.	Principal Component Analysis and RBF	Principal component analysis (PCA) is used with linear projection to recognized faces in a real-time video stream. It not only reduces the dimensionality of the image, but also some of the variations in image data. After performing the PCA, the hidden layer neurons of the radial basis function neural networks have been modeled by considering intra-class discriminating characteristics of the training images, This help the RBF neural networks to acquire wide variation in the lower input space and improve its generalization capabilities.	Jeffrey Norris S. Thakur, J. K. Sing [8-9]
4.	Graphics Processing Unit (GPU)	The Lopes and Ribeiro presented an analysis of an ANN implementation executing on GPU, showing how the training and classification times can be reduced significantly. It's also consists where the image is pointing corresponding to person image. They also conclude that the GPU scales better than the CPU when handling large datasets and complex problem.	Juan Pablo Balarini, Martin Rodriguez, and Lopes, N and Riberio [18-19]
5.	Linear Regression Classification (LRC)	Linear regression classification algorithms are used to identify the facial expression in pattern recognition .linear regression using a concept of single object class lie on linear subspace. Linear model take the images as a linear combination of class specific galleries, which used a standard database for handle the images.	Imran Naseem, Roberto Togneri [20]
6.	Hidden Markov Models (HMM)	Traditional, hidden markov model use the independence assumption of visible observation based on hidden layer. It is no use any structure for pattern recognition. Due to these challenge, various approaches have been proposed. Hierarchical hidden markov model, structural hidden markov model, embedded hidden markov model are used to provide a great flexibility in face recognition.	Djamel Bouchaffra [21]
7.	Radial basic function network(RBFN)	Radial basic function is a fully connected and two layer feed forward learning network. In which each hidden neuron is a symmetric radial basis function, the purpose of hidden neurons is to reduce the dimensionality by clustering the data, and train the data input to minimize the sum of square error and	Devi Arumugam, Dr. S.Purushot-haman [2]

		find the best result between hidden neurons and output.	
8.	Fisher discriminant (FLD) and singular value decomposition (SVD)	linear and value The Fisher linear discriminant reduces the number of variable with information which is not related to facial expression by projecting data on to a low dimensional space. This help network to prevent unwanted detailed in the input and improve the network classifier's performance and generalization. The singular value decomposition is a tool of numerical signal processing, in digital applications it provides a best method of storing a large images a smaller manageable way. This is done by reproducing the original image with non zero singular values. The concatenate (FLD+SVD) to evaluate the expressions accurately from images.	Imran Naseem, Roberto Togneri [20]
9.	Self organization map	Self Organization Map (SOM), the self organizing map is known as a KohenMap in artificial neural network. During the facial expression recognition the SOM technique are used to measure image similarity. A Self-Organizing map consists of competitive layer which can classify a data set of vectors with any number of dimensions into the many classes.	Shamla Mantri, Kalpana Bapat [22]

III. ARTIFICIAL NEURAL NET-WORKS FOR FACE DETECTION AND RECOGNITION

MATLAB tends for matrix laboratory. It is the power software tool for solving various types of problem in mathematics, science and engineering, having 40 toolboxes for different subjects of studies. In which we work with simulink model and generate the code, integrate the generated code with existing system and validate the simulation and executable results. It has a very expensive library of predefined function or programs which design to help to solve their problem in a minimum timestamp. The Neural Network toolbox is present in MATLAB. Artificial Neural Network is a set of interconnect links that have weight associated them. The concept of Artificial Neural Network was derived from biological neural network, in which set of interconnected units broadly categorized into three layers that is input layer, output layer and hidden layer. Neural networks are composed of simple elements operating in parallel. As in nature, the connections between elements largely determine the network function. Neural Network can train to perform a particular function by adjusting the values of the connections (weights) between elements. Typically, Neural Networks are adjusted or trained, so that a particular input leads to a specific target output. Figure 1 illustrates gesture representation in face detection arrangement. The network is adjusted based on a comparison of the output and the target, until the network output matches the target. Typically, many such input/target pairs are needed to train a network.

In the recent years, different architectures and models of ANN were used for face detection and recognition [18]. Artificial neural network can be used in

face detection and recognition because these models can simulate the way neurons work in the human brain. Steps of face detection and recognition:

1. In the gesture recognition arrangement each box treated as one module. First uses the web-cam, digital camera or scanner to capture the images and gives to the input block for classification of the images. In the input image block captured images are stored for further classification.
2. The face area provided to the pre-processing block which contains a combination of four modules such as face detection and tracking, histogram equalization, process of edge detection and token matching to remove the unwanted noise and also zed the image.
3. The output of image pre-processing block is provided to classification trainer module to trains the image and decides whether the image belongs to the face class or not.
4. Finally it will provide the information about the recognition of face and generate the output [22].

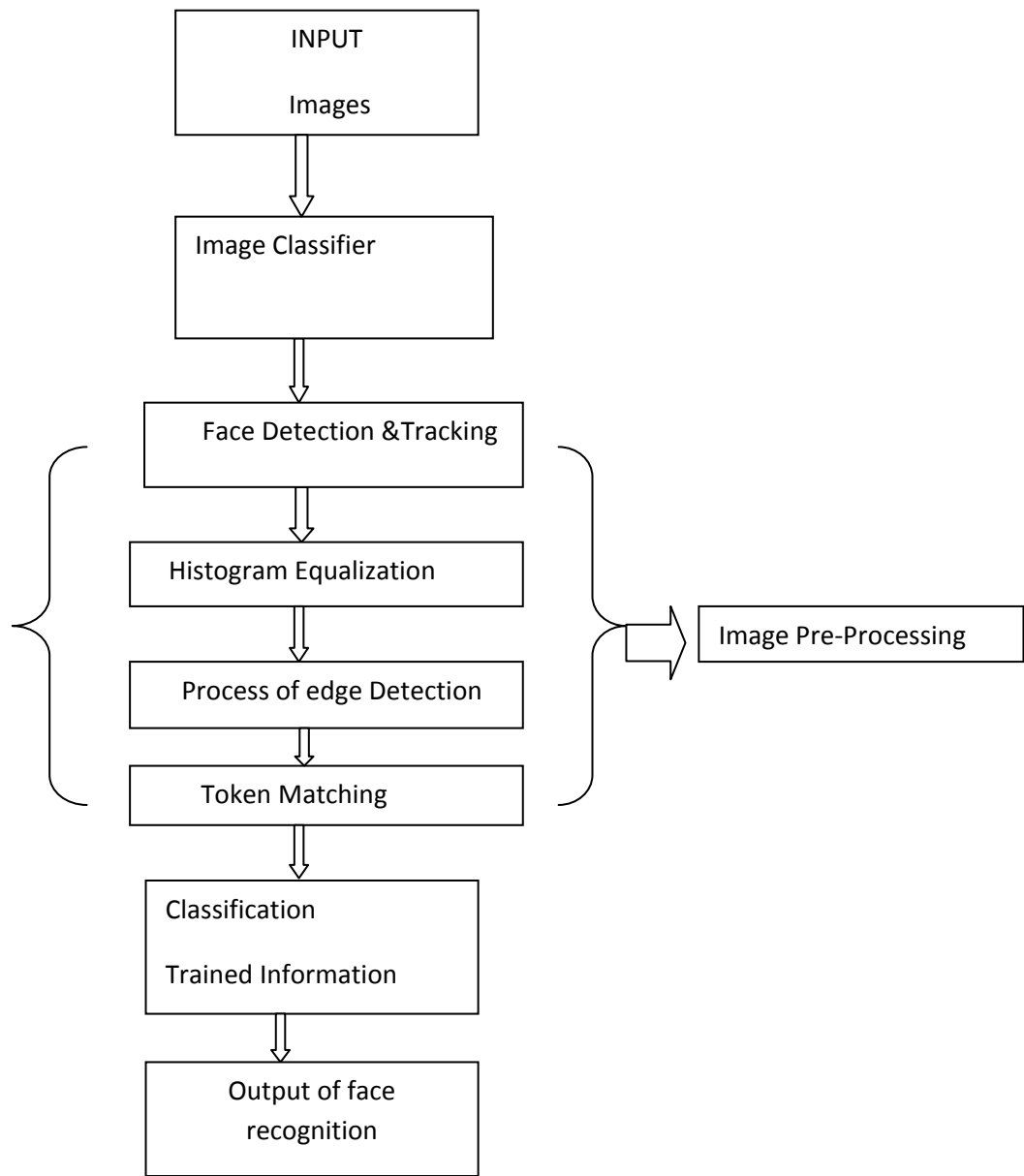


Figure 1 : Gesture Representation in Face Detection Arrangements

IV. CONCLUSION

The present investigation proposed an overview of face detection and expression recognition using artificial neural network with aim to provide recent holistic and feature based approaches. Human face recognition has drawn considerable interest and attention from several researches in past to develop a learned system which has ability to take a decision nearly like human brain. Face detection and expression recognition is a challenging problem and there is still a lot of work that needs to be done in this area.

V. FUTURE WORK

In future work face detection and expression recognition can be designed using advance approaches e.g. the use of neuro fuzzy techniques/ computational techniques like ant colony optimization (ACO), fuzzy rule interpolation (FRI), and neuro-fuzzy inference etc. which give the nearly perfect matching with in required time. Back Propagation Neural Network (BPNN) technique with hidden layers will be use for gesture the quality of image for face detection and training network and also will use many applications such as digital monitoring, intelligent robots and 3G cell phones.

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