

FACE RECOGNITION USING NEURAL NETWORK

Naresh Dommata¹, Akhil Gulla², Shruti Bhargava Choubey³
16311a04p2@sreenidhi.edu.in
16311a04p3@sreenidhi.edu.in
shrutibhargava@sreenidhi.edu.in

Abstract— This paper represents the improvement of a system which can become aware of the man or woman with the assist of a face using artificial neural network approach. This system is implemented in two stages. They are the mastering level and the trying out stage. Image acquisition, preprocessing, photo filtering, function extraction and gaining knowledge of are blanketed within the getting to know stage. At first the machine takes the photograph of someone. The enter photograph is then transformed to a gray scale photo and the position of the face is detected from the picture after highpass filtering and part detection. The functions, grey stages of the image are extracted which can be represented as a matrix and this feature matrix is given as input for the Kohonen self organizing map and fed to this network. The unsupervised learning network is educated and creates a expertise base for destiny use. In the checking out degree the gadget takes the face of the picture of someone for recognition. Image acquisition, pre-processing, image filtering, feature extraction are similar to the gaining knowledge of level. For type the capabilities are fed to the community. The network will classify the face image from the information base and acknowledges it.

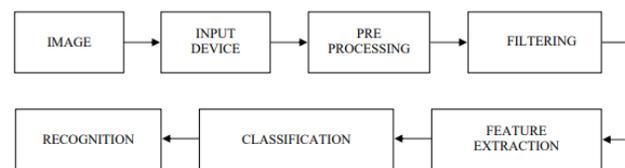
Keywords— artificial neural network, Image acquisition, highpass filtering, Kohonen, unsupervised learning network

I. INTRODUCTION

Human face popularity by using pc device has been studied for greater than two decades. Unfortunately growing a computational version of face reputation is pretty hard, because faces are complex, multi-dimensional visual stimuli. Therefore, face reputation is a very excessive level laptop imaginative and prescient venture, in which many early vision techniques can be worried[1]. So, we expand an automated machine to find neutral faces in pics for face popularity. A neutral face is a cozy face with out contraction of facial muscle tissue and facial actions. It is the states of a person's face most of the time, i.E. It's miles the facial appearance with none expressions[2]. The problem of face popularity is as old as computer vision, each due to the realistic importance of the topic and theoretical hobby from cognitive scientists. Despite the truth that other methods of identity (such as fingerprints, or iris scans) may be extra correct, face recognition has always stays a primary recognition of studies due to its non-invasive nature and because it's miles human beings's number one technique of individual identity. Much of the paintings in laptop reputation of faces has centered on detecting individual functions which includes the eyes,

nose, mouth, and head outline, and defining a face model via the position, size, and relationships among these features. Such methods have tested difficult to extend to more than one views and have frequently been quite fragile, requiring a terrific preliminary bet to manual them.[4][5]

1.1 Block Diagram of Testing Process



II. WHY NEURAL NETWORK

It has a characteristic of adaptive getting to know i.E. An ability to learn how to do tasks. Also it could create its very own organization. It has a excellent ability to derive which means from complex or obscure facts. Today neural networks are occurring anywhere. ANN are tremendously crude electronic fashions primarily based on the neural shape of the brain. Computers do rote things well like keeping ledgers or acting complex math. But computer systems have hassle recognizing even simple sample[3][6]. The research indicates that mind shops facts as patterns. Some of the patterns are complicated and lets in us the ability to recognize person faces from many extraordinary angles. Basically all ANN have a similar shape or topology. In the structure a number of the neurons interface to the real world to receive its input. The output might be the particular person that the community thinks it has scanned or the unique image it thinks is being regarded. All the relaxation of the neurons are hidden from view. But a neural community is greater than a gaggle of neurons. One of the very best approaches to design a structure is to create layers of factors.[7][4]

III. FACE DETECTION AND RECOGNITION

Face detection takes pics/video sequences as input and locates face areas inside those photos. This is accomplished by using keeping apart face regions from non-face heritage regions. Facial feature extraction locates crucial feature

(eyes, mouth, nostril and eye-brows) positions within a detected face. Feature extraction simplifies face vicinity normalization where detected face aligned to coordinate framework to reduce the huge variances delivered with the aid of distinctive face scales and poses. The accurate locations of function factors sampling the shape of facial functions offer enter parameters for the face identification. Other face evaluation mission: facial expression evaluation [9]; face animation and face synthesis can be simplified through correct localization of facial capabilities [9][10].

Face identification generates the very last output of complete face-reputation system: the identification of the given face photo. Based on normalized face picture and facial characteristic places derived from previous ranges, a feature vector is generated from given face and compared with a database of known faces. If a near healthy is observed, the set of rules returns the related identity. A foremost problem in face identification is the massive variations between face images from the identical individual in comparison to the ones from unique men and women. Therefore, it's far crucial to pick out a suitable face category technique that can offer a terrific separate potential among exceptional men and women. Face identification has a wide range of programs. Because it gives a non-intrusive manner for human identification, the face is used as an critical biometric in safety applications[6].

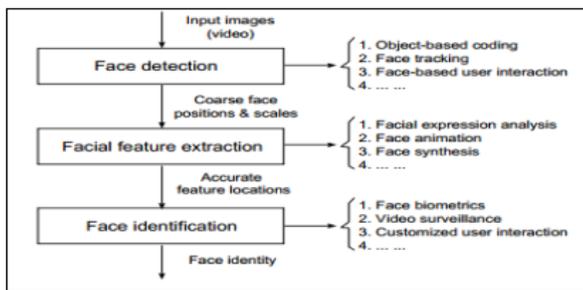


Figure 1. Framework of a face-recognition system

The main steps of face detection device are shown in Figure2. Face detection separate photo windows into two components: one containing faces, and one containing the history. The manner is tough because the: commonalities exist between faces (range in phrases of age, pores and skin color and facial features); and additionally differing in: lighting conditions; photo qualities; and geometries. The

face detector could be able to stumble on the presence of any face underneath any set of lighting fixtures conditions, upon any history.

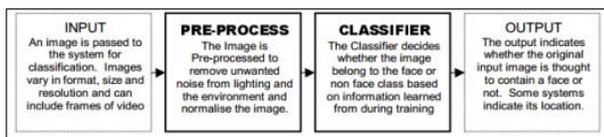


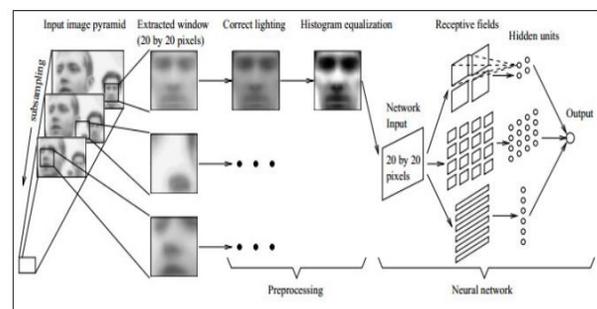
Figure 2. A general face detection system

IV. ARTIFICIAL NEURAL NETWORKS FOR FACE DETECTION

In the recent years, unique architectures and models of ANN have been used for face detection and popularity. ANN may be used in face detection and popularity due to the fact those models can simulate the way neurons work inside the human mind. This is the principle cause for its role in face recognition. This studies consists of summery review of the researches associated with face detection primarily based on ANN.[13]

A. Retinal Connected Neural Network (RCNN)

The machine arbitrates among many networks to enhance performance over one network. They used a bootstrap set of rules as training progresses for training networks to feature false detections into the schooling set. This removes the tough venture of manually selecting non-face education examples, which need to be selected to span the entire space of non-face photos. First, a pre-processing step, adapted from [11], is carried out to a window of the image. The window is then exceeded thru a neural community, which decides whether or not the window incorporates a face. They used three training units of pics. Test SetA amassed at CMU: includes 42 scanned pics, newspaper pix, photographs collected from WWW, and TV photographs (169 frontal views of faces, and require ANN to observe 22,053,124 20x20 pixel home windows). Test SetB consists of 23 pix containing a hundred and fifty five faces (nine,678,084 home windows). Test SetC is much like Test SetA, but carries pics with greater complicated backgrounds and with none faces to measure the false detection rate: carries sixty five pics, 183 faces, and fifty one,368,003 window. The detection ratio of this method same 79.6% of faces over massive take a look at sets and small quantity of false positives.[11]



RCNN FOR FACE DETECTION

B. Rotation Invariant Neural Network (RINN)

The machine employs more than one networks; the first is a “router” network which processes each enterwindow to determine its orientation after which makes use of this

records to put together the window for one or extra detector networks. We present the training techniques for both varieties of networks. We also carry out sensitivity evaluation at the networks, and gift empirical results on a large check set. Finally, we present preliminary results for detecting faces which can be turned around out of the picture aircraft, including profiles and semi-profiles.[10]

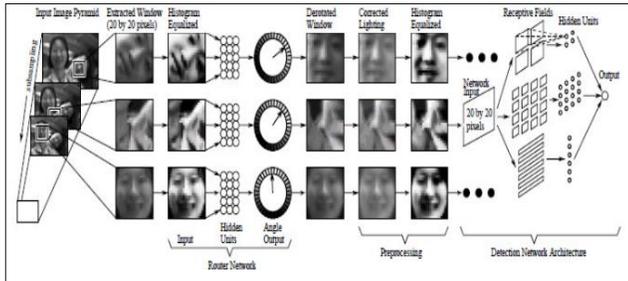


FIGURE 4. RINN FOR FACE DETECTION [29]

C. Fast Neural Networks (FNN)

proposed fast neural networks (FNN) technique to reduce the computation time for finding human faces. Each image is split into small sub pixels after which every one is tested one at a time the usage of a fast ANN. The experimental consequences of comparison with traditional neural networks confirmed that the high pace is carried out whilst making use of FNN.[12]

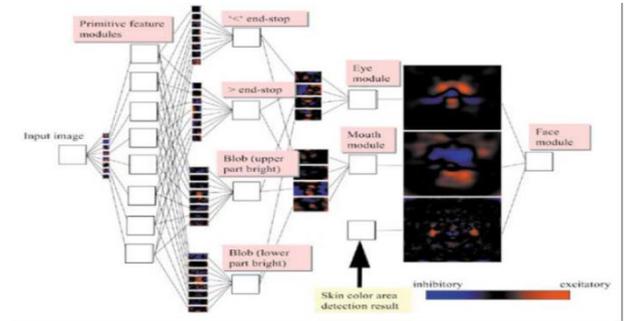
D. Convolutional Neural Network (CNN)

Masakazu Matsugu (2003) [13] defined a rule-primarily based set of rules for sturdy facial features popularity mixed with face detection the use of a convolutional neural community (CNN). Figure 6 shows the CNN approach. The trouble of subject independence and translation, rotation, and scale invariance in facial features reputation had been addressed on this observe

E. Evolutionary Optimization of Neural Networks

Stefan, et al (2004) [14] used ANN to get decision whether a pre-processed image area represents a human face or now not. They described the optimization of this community by a hybrid set of rules combining evolutionary computation and gradient-based gaining knowledge of. The advanced solutions carry out drastically faster than an expert-designed structure without lack of accuracy. The proposed hybrid algorithm tackles the problem of decreasing the quantity of hidden neurons of face detection network

with out loss of detection accuracy. The pace of category whether or not an photo vicinity corresponds to a face or not could be improved by using about 30 %.[12]



V. COMPARISONS BETWEEN DIFFERENT ANN APPROACHES

Table 1. DB and Performance measures used in literature studies

Research	Topology	Data Base: Training & Testing	Performance
[27]	Retinal connected neural network	Three training sets of images. Test SetA: 42 scanned photographs Test SetB: 23 images contain 155 faces Test SetC: 65 images, 183 faces (images with more complex backgrounds and without faces to measure false detection)	Detect 78.9% - 90.5% of faces in a set of 130 test images Acceptable number of false detections.
[30]	PCA with ANN	Select 700 pictures in Kah-Kay Sung's data set of 1488 faces to train ANN with 700 random noise pictures as negative examples remaining 788 faces in Kah-Kay's data set, followed by 788 random noise pictures	1.2% error after training for 50 epochs 1566 examples, 35 mis classifications made (2.23% error).

[32]	PNN	First set: 3257 images downloaded from several websites (384×384), with one face in each image. Second set: 130 images downloaded from website of CMU	Detection rate = 84.6% False rate=3:51 × 10 ⁻⁶
[33]	CNN	training of CNN, the number of facial fragment images used is 2900 for the FD2 layer, 5290 for the FD3, and 14,700 (face) for the FD4 layer, respectively. Number of non-face images, also used for the FD4 layer, is 137.	Recognition rate = 97.6% for 5600 still images of more than 10 subjects
[37]	BPNN	Training set contains 12000 face images collected from various face DBs. These samples also include the scaled versions at the same face with factor (0.8 - 1.12)	Detection Performance=94 %.
[39]	Gabor wavelet with ANN	ORL dataset: 400 frontal faces: 10 tightly cropped (92×112) with 256 grey images of 40 individuals with variations in pose, illumination, ..etc	Detect (77.9% - 90.3%) of faces in a set of 130 test images
[36]	MLP and MRC	Training set: face images from MIT DB. Images (scaled to 20×20) Test set: 2000 face/non-face images from MIT DB. Non-face patterns generated at different locations and scales.	Detection rate = 91.6% Error rate = 7.54%

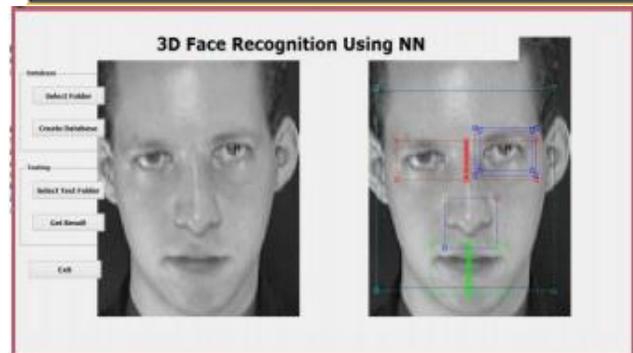
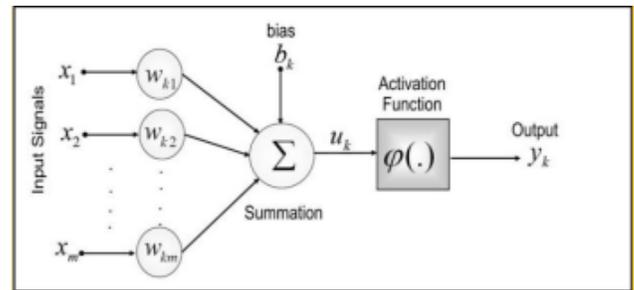
VI. ANN STRUCTURE

A layer with n inputs X_i and corresponding weights W_{ji} ($i=1,2, \dots, N$) feature \sum sums the n weighted input and passes the end result via a non linear feature $\phi(.)$ called activation characteristic. The characteristic ϕ strategies the adding consequences plus a threshold price θ as a

consequence producing the output $Y[1]$. ANN may be very widely recognized effective and strong class approach that has been used to approximate real valued capabilities. ANN has been used in many regions consisting of interpreting visual scenes, speech recognition and so forth. [7][2]

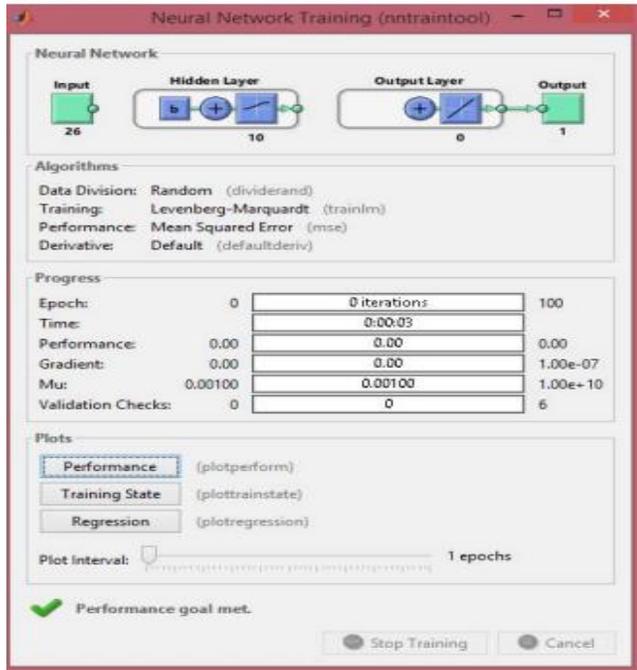
VII. EXPERIMENT RESULTS.

In this experiment where the images taken for detection and recognition is from ORL database. ORL stands for Olivette Research Laboratory Database which is of size 3. Three Mb. It consists of total four hundred snapshots in database out of which 188 photos are used for checking out cause [5][3]. The training set is created primarily based on this 188 pics whose whole information is been stored inside the community. Once training set is created then the take a look at enter is taken whose initially all data is extracted the usage of built in functions. Once the information is extracted it is matched with the training set. Below fig shows the level clever output received. [6]



Above fig indicates GUI wherein on left hand aspect is the input to be detected and coupled. On the right hand aspect we're comparing the take a look at enter with the database enter every a part of the face is tested one at a time for ex: eye co-ordinates, nostril point, mouth vicinity and many others. The statistics from every location is noted one at a time and saved in database that allows you to be useful for evaluating. After evaluating the check input faces with the database snapshots it displays the result as suit with the

image.[8]



Above fig indicated the very last result of neural network where there are 26 input layers, 10 hidden layers and 1 output layer.

VIII. CONCLUSION

After acting the test it could be concluded that face detection and reputation works very well with neural networks because despite the fact that the face is no longer proper it may be detected precisely because of hidden layer processing. Therefore all of the photographs in the database have been examined and received precise outcomes

IX. REFERENCES

[1] Applying artificial Neural network for face recognition. By Thai Hoang Le, Department of computer science, Ho chi Minh university of science, Vietnam.

[2] Face recognition system using artificial neural network approach. By Normah Binti Omar University Teknologi MARA, IEEE-ICSCN 2007, MIT Campus, Anna university, Chennai, India.

[3] Artificial Neural network based face recognition. By Adjoudj reda university of sisi, Algeria & Dr Boukelif Aoued university of sisi, Algeria.

[4] A survey on backpropagation algorithm for feedforward neural network. By kuldip vora, shruti yagnik, WWW.IJERD.ORG

[5] Artificial neural networks in face detection. By Tarun Kumar, kushal veer singh, shekhar malik. International journal of computer application.

[6] Face recognition using neural network. By P.Latha, Dr.L.Ganesan & Dr.S.Anna Signal processing: An international journal.

[7] Face recognition using artificial neural network. By Ashvini E shivdas WWW.IJRMST.ORG

[8] Neural network based face recognition using Matlab. By Shamla mantra, MITCOE Pune, India, IJCSET.

[9] Stan Z. Li & Anil K. Jai (2005) Handbook of Face Recognition, Springer Science & Business Media.

[10] Abboud B, Davoine F & Dang M (2004) "Facial expression recognition and synthesis based on an appearance model", Signal Processing: Image Communication, Vol.19, No.8, pp723-740

[11] KahKay Sung & Tomaso Poggio (1994) Example Based Learning For View Based Human Face Detection, Massachusetts Institute of Technology Artificial Intelligence Laboratory and Center For Biological And Computational Learning, Memo 1521, CBCL Paper 112, MIT, December

[12] Hazem M. El-Bakry (2002), Face Detection Using Neural Networks and Image Decomposition Lecture Notes in Computer Science Vol. 22, pp:205-215.

[13] Masakazu Matsugu (2003) "Subject independent facial expression recognition with robust face detection using a convolutional neural network", Neural Networks, Vol.16, pp555-559.

[14] Stefan W., Christian I. & Uwe H (2004) "Evolutionary Optimization of Neural Networks for Face Detection", Proceedings of the 12th European Symposium on Artificial Neural Networks, Evre, Belgium: d-side publications.