RESEARCH ARTICLE
SAMRIDDHI Volume 12, Special Issue 3, 2020 Print ISSN : 2229-7111 Online ISSN : 2454-5767

A Modified System for Facial Expression Recognition and Head Pose Estimation Techniques

Md Rashid Mahmood*[1], Raj Kumar Patra[2], Kamal Mehta[3], Swati Jain[4], Ashwala Mohan[5]

[1] ECE department, Guru Nanak Institutions Technical Campus, Hyderabad, India; e-mail : er.mrashid@gmail.com
[2] Department of CSE, CMR Technical Campus, Hyderabad, India; e-mail : patra.rajkumar@gmail.com
[3] Professor & HOD Department of CSE, Mukesh Patel School of Technology Management and Engineering, NMIMS Shirpur Campus, Maharashtra, India; e-mail : drkamalmehta123@gmail.com
[4] Govt. J. Y. Chhattisgarh College, Raipur, India; e-mail : sjcscghed@gmail.com
[5] ECE department, Guru Nanak Institutions Technical Campus, Hyderabad, India; e-mail : ashwala@yahoo.com

ABSTRACT

In this paper, feature extraction is being done by Viola Jones Face Recognition Algorithm. The work has been divided into two phases: Facial Expression Recognition and Head Pose Estimation. In the first phase of Facial Expression Recognition, the image is being taken from the camera of any person or any other thing. The image having an object is first examined by the viola Jones face recognition technique and then recognized as the proper input for the system. If the image or the object is an undesirable input it will not be tested or examined for recognition of facial expression. The image will be examined if the input image is desirable. And its expression will be saved. After that the second phase starts which is for estimation of the position of the head of a human being. the image having object is being tested by using the templates and whichever result will be coming with the minimum error will be the result. The project is the integrated system for recognizing a person's facial expression as well as to estimate the head pose. It can be used as an advancement on the field of biometrics.

Keywords: Face Recognition, Face pose estimation, Viola Jones Face Recognition.

SAMRIDDHI : A Journal of Physical Sciences, Engineering and Technology, (2020); DOI : 10.18090/samriddhi.v12iS3.27

INTRODUCTION

This document is a template for *Word (doc)* versions. If you are reading a paper version of this document, so you can use it to prepare your manuscript. Facial Expression and Head Pose Estimation are the most important areas in the field of biometrics. These are the most common methods for recognition of a human being. Human intelligence uses these biometrics most of the times in recognizing the face of the human being and who is that person, what he is thinking or feeling, what is he going to do can be estimated by these approaches. There are so many techniques and approaches for recognizing the face of a human being, their facial expressions and head-poses as well.In the present scenario, there is no such approach which is giving the result of both the facial expression recognition and head-pose estimation. Therefore, an integrated system has to be developed to recognize facial expression and estimate the head-pose.

Corresponding Author : Md Rashid Mahmood, ECE department, Guru Nanak Institutions Technical Campus, Hyderabad, India; e-mail : er.mrashid@gmail.com

How to cite this article : Mahmood, Md., R., Patra, R.K., Mehta, K., Jain, S., Mohan, A. (2020). A Modified System for Facial Expression Recognition and Head Pose Estimation Techniques.

SAMRIDDHI : A Journal of Physical Sciences, Engineering and Technology, Volume 12, Special Issue (3), 136-141.

Source of support : Nil

Conflict of interest : None

Facial expressions have been recognised of persons of different ages. The features of the face of the person at different ages vary which causes varieties in features of face. Gooding Guo et al. described how the human aging influences the facial expression has been described [1]. The Linear Parametric Component Analysis Mapping(LPCMAP) method is described in the most effective method for pose estimation of human head.

A framework for analysis, synthesis mapping is proposed for mapping head to pose and vice-versa [2].

It has been seen that Model based pose estimation technique is much more efficient as compared to appearance-based pose estimation technique. It described how a 2D facial image is converted into 3D image with different expression. A multi view face recognition system has been given which can easily recognise face apart from many facial challenges [3].Feature based head pose estimation where a system estimates the pose from monocular images, head angle along x- axis, Pitch determines head angle along y-axis, and the head angle along z-axis [4]. The location and orientation of a given object can be determined and finding both pose of a rigid object and constrained object [5]. Combination of Principal Components (PCs) and Subspace methods is used for head angle calculation and 3D facial model are captured by cyber ware cameras showing superior face recognition and pose estimation system [6]. Gabor Wavelets Network (GWN), provides robust landmark tracking system; it detects any facial feature and can capture any geometry of face. Principal Component analysis is used for land mark extraction and for face recognition feed forward back neural network is used to detect or recognise face [7-10]. Model based pose estimation technique is much more efficient as compared to appearance-based pose estimation technique. 2D facial image is converted to 3D image having different expression. Multi view face recognition system has been given which can easily recognise face apart from many facial challenges [11-12].

In this paper, Viola Jones Face Recognition Algorithm has been used to recognize the object in the image as the face of a human being. Whereas Linear Programming Method has been used to estimate the head pose of the face of the person. The facial features are the basic things on the face on the basis of which a face is recognized as a face of human being. Due to changes in the positioning of the facial features the software will be able to recognize the various changes in the expressions on the face and the changes in the position of head.

VIOLA JONES FACE RECOGNITION ALGORITHM

This algorithm has been used in this project for recognizing the face of the human being. Basically, the system can only recognize the face of a human being, here the comparing and analysing of the human face is being done only. This is the reason for which this algorithm has been used.In order to make the result correct and more perfect proper input must be taken, the algorithm will recognize the exact image which is to be taken as input for further processing.

Consider images $(x_1,y_1),...,(x_n,y_n)$

Where, $y_i = 1, 0$ for positive and negative examples respectively.

Set the classifier counting $t = 0$ and the sample weights $w_{i,1} = \frac{1}{2m}, \frac{1}{2l}$ for $y_i = 1,0$ respectively, where m and l are number of positives and negatives respectively.

For $t = 1$ to T;

Normalized weights

$$w_{t,i} = \frac{wt,i}{\sum_{j=1}^{n} wt,i}.$$

A classifier hj will be trained for each feature j, restricting to use a single feature. The error is estimated with respect to

$$wt, \epsilon j = \sum_i wi|hj(xi) - yi|.|$$

Chose the classifier ht, whic his the nearest to error, ϵt .

Weights to be updated for,

$$w_{t+1,i} = w_{t,i}\,\beta_t^{1-ei}$$

where, $ei = 0$ or 1, for correct xi classification $ei = 0$ otherwise, $ei = 1$

$$\beta t = \frac{\epsilon t}{1-\epsilon t}$$

Strong classifier can be evaluated by

$$h(x) = \begin{cases} \sum_{t=1}^{T} \alpha t h t(x) \geq \frac{1}{2} \sum_{t=1}^{T} \propto t \\ 0 \; otherwise \end{cases}$$

$$\text{where, } \propto t = \log_{10} \frac{1}{\beta t}$$

For Head-Pose Estimation, Linear Programming method for identifying the position of head is being used. This technique is being applied in a very simple manner and is executed in three steps. The first step is to train the software with the data stored in the database as the templates. The second step is to test the input data or a input image in the software with as the software has been trained with the database. The third step is to save the data.

The image which is taken as input is to be browsed from the system. The image is being saved from the camera to the system. The images can also be saved from the image sequences. Image enhancement has to be done to make the image clearer and sharp for further easy operations. Since the images acquired from sensors or other Medias are not assured with perfect quality, so a technique is used for increasing the clarity of the object in an image. It is very essential to keep a higher accuracy for face recognition with its features.

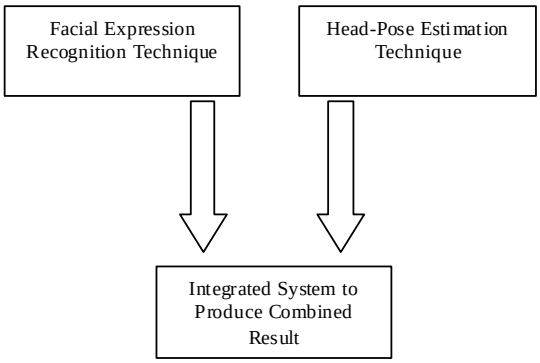

Figure 1: Integration of The Techniques

The image taken in input is being recognized as the desired image of the human being. The feature extraction is done by using Viola Jones Face Recognition Algorithm. There are various techniques for recognition of face but this technique is the most widely used algorithm for recognition of faces of human beings. The object in the image which should be a face is to be recognized as the desired input, because if some other is taken as input it will show wrong output. It will play as a paradox, for example if an image of some other animal is being taken it will give some output which will be proved as wrong. Hence correct input should be taken and it will become possible only if we are recognizing the actual face of human being using some algorithm or the other.

Implementation of The Algorithm

The algorithm has been implemented for the project in a very easy manner. The system has been divided into two phases: Facial Expression and Head-Pose Estimation. But firstly the system recognizes an image as an input, any image taken from the camera cannot be the desired or required input it should have the face of the human being. For this we are using the Viola Jones Face Recognition algorithm. This algorithm will approve whether the image can b taken as input or not because it is necessary to have a proper object in the image to recognize it, which is the face of the human being.

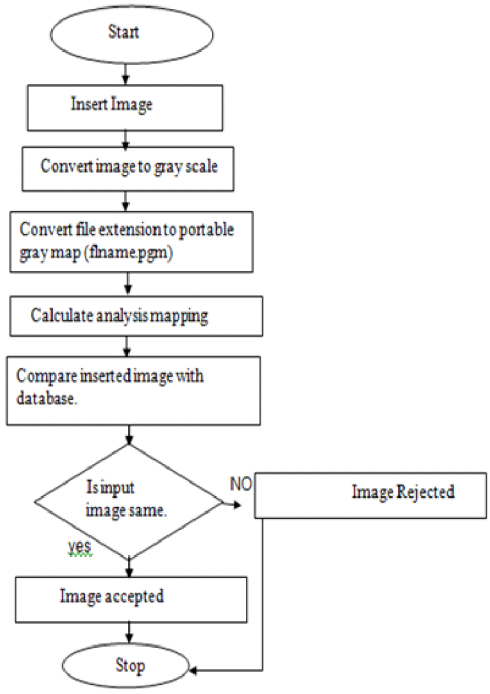

Figure 2: Integration of The Techniques

Experimental Results and Discussions

This section deals with experimental setup of the work that has been carried over a collection of data set of images. The developed algorithm called Viola

Jones Algorithm for Face Recognition for human faces and for Head-Pose Estimation Linear Programming Method has been used to get the desired output with necessary test data. After collection of data set, different phases and algorithm are implemented. And experimental results are shown for both semiautomatic and fully automatic comparison, verification and identification of faces. Along with this the expression of the face and its head pose is also being retrieved as output as desired. In the figure 3, G.U.I for Integrated System has been made, here three buttons are there that is Face Expression, Pose Estimation and Result. Figure 4, represents the window for recognition of face expression has been made, here execution of the browse button & import of an image is done. In Figure 5. Execution of GEO Points has been done to detect data points on face. Figure 6, shows the window for Free Hand Location to place data points on face.

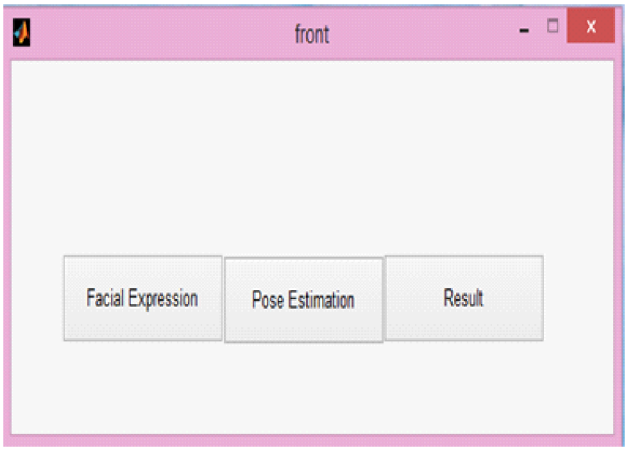

Figure 3: Opening of GUI to Execute Project

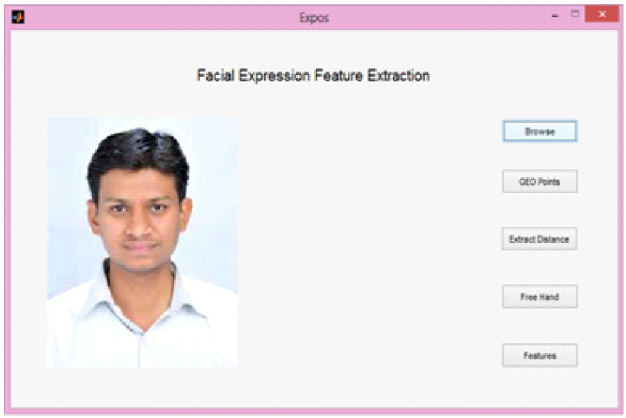

Figure 4: Window for Calculating Facial Expression

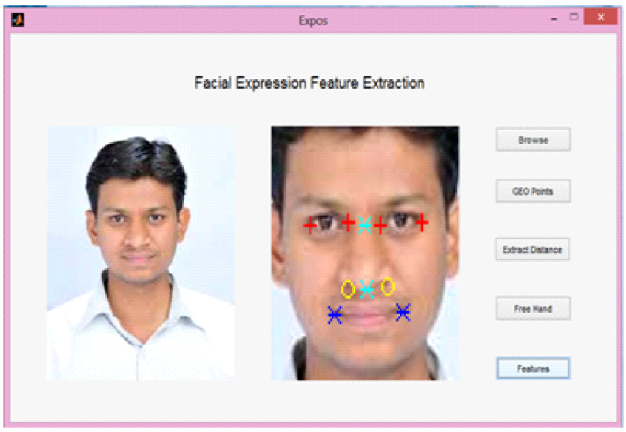

Figure 5: Extracting GEO Points on the face

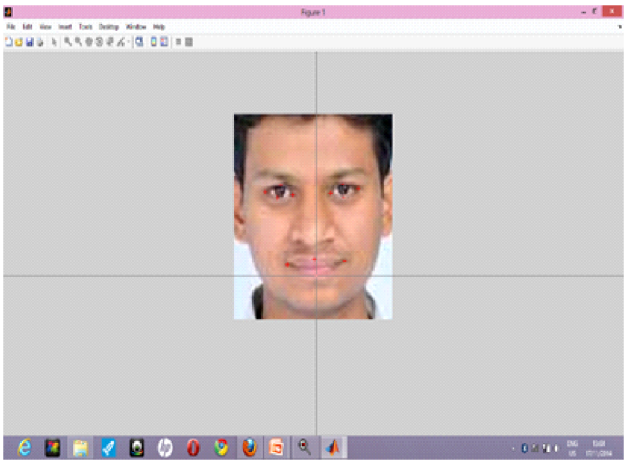

Figure 6: Free Hand Locating of Facial Data Points

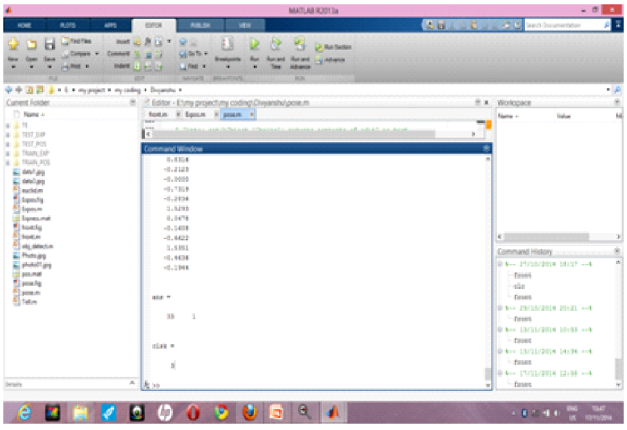

Figure 7: Calculation of Expressions in The Software

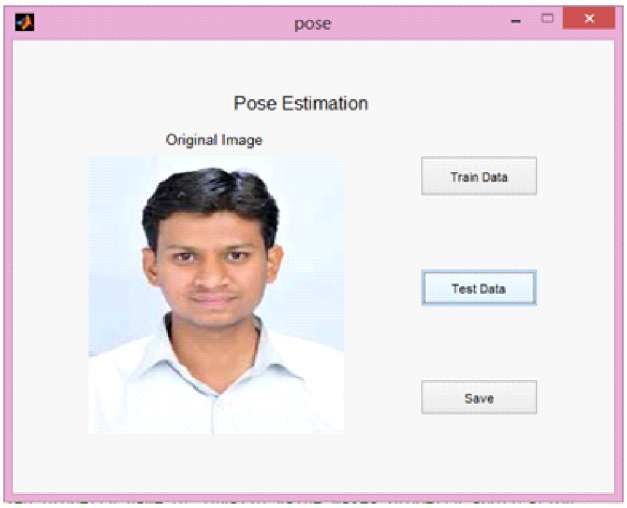

Figure 8 : Second Phase: GUI for Head-Pose Estimation

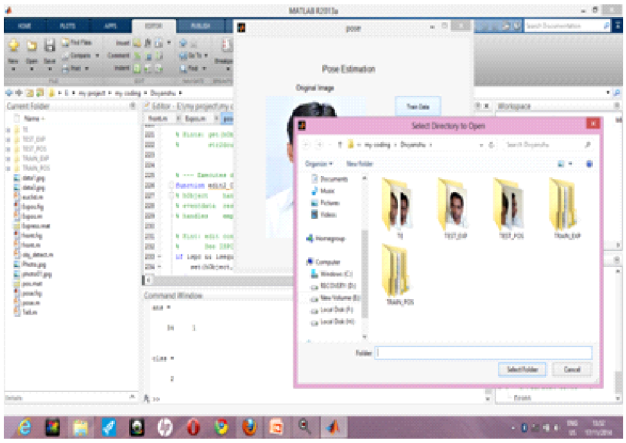

Figure 9 : Selecting and Executing the Folders for Head-Pose Estimation

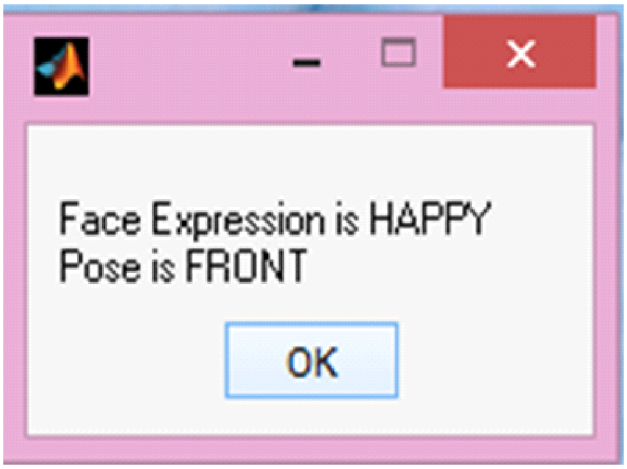

Figure 10 : Display Result

Windows of data points positions and recognising the expression has been shown in Figure 7. In Figure 8, G.U.I. for Head Pose Estimation, having three buttons, Train Data, Test Data, Save button has been shown. Figure 9, Execution of Train Data is shown and training of the data is done. Figure 10, display the final G.U.I. for Results has been shown.

CONCLUSION

Here, the complete execution of the project has been done. In this paper, the input image is recognised as the desired image as the proper input to the system. The face in the input image has been recognised as the face of the human being and then the expression and the head pose of the face and head respectively has been recognised.

REFERENCES

[1] G Guodong Guo,Xin Li, "Facial Expression Recognition Influenced by Human Aging." IEEE Transactions on Affective Computing (Volume : 4, Issue: 3 , July-Sept. 2013)

[2] Kazunori Okada, Christoph von der Malsburg, et al, "Face Recognition and Pose Estimation with Parametric Linear Subspaces", Applied Pattern Recognition, Studies in Computational Intelligence book series (SCI, volume 91), 2008

[3] Parama Bagchi, Debotosh Bhattacharjee, Mita Nasipuri, "3D Face Recognitionacross Pose Extremities", Smart Innovation, Systems and Technologies book series (SIST, volume 27), Springer International Publishing Switzerland 2014

[4] Teodora Vatahska, Maren Bennewitz, and Sven Behnke et al., "Feature-based Head Pose Estimation from Images", IEEE Transactions on Pattern Analysis and Machine Intelligence, 2007.

[5] Gerard Pons-Moll, "Model-Based Pose Estimation", Visual Analysis of Humans (pp.139-170)

[6] Hikaridai Seika-cho Soraku-gun, "Analysis and Synthesis of Pose Variations of Human Faces by a Linear PCMAP Model and its Application for Pose-Invariant Face Recognition System", Proceedings Fourth IEEE International Conference on Automatic Face and Gesture Recognition (Cat. No. PR00580), 2000

[7] Yamini Chouhan and Rohit Raja, "*Robust Face Recognition And Pose Estimation System*", International Journal of Science, Engineering and Technology Research (IJSETR), Vol. 3, (1), Jan 2014

[8] Yamini Chouhan, and Rohit Raja,"*Face Recognition With 3D Pose Estimation Using Gabor Wavelets.*", International Journal of Science, Engineering and Technology Research (IJSETR), Vol 2, (5), May 2013

[9] Thai Hoang Le, Len Bui, "*Face Recognition Based on SVM and 2DPCA",* International Journal of Signal Processing, Image Processing and Pattern Recognition Vol. 4 (3).

[10] Rohit Raja, Sandeep Kumar, Md Rashid, Color Object Detection Based Image Retrieval using ROI Segmentation with Multi-Feature Method, in Wireless Personal Communication Springer Journal, Print ISSN0929-6212 o nline ISSN1572-834 pp-1-24, https://doi.org/10.1 007/s11277-019-07021-6

[11] Regerio S. Feris and Roberto M, "*Locating and Tracking facial land marks using Gabor wavelet network",* Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition, 2001

[12] L.Sirovich, M. Kirby, "*A low-dimensional procedure for the characterization of human faces",* The Journal of the Optical Society of America, 4:519 – 524. 1987.

[13] Sumati Pathak, Rohit Raja, Vaibhav Sharma, Srinivas Ambala, ICT Utilization and Improving Student Performance in Higher Education, International Journal of Recent Technology and Engineering (IJRTE) at Volume-8 Issue-2, pp. 5120-5124, July 2019.

[14] Rohit Raja,Tilendra Shishir Sinha, Raj Kumar Patra and Shrikant Tiwari(2018), Physiological Trait Based Biometrical Authentication of Human-Face Using LGXP and ANN Techniques, Int. J. of Information and Computer Security, Vol. 10, Nos. 2/3, pp. 303- 320.

[15] Rohit Raja, Tilendra Shishir Sinha, Ravi Prakash Dubey (2015), Recognition of human-face from side-view using progressive switching pattern and soft-computingtechnique**,** Association for the Advancement of Modelling and Simulation Techniques in Enterprises, Advance B, Vol. 58, N 1, pp. 14-34, ISSN:-1240-4543.

[16] Md. Rashid Mahmood, Raj Kumar Patra, Rohit Raja, "A Novel Approach for Weather Prediction Using Forecasting Analysis and Data Mining Techniques, Lecture Notes, Network and System, Springer ICIECE-2018,

[17] Rohit Raja, Raj Kumar Patra, Md Rashid Mahmood, "Image Registration and Rectification using Background Subtraction method for Information Security to Justify Cloning mechanism using High-End Computing Techniques", 3rd International Conference on Computational Intelligence & Informatics, Springer-2018

[18] Rohit Raja, Sandeep Kumar, Md Rashid Mahmood, "Color Object Detection Based Image Retrieval Using ROI Segmentation with Multi Feature Method, Wireless Personal Communications, Vol. 110, Issue 3, January, 2020