EMOTION DETECTION FROM FACE USING PCA, GLCM, GMM and SVM

Scholar: Pankaj
Guide: Er. Sumit Dalal**, Assistant Professor, ECE Dept.**
SAT KABIR Institute of Technology & Management, M.D.U. Rohtak

Abstract

Face mining is characterized as the revelation of picture designs in a given gathering of pictures. It is an exertion that generally attracts upon information PC vision, picture handling, information mining, AI, database, and man-made reasoning. Facial acknowledgment breaks down and thinks about the examples from the facial pictures. Facial component extraction is a programmed acknowledgment of human faces by recognizing its highlights for example eyes, eyebrows and lips. In this paper, we are assessing the execution of PCA, GMM, GLCM and SVM to perceive seven distinctive outward appearances of two people, for example, cheerful, unbiased, and furious, nauseate, dismal, dread and astonishment. Our point is to speak to best systems which work best for facial acknowledgment. The present investigation demonstrates the plausibility of outward appearance acknowledgment for viable applications like reconnaissance and human PC communication.

INTRODUCTION

Picture mining is utilized to discover examples and connections from gathering of pictures. It is the way toward seeking and finding significant data in extensive volumes of picture information. Face acknowledgment is to distinguish faces. Face acknowledgment has been broadly connected in security framework, MasterCard check, criminal recognizable pieces of proof and video chat. The uses of picture mining are done in face acknowledgment. Face acknowledgment calculations distinguish faces by extricating highlights from a picture. It is chiefly used to perform two essential errands, for example, confirmation and recognizable proof. Face acknowledgment strategies utilizes calculations which are utilized to break down explicit facial highlights like eyes, eyebrows and lips. Application territories of face acknowledgment are mechanized capture and booking framework (CABS), distinguishing proof arrangements, country barrier, air terminal security, money related administrations and so forth. Facial element extraction is a successful strategy to separate facial highlights like eyes, eyebrows and lips relying upon their areas with the face districts and it are characterized as the technique for finding focuses in a predefined picture.

People's capacity in perceiving faces is exceptional since we can review and perceive a huge number of faces which we learned for the duration of our lives. In other words, we can even perceive the essences of colleagues numerous years after the fact despite the fact that they have experienced changes in their facial highlights because of maturing, developing whiskers, long hair, and so forth. Face acknowledgment is viewed as a noteworthy issue in security frameworks, distinguishing proof of lawbreakers, Visa control, and so forth. For example, the capacity to show a specific face and distinguish it among such a large number of countenances put away in a database can eminently improve the ID of culprits . In face acknowledgment, in view of the prepared countenances, a framework can pick a face which is progressively like the particular face and think about it as the last reaction. The most noteworthy distinction among the face acknowledgment techniques is identified with the manner in which they concentrate and show facial highlights and segments. As of recently, various strategies have been proposed for extricating face highlights which can be isolated into two general sorts, for example structure-based techniques and highlight based strategies . Structure-based techniques for face acknowledgment are non-checked strategies which produce suitable reactions to the direct facial changes. As a for example, important part

examination (PCA) is viewed as a direct change which utilizes input information fluctuation. As a rule, face acknowledgment techniques comprise of an element extractor and a classifier.

Developing enthusiasm for the improvement of human and PC interface and biometric ID, human face acknowledgment has turned into a functioning examination territory. A review of the examination chips away at outward appearance acknowledgment. Notwithstanding of the way that there has been great advancement till now, outward appearance acknowledgment with high precision remains a difficult undertaking because of the nuance, unpredictability and changeability of outward appearances.

The basic strategies for facial component extraction are geometry based and appearance-based. Geometry put together techniques depend with respect to powerful and precise facial element identification and following. Among the appearance-based strategies, the capability of Gabor wavelets for perceiving articulations from still pictures have been built up. As of late, amazing face acknowledgment results were accounted for utilizing the new multi goals investigation strategy called advanced curvelet change. For the most part, face acknowledgment and outward appearance acknowledgment are double issues. Face acknowledgment is made troublesome by assortment of appearances and demeanour acknowledgment gets harder because of the countenances fluctuating in age, sexual orientation, and ethnicity. The strategy introduced connected advanced curve let co-proficient to frame highlights for speaking to the whole face. So as to order the outward appearances, the nearby facial data should be put away. To acquire the nearby depiction of the articulations, neighbourhood paired examples (LBPs) are figured utilizing chosen sub-groups of picture pre-handled by curve let change. LBP was proposed by T. Ojala for surface order. LBP‟s have been utilized broadly for articulation acknowledgment with a decent rate of accomplishment.

PCA is gotten from Karhunen-Loeve's change. Given an s-dimensional vector portrayal of each face in a preparation set of pictures, Principal Component Analysis (PCA) will in general discover a t-dimensional subspace whose premise vectors relate to the most extreme difference course in the first picture space. This new subspace is typically lower dimensional. Chief segment investigation (PCA) is a numerical strategy that utilizes a symmetrical change to change over a lot of perceptions of conceivably connected factors into a lot of estimations of straightly uncorrelated factors called vital segments. The quantity of key parts is not exactly or equivalent to the quantity of unique factors. This change is characterized so that the primary vital part has the biggest conceivable fluctuation (that is, represents however much of the inconstancy in the information as could be expected), and each succeeding segment thusly has the most elevated difference conceivable under the requirement that it be symmetrical to (i.e., uncorrelated with) the previous segments. Important segments are destined to be free just if the informational collection is mutually regularly conveyed. PCA is delicate to the general scaling of the first factors.

In this paper, first the GLCM include vectors for the database pictures and the question picture are extricated and utilizing the Euclidean separation change the pictures are coordinated.

Just top ten pictures that are like the component vectors are arranged in the rising request while the Snap shot strategy for the Eigen face is connected just to these pictures for face acknowledgment.

Related Work:

[1] Alaa Eleyan: Moving from manually interaction with machines to automated systems, stressed on the importance of facial expression recognition for human computer interaction (HCI). In this article, an investigation and comparative study about the use of complex wavelet transforms for Facial Expression Recognition (FER) problem was conducted. Two complex wavelets were used as feature extractors; Gabor wavelets transform (GWT) and dual-tree complex wavelets transform (DT-CWT). Extracted feature vectors were fed to principal component analysis (PCA) or local binary patterns (LBP). Extensive experiments were carried out using three different databases, namely; JAFFE, CK and MUFE databases. For evaluation of the performance of the system, k-nearest neighbour (kNN), neural networks (NN) and support vector machines (SVM) classifiers were implemented. The obtained results show that

the complex wavelet transform together with sophisticated classifiers can serve as a powerful tool for facial expression recognition problem.

[2] Dr. S. Vijayarani, S. Priyatharsini

Image mining is defined as the discovery of image patterns in a given collection of images. It is an effort that fundamentally draws upon knowledge in computer vision, image processing, data mining, machine learning, database, and artificial intelligence. Facial recognition helps to analyze and compare the patterns from the facial images. Facial feature extraction is an automatic recognition of human faces by detecting its features i.e. eyes, eyebrows and lips. In this research work, features are extracted from the human facial images by using the existing Face Part Detection (FPD) algorithm and the newly proposed Gray Level Co-occurrence Matrix (GLCM) algorithm. FPD uses bounding box method and GLCM uses affine moment invariants method. Performance factors applied here are feature extraction accuracy and execution time. The implementation of this work is performed in MATLAB 7.0. Based on the experimental results, it is observed that the proposed GLCM algorithm extracted the features more accurately with minimum execution time than FPD algorithm.

[3] Taqdir, Jaspreet Kaur : Facial expression provides an important behavioural measure for studies of emotion, cognitive processes, and social interaction. Facial expression recognition has recently become a promising research area. Its applications include human-computer interfaces, human emotion analysis, and medical care and cure. In this paper, we are evaluating the performance of PCA and LDA to recognize seven different facial expressions of two individuals such as happy, neutral, angry, disgust, sad, fear and surprise, in the JAFFE database. Our aim is to represent best techniques which work best for facial recognition. The present study proves the feasibility of facial expression recognition for practical applications like surveillance and human computer interaction.

[4] Taqdir : The face detection is a challenging task that needs to be performed robustly and efficiently regardless of variability in scale, location, orientation, illumination. Hence the main objective of this paper is to evaluate the different attributes of face detection and recognition for invariant dataset. The DWT, PCA+DWT, LDA+DWT techniques are used to evaluate the performance on the basis of RMS error, CC, PSNR, MSE to recognize the same face with invariant condition like expression, location, scale, aging , lightning etc.

[5] Abdulrahman M., Gwadabe T. R., Abdu F. J., Eleyan A. These Human facial expressions convey a lot of information visually rather than articulately. Facial expression recognition plays a crucial role in the area of human-machine interaction. Recognition of facial expression by computer with high recognition rate is still a challenging task. Facial Expression Recognition usually performed in three-stages consisting of face detection, feature extraction, and expression classification. This paper presents a survey of the current work done in the field of facial expression recognition techniques with various face detection, feature extraction and classification methods used by them and their performance.

[6] Uzammil Abdulrahman, Tajuddeen R. Gwadabe, Fahad J. Abdu, Alaa Eleyan

This paper proposed a facial expression recognition approach based on Gabor wavelet transform. Gabor wavelet filter is first used as pre-processing stage for extraction of the feature vector representation. Dimensionality of the feature vector is reduced using Principal Component Analysis (PCA) and Local binary pattern (LBP) algorithms. Experiments were carried out of using Japanese female facial expression (JAFFE) database. In all experiments conducted using JAFFE database, results obtained reveal that GW+LBP has outperformed other approaches in this paper with an average recognition rate of 90% under the same experimental setting.

[7] FRANK Y. SHIH and CHAO-FA CHUANG PATRICK S. P. WANG : Facial expression provides an important behavioural measure for studies of emotion, cognitive processes, and social interaction. Facial expression recognition has recently become a promising research area. Its applications include human-computer interfaces, human emotion analysis, and medical care and cure. In this paper, we investigate various feature representation and expression classification schemes to recognize seven different facial expressions, such

as happy, neutral, angry, disgust, sad, fear and surprise, in the JAFFE database. Experimental results show that the method of combining 2D-LDA (Linear Discriminant Analysis) and SVM (Support Vector Machine) outperforms others. The recognition rate of this method is 95.71% by using leave-one-out strategy and 94.13% by using cross-validation strategy. It takes only 0.0357 second to process one image of size 256 × 256.

Proposed Methodology:

An improved approach to emotion detection using modified PCA algorithm. In our proposed algorithm we focused on main three constraints are Time, accuracy, number of recognized emotions. Because previous algorithms are not focused on all three constraints together so, our aim is to design an algorithm which focus on these basic and make the algorithm efficient than previous algorithms.

Issues we will focus on:

Time constrain: The performance time for the feature extraction and time of classification.

Accuracy: The accuracy of the emotion recognition still needs to be improved. The accuracy decreases when more emotions are needed to be recognized.

Number of the recognized emotions: Although there are varieties of emotional states to describe the human's feelings, until now only limited types of emotions can be recognized. But our algorithm recognized at least 5 emotions.

Proposed System Architecture:

In our proposed methodology for this thesis we categorize the process on two parts first on is training dataset for emotion detection using PCA algorithm and GLCM for feature Extraction. We have introduced a novel face identification scheme based on phase and GMMs. Although the importance of phase is well-known, this fact had not yet been utilized in building model-based identification techniques. This is partially because modelling phase with the help of an appropriate representation of its variability across different images of a person is indeed a challenging task and our experiments show that our proposed models are able to handle it fairly well.

First part shows how we train our data set for the emotion detection. First we input the different emotion images then we extract the features of the images using PCA (Principal component Analysis), GLCM Texture Feature and then we train our dataset using SVM (Support Vector Machine) and finally we take a test for the correctness of the emotion detection.

Second part shows how we detect emotion and then music played according to the emotion. First we capture image and then queue these samples in database and then detect emotion and then comparing the detected emotion to the trained database. When the emotion is detected then the music is played according to the detected emotion.

Working Methodology with PCA

Facial Expression Detection means finding the Expression of an image and recognizes which expression it is such as Happy, Sad, Angry, Disgust, and Neutral etc. The technique used for Facial Expression Detection is Principal Component Analysis. The Principal Component Analysis (PCA) is one of the most successful techniques that have been used to recognize faces in images.

One difficulty in face recognition is how to handle the variations in the expression, pose and illumination when only a limited number of training samples are available.

1. For recognizing face, we need dataset that contain the number of records. But dataset consisting of large no of interrelated variables while retaining as much as possible of the variation present in the dataset.

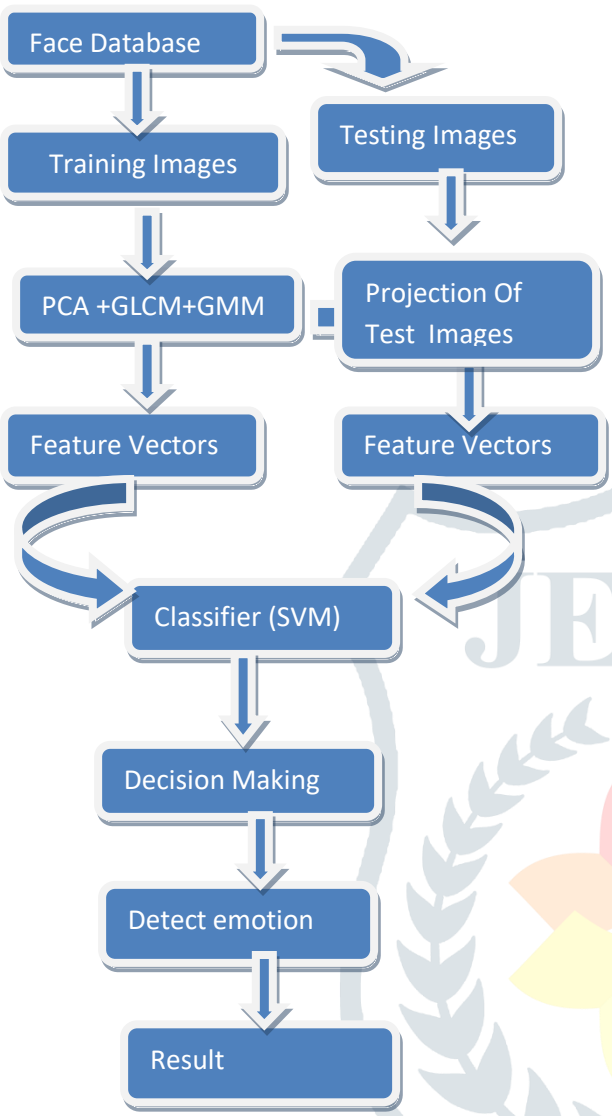
2. For reducing the dimensionality of the dataset we use PCA (Principal Component Analysis) and this is achieved by transforming a new set of variables which are uncorrelated and ordered.

3. Original data image contain numbers of variables but while transforming few are retain most of the variable present.

4. In our system we resolve another issue, we also detect emotion from given image at real time.

5. To solve this issue we extract features from given image like eyes, nose and lips and compare that extracted features from dataset so that the exact motion is detected and music is played according to the detected emotion.

Flow Chart



Features Extraction using PCA :

The Eigen Object Recognizer class applies PCA on each image, the results of which will be an array of Eigen values that a Neural Network can be trained to recognize. PCA is a commonly used method of object recognition as its results, when used properly can be fairly accurate and resilient to noise. The method of which PCA is applied can vary at different stages so what will be demonstrated is a clear method for PCA application that can be followed. It is up for individuals to experiment in finding the best method for producing accurate results from PCA. To perform PCA several steps are undertaken:

Stage 1: Subtract the Mean of the data from each variable (our adjusted data)

Stage 2: Calculate and form a covariance Matrix

Stage 3: Calculate Eigenvectors and Eigen values from the covariance Matrix

Stage 4: Chose a Feature Vector Stage 5: Multiply the transposed Feature Vectors by the transposed adjusted data

Feature Extraction

Feature extraction converts pixel data into a higher-level representation of shape, motion, color, texture, and spatial configuration of the face or its components. The extracted representation is used for subsequent expression categorization. Feature extraction generally reduces the dimensionality of the input space. The reduction procedure should (ideally) retain essential information possessing high discrimination power and high stability. Such dimensionality reduction may mitigate the „curse of dimensionality". Geometric, kinetic, and statistical-or spectral-transform-based features are often used as alternative representation of the facial expression prior to classification.

Performing PC

[Coeff, Score, latent, tsquare] = princomp (X) X is n b p data matrix. Rows of X correspond to observations and columns to variables.

Coeff: Coeff. is a p-by-p matrix, each column containing coefficients for one principal component. The columns are in order of decreasing component variance.

Score: Representation of X is principal comp. Space rows of score correspond to observation, columns to components.

Latent: Eigen values of the covariance matrix of X. It is the variance of Score

GLCM (Gray Level Co-Occurrence Matrix) ALGORITHM

GLCM is defined as the gray level co-occurrence matrix. Here the texture features of images are extracted and stored in a matrix. GLCM is one of the simplest matrix methods to extract the texture features. GLCM features are extracted for all the images in the database and the input image are

stored for performing affine moments. The four commonly used properties such as Energy, Entropy, Contrast and Inverse difference moment are used to reduce the computational complexity. The co-occurrence matrix is a statistical model and is useful in a variety of image analysis applications such as in biomedical, remote sensing, industrial defect detection systems, etc. Gray Level Matrix is used to extract features based on the gray level value of pixels. The features are important for every classification algorithms. Here texture features of images are extracted. The GLCMs features are stored in a matrix,

Where the number of GLCM is calculated. The GLCM features are extracted by the variance and difference of entropy Information. Using the affine moment invariants technique the feature extraction is done to extract features such as eyes, eyebrows and lips. It is done by using facial expression recognition of different emotions like angry, fear, sad, happy, surprise and normal. Using these facial expressions the images are converted in to binary images for extracting the features.

Result:

For better recognising, here used emotion detection from face using PCA, GLCM, GMM and SVM. There is three main factors Time constraint, Accuracy and Number of recognising factor. Here take an example for one facial expression which are given below:

Emotion Detection for happy face

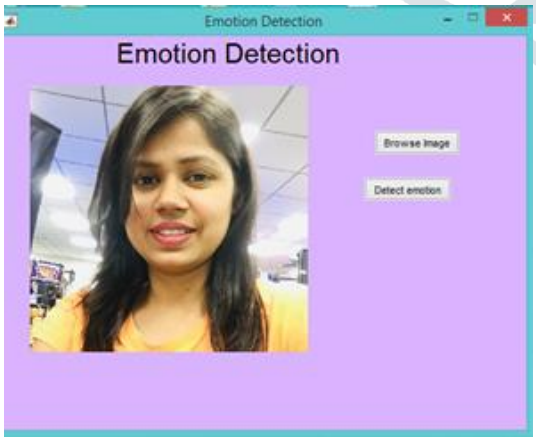


Fig. 1. Detect Emotion

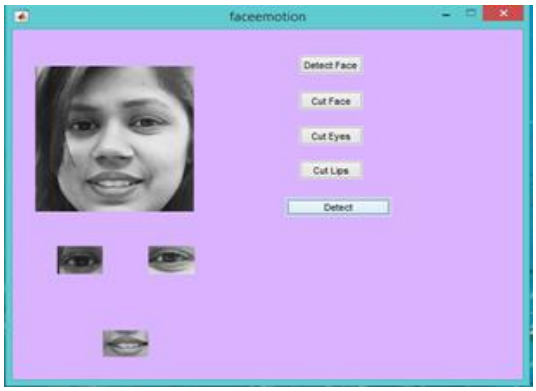


Fig. 2. Different operation of emotion

Fig.3. Emotion Result

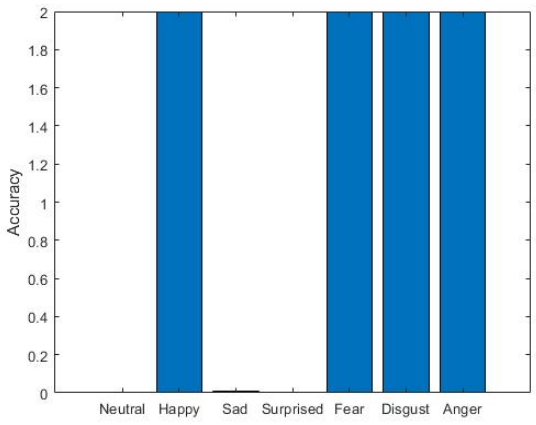


Fig. 4 Graph showing Accuracy for happy emotion from different emotion

Performance analysis of different expressions:

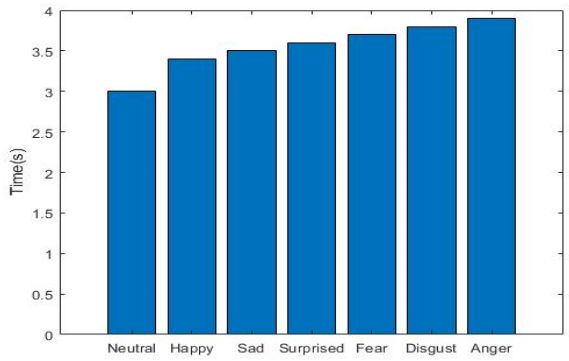


Fig.5. Time analysis for different emotions

Time Constraints:

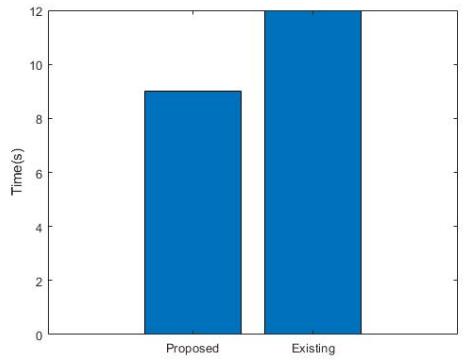


Fig. 6 Time analysis of purposed vs. Existing technique

Conclusion

This work investigated facial expression recognition problem using SVM classifiers using person-dependent approach. PCA and GLCM, GMM algorithms were used to reduce the dimensions of the feature vectors generated using PCA+GMM+GLCM with SVM classifier recorded the best average recognition rates. Experimental results obtained demonstrated the high performance the overall performance of SVM were, as expected, better than the kNN in all scenarios. Also, the importance of applying dimensionality reduction on the feature vectors before classification stage was realized, where in most experiments the performance increased after applying dimensionality reduction.

Reference

[1] Alaa Eleyan, Comparative Study on Facial Expression Recognition using Gabor and Dual-Tree Complex Wavelet Transforms International Journal of Engineering & Applied Sciences (IJEAS) Vol.9, Issue 1(2017) 1-13

[2] Dr. S. Vijayarani, S. Priyatharsini Facial Feature Extraction Based On FPD and GLCM Algorithms International Journal of Innovative Research in Computer and Communication Engineering (An ISO 3297: 2007 Certified Organization) Vol. 3, Issue 3, March 2015 Copyright to IJIRCCE 10.15680/ijircce.2015.0303016 1514.

[3] Taqdir, Jaspreet Kaur Facial Expression Recognition with PCA And LDA, Taqdir et al, / (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 5 (6) , 2014,

[4] Taqdir, "Comparative analysis of DWT, PCA+DWT AND LDA+DWT for face Recognition", International Journal of Scientific Research Engineering & Technology (IJSRET), ISSN 2278 – 0882 Volume 3, Issue 6, September 2014

[5] Abdulrahman M., Gwadabe T. R., Abdu F. J., Eleyan A., Gabor wavelet transform based facial expression recognition using PCA and LBP. In IEEE 22nd Signal Processing and Communications Applications Conference (SIU), 2265-2268, 2014.

[6] Uzammil Abdulrahman, Tajuddeen R. Gwadabe, Fahad J. Abdu, Alaa Eleyan Gabor Wavelet Transform Based Facial Expression Recognition Using PCA and LBP M IEEE 22nd Signal Processing and Communications Applications Conference (SIU 2014)

[7] FRANK Y. SHIH and CHAO-FA CHUANG PATRICK S. P. WANG PERFORMANCE COMPARISONS OF FACIAL EXPRESSION RECOGNITION IN JAFFE DATABASE International Journal of Pattern Recognition and Artificial Intelligence Vol. 22, No. 3 (2008) 445–459.

[8] S.F.Bahgat, S. Ghoniemy,M. Alotaibi, Proposed Multi-Modal Palm Veins-Face Biometric Authentication (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 4, No. 6, 2013