ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Recognition of State of Mind for Human Being Using Image Processing: A Survey

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Abstract
Image processing is emerging field for artificial intelligence world of application. In image processing there are many techniques to extract information from image. Then using this information new algorithm or method are developed for artificial intelligence. Here we proposed a method to recognise the state of mind of human in real time video streaming approach based on image processing technique.

State of mind recognition for human being using image processing technique is a new term for researcher. Many people already work on facial emotion recognition of human being using different algorithm and method of image processing.

But in this review we focus on the how can we use image processing techniques to find state of mind of human from video to make computer human interface more advance.

Human mind mostly reflect its emotion through his face. This will generate different pattern on facial part of human. We extract those feature from input image frame which is generated from video file to recognise the pattern of image. Then this pattern matched to the database(JAFFE database) for that we used SMOM(Spatially Maximum Occurrence Model)) And ESTM(Elastic Shape Texture Matching) algorithm.

Keywords
Adaboost classifier, Haar-Like feature, SMOM, ESTM, JAFFE, ASM, PCA, Hausdorff distance, facial emotion recognition.

Introduction
Today artificial intelligence is master key in different smart devices. With compare to other data processing techniques image processing technique is easy and simple to implement. Because it is low cost system to develop and we can easily update older system with new one, also debugging of such system is easy. Anyone can understand and develops such system in less time and effort. So that's why we are considering first choice for image processing techniques for state of mind detection.

To detect state of mind of human we can consider different face structure and speech. Because in two or many human communication include not only spoken language but also some facial structure and variation in sound of speech. But as we are decided to use image processing so that here we use face structure for analysis. As we known that state of mind of person will play important role in social interaction or in human computer interaction. So that detection of state of mind will be important task of research using image processing.

Gesture recognition is basic and initial research field. H. Gunes and M. Piccardi [1] explain how automatic emotion recognition using face and body gesture. In that they consider eye, lip region, eyebrow, wrinkle nostrils and chin for facial feature detection. For body gesture they consider hand pose, shoulder locating and tracking of body part. Then they used automatic classification tool Weka for this two gesture [1].

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Different techniques of image processing are used in facial image analysis. Some of those are neural network, 3D facial model, optical flow computation, principal component analysis, active appearance model, 2D DCT with neural network [5] etc. Using this method researcher develop different facial emotion recognition application.

For emotion recognition different database commonly used for research which are following

Different Database:

BU-3DFE, JAFFE, FACS, Cohn-Kanade, Yale, AR, Korean Expression, and Self-built.

Figure 1: JAFFE Database

Same database we can use for state of mind detection for reference.

In this paper we proposed a system which will work on real time platform. Using live video streaming input applied to this system so that it will work in real time platform.Here we proposed real time facial emotion recognition for state of mind detection using SMOM (Spatially Maximum Occurrence Model) and ESTM (Elastic Shape and Texture Matching) algorithm. For that we used webcam to take facial image of human along with JAFFE database and then this image applied to selected algorithm for detecting state of mind of human.

Related Work

Emotion recognition has been given more importance as a field of research in the last decade. Human facial image shows the vital information about state of mind & mood. Hence our aim is automatically recovers such information from facial image of human for better machine human communication.

Basically most of researcher classifies human's face emotion into seven categories such as Happiness, fear, neutral, sadness, anger, surprise and disgust. Reda Shbib and Shikun Zhou [2] used Active Shape Model (ASM) to facial analysis. Adaboost classifier and Haar-Like feature are used for detecting the face of image. After that geometric displacement helps to calculate facial emotion of image. They proposed a segmentation face candidate and then 68 feature points from each face extracted by using ASM method [2]. Image which is applied to the system its contrast, illumination, size like parameter will affect the accuracy, efficiency and robustness of the facial emotion recognition system so that's why pre-processing of the taken image done before starting the emotion recognition analysis.

Proposed Approach

Comparing all above techniques explain we can come to following conclusions. When we trying to develop a real time face emotion system which will later use in state of mind detection process in that main problem is to process image without its reference database. Irine and Pitas [3] method grid tracking is used to extract the face features.Which will have more accurate detection of emotion. But tracking of grid for each face is too time consuming and also if face pattern change it will affect the output.

In mostly emotion recognition system use Principal Component Analysis (PCA) algorithm for detection. But in that detection of action unit is not done properly so it has some limitation. Recognizing emotion from ensemble of features uses patch descriptors like histogram of oriented gradients, local binary patterns and scale invariant feature transform. It has two outcomes one is person specific and another is person independents. But by comparing both we can say that person dependent emotion recognition system has better performance.

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The basic flow of algorithm is as show in figure 1. As our aim is to do real time state of mind detection of human so input image is directly taken from webcam. So we take few second video as input then extracting the frames from that video. After that one the frame is selected for analysis.

Figure 2: Image processing flow for a single image.

Most real-time video processing and computer vision systems require a stream processing architecture, in which video frames from a continuous stream are processed one (or more) at a time. This is critical in systems with live video, or when the video data is so large that loading the entire set into the workspace is inefficient. Video and Image Processing Block set supports a stream processing architecture in MATLAB.

Video and Image Processing Block set contains video-specific algorithms, including motion analysis techniques such as optical flow, block matching, and template matching. From this video we take one particular frame for analysis.

Then this image compare with JAFFE database image set. JAFFE database [4] includes the 213 facial images of 10 Japanese females showing seven basic facial expression multiple times (happiness, Anger, Neutral, Sadness, Disgust, Fear and Surprise).

Human facial expression varies from person to person. But expression is calculated by movement or change in facial feature. Which shows that it is person-dependent and affected by different characteristics such as position, potion and shape of facial feature.

Our objective is real time facial emotion recognition for state of mind detection of human. So we take live streaming input from webcam and then this video converted into image frame using Matlab tools. But frame images is in RGB format we have to convert it into grey format because grey image simple to process as compare to RGB. Finally our input image for SMOM and ESTM algorithm is ready. Using this algorithm we detect the face and extract the corresponding facial feature of image. Then with reference to the database facial feature point algorithm select the particular emotion for that image. After completing all analysis input image is then store in database for future use so that accuracy of system get increases time to time.

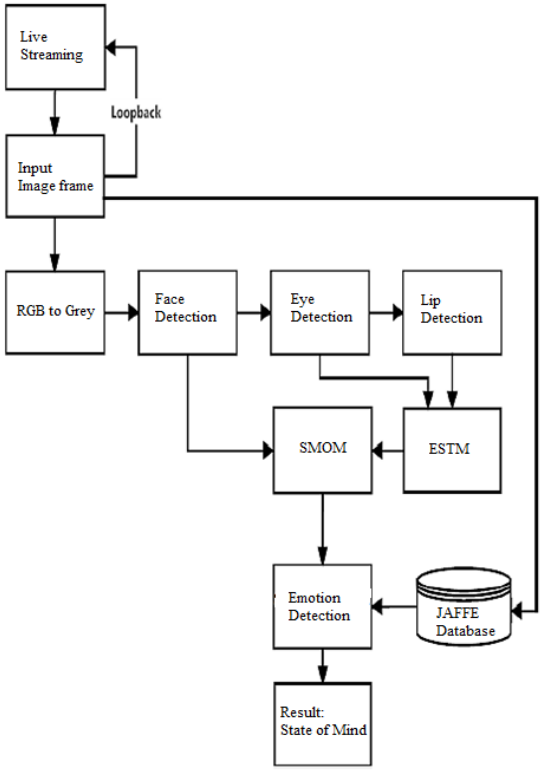

Figure 3: Overall Proposed System for State of mind detection

For facial feature extraction we used SMOM model, it is based on the probability of repetition of pixel values of each pixel location for all database image as shown in figure 3.

Consider that the number of database training images equal to N and the size of an image is M*H,

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Therefore, there are N possible values at every pixel position(x, y). Ranking these N intensity values we can obtain the histogram H (b) for the pixel position (x, y) as follows,

$H_{x,y}(b) = \sum \delta(f_k(x, y)-b) \ldots\ldots\ldots 1 \leq k<N$

Where,

$\delta(m)= 1$ if $m = 0$

$= 0$ if $m \neq 0$ for $0 \leq b < B$

Intensity value is f(x, y) and B is number of bins in histogram of image.

$H`_{x,y}(b) = H_{x,y}(b)*G(\sigma,b)$

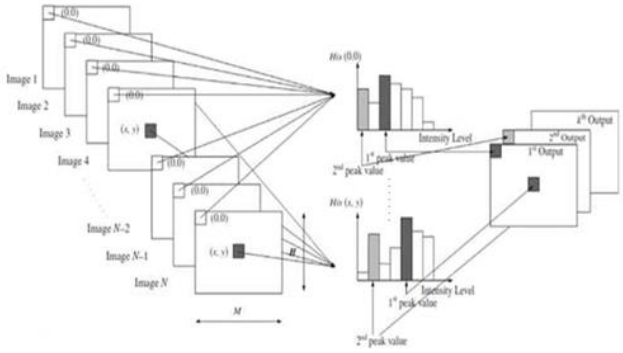

Figure 4. SMOM Construction

Gaussian filter is indicated by $G(\sigma,b)$ and $H_{x,y}(b)$ is histogram of pixel position (x, y). Then SMOM defined as follow,

$SMOM(x, y, k) = \{b1, b2, \ldots bk\}$ where $0 \leq bk< B$

for $0 \leq x <M$

for $0 \leq y < H$

ESTM algorithm used to measure the shape and texture information of image. In ESTM algorithm Edge map, Gabor map and Angle map of the input expression image consider. The edge map represents the shape information about the face image. The Gabor map characterises relative texture information and the angles of the edge points provides additional information about the shape.

Where edge map E(x, y) used for shape while texture is characterised by the Gabor Wavelet and the gradient direction of each pixel through Gabor map G(x, y) and the Angle map A(x, y).

To calculate Gabor map G(x, y), Angle map A(x, y) and Edge map E(x, y) corresponding shape texture Hausdorff distanceH(A, B) is as follow,

$H(A, B) = \max (hst(A,B),hst(B, A))$

Where,

A and B is two human face image and hst(A,B) is directed shape texture Hausdorff distance.

After construction of SMOM and ESTM, we find the difference between the facial expressions in a query input

$Dm(f(x, y), l) = \sum\sum q(u'). \left| f(x, y)- SMOMl (x, y, u') \right|$

Where $0 \leq x < (M – 1)$

$0 \leq y < (N – 1)$

SMOM is based on the statistical properties of the training image set at each position, while ESTM depend upon the shape texture relations within a neighbourhood in the spatial domain. Hence, they are complementary to each other. SMOM and ESTM algorithm extract the facial feature and then it will match this feature database feature set and show result as a respective state of mind of human

This system implemented on MATLAB R2010a version. To interface camera different image processing toolbox available in Matlab. Using this toolbox we can get real time video input for the system through webcam or external camera.

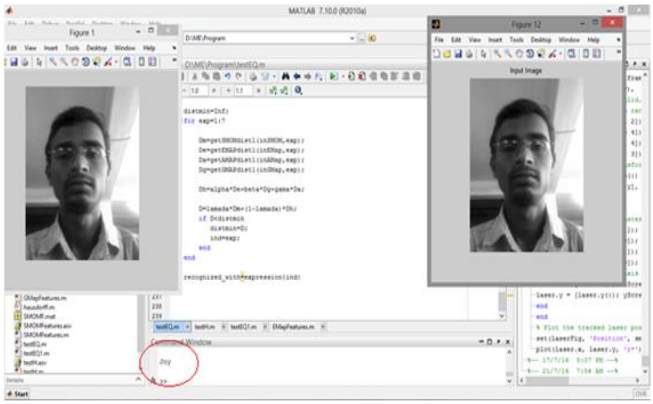

Figure 5: State of mind detection

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Conclusion

Today computer-human communication has a dynamic research area. In this paper we take detail survey of facial emotion recognition systems in that we compare different image processing techniques which may be used for emotion recognition. Here we present the method to detect the state of mind of human from video using SMOM and ESTM algorithm. As according to mood and feeling of human machine can easily understand human. For that we use facial expression of human. In this paper we take detail survey of facial emotion recognition systems inthat we compare different image processing techniques which may be used for emotion recognition. SMOM and ESTM used to recognised facial expression and from that we determine the state of mind of human weather he happy or sad etc.

Future work involves increasing the accuracy and ability of the constrained local model to detect facial feature points by modifying the training set, modifying the input resolution of the system, or reducing the number of features on the face to more easily defined ones. Also reducing the time require for image processing, feature extraction and emotion recognition.

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