**Emotion Detection System Analysis under Partial Occlusion: A Survey**

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***Abstract - Automatic machine-based Facial Expression Analysis (FEA) has made substantial progress in the past few decades. It has important applications in the fields of psychology, security, health, entertainment, human-computer interactions, etc. In humans emotions play an extremely important role for communication. They determine how we think, how we communicate, how we feel. The majority studies of FEA are occluded from general and tested system globally in controlled environment. Emotion detection systems works on various aspects like face, body language, voice, body type, skin colour, etc. Facial expression give some vital information of a human feelings. Understanding facial expression is a tough task to interpret interpersonal behaviours. For the ongoing and upcoming future technologies, facial expression recognition systems will play a crucial role in the development of human-computer-interactions(HCI). For the computation of emotions in machines, machines have to learn the emotions like humans and understand them. In this paper, we are reviewing the facial emotion detection systems and research carried out in this field from multiple sources available globally.***

***Keywords:*** facial emotion detection Analysis, emotion detection system, artificial neural network, deep learning, machine learning, artificial intelligence, image visualization, image processing.

***Introduction*: Detecting emotions has been a popular area of research in the recent times. Currently the research is carried on the basis of converting image data into machine readable format like tables, matrices, statistical approaches, image analysis, point to point analysis.**

**In the underlying reasoning, we humans cannot take full advantage of communicating abilities as the process is carried by the computers which is predefined and constrained by human examples. There are several methodologies that can be used to implement, specifically we have analysed the class specifier methodology and image fusion methodology in the study. The facial features and emotions are one of the major prospects through which humans interact and the study is carried on this bases likewise. Partial occlusions present on the face are real world obstacles for FEA. Vision of the face may be obstructed by sunglasses, hat, scarf, cosmetics, rubbing hands over mouth, tattoos or piercings, facial hair, etc. In the end, the HCI need to be improved and the benefit in this field of study should be carried is the main motive of this paper.**

**Technical Overview:**

The concepts of artificial intelligence, machine learning, deep learning, image processing, programming languages like python, matlab, etc. are used in this technology.

**Major aspects:**

**CNN(Convolutional Neural Network)**

**ANN(Artificial Neural Network)**

**Deep learning**

**Keras libraries**

**Machine learning**

**Python programming**

**OpenCV**

**Tensorflow**

**Pandas libraries**

**Numpy libraries**

**Matplotlib libraries**

**Automatic Facial expression methodology [1]:**

Most of the existing literature about face expression recognition systems decomposes the image processing of facial expressions into the following steps:

* Face localization on the image.
* Facial feature vector extraction and representation.
* Facial expression recognition.
* Emotion recognition.

Not all the systems follow these steps up to a point but they are the building blocks for these systems.

Fig. Processing pipeline flow of the system

Facial expression

Facial vector

Face localization

Emotion Recognition

**Face localization:** this task involves detecting every face in the frame, obtaining its position and delimiting its area in some ways. The methods involved are independent of the position, size, rotation angle, partial occlusions, and illumination of the face. There are also 3D approaches which obtain not only the tri-dimensional position of the face but also its orientation in the scene.

**Facial Feature Extraction:**

Facial feature extraction is usually the most difficult step in the emotion detection system, it is also the most demanding in some methodologies. It consists of obtaining some features of the facial expressions in vector form for computation. Usually the feature vector is a set of 2D or 3D points describing each detected facial feature. In the image based methods, local spatial analyses are applied to recognize the facial expressions. In the model based methods, statistical model is constructed from training images and the dataset is used to recognize the facial expressions.

Image based reognition:

Neural network:

* 3D
* 2D
* Still image
* Active appearance

Model based

Appearance based:

* Linear
* Non linear

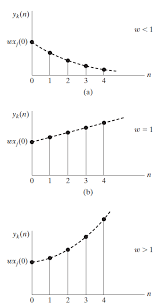
Parameters for still image:

* Active contours
* Blobs
* Colour
* Edges
* Gabor wavelet
* Local PCA
* Template

Parameters for active appearance:

* Local PCA
* 2D Discrete Cosine transform
* Optical Flow
* Image difference
* Grayscale
* Edges

Fig. parametrized linear graph representation of images.



**Active appearance method:**

Video based algorithms usually have high computational requirements, thus simplifications are required in almost every case. Holistic methods use the smallest image size and minimum number of color channels that maintain the recognition performance.

Main critics in this are:

* Opticalflow: this technique is computationally inensive, but it offers the greates quantity of information. The direction and intensity of motion at each face pixel in the image requires filtering between rigid facial movements and facial feature motion. It can be computed either locally or spatially. For computational power limitations, it is usually done locally.
* Kalman filter: use as point tracking algorithm, reported good results, but it has problems to deal with rapid motion, and requires that the tracked points are easily differentitated from the other points.