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Estimating Audience Engagement for Prediction: A Survey

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Abstract— While watching movies, an audience may express both nice and vulgar gestures (emotion) like; smiles, head-pose change, fidgeting, stretching which convey sentiment in form of engaged or disengaged during feature-length movies. Observing these behaviours using computer vision systems is a very challenging task— especially in a movie theatre environment. The movie theatre environment is dark and contains views of an audience at different scales and viewpoints. Finally, annotating audience sentiment at the frame-level is probably time-consuming task. To bypass these issues, this survey paper represents the various techniques used in facial expression detection from crowd-sourced for ratings and demonstrates its sentiment predictive capability.

Keywords—Audience, Behaviour, Engagement, Movie, Facial Expression Detection, HCI.

I. INTRODUCTION

Now a day, many improvements and research work have been adept in the areas like face aspects, face tracing and in facial expression detection fields. The facial expressions are monitoredfor recognizing the basic human emotions like fear, anger, sadness, happiness, surprise and disgust and etc. Measuring audience sentiment i.e. engaged or disengaged for long continuous timeseries like movies is very essential for writers, directors, marketers and advertisers.

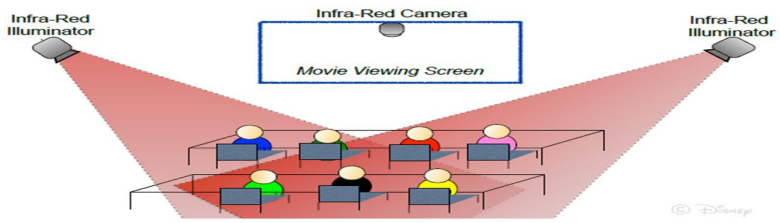

Figure: - A schematic of the audience test bed [1].

Observing an audience in a movie theatre using computer vision is challenging task. As the environment of movie theatre is dark, and light splash from the screen causes drastic difference in illumination surrounding. Moreover, the physical composition makes it problematic to observe facial expressions of all audience in movie theatre environment.To overcome these issues, a novel perceptualframeworkfor facial expression recognition is presented in this survey paper to achieve better accuracy. There are two categories of methods for face expression recognition:-

A. 1-Dimensional Representation

In 1-dimensional representation there are some methods like Linear Discriminant Analysis, Independent Component Analysisand etc. These techniques are the majorpart in the facial expression detection system.

B. 2-Dimensional (2D) Representation

In 2-Dimensional (2D) representation there are different methods like, Principal Component Analysis (PCA), Global Eigen Method, Sub pattern extended, Gabor Filer, and Local Gabor Binary Pattern technique. These techniques has significantly improved facial expression recognition rate as compared to 1-Dimensional representation.

II. LITERATURE SURVEY

Principal Component Analysis (PCA) is also known as the Eigenface approach is one of the key methods for facial expression recognition [2]. The extraordinary role of PCA is to minimize the dimensionality for efficient face indexing and retrieval [3]. PCA also uses linear projection, which makes the best use of maximizing the projected sample.

In PCA, feature extraction is done based on 1D vector the image matrix needs to be converted into a route. 2DPCA uses 2D matrix instead of the 1D route [4]. The detection proportion of 2DPCA is higher than PCA. But the disadvantage is the storage required for 2DPCA is higher than PCA as the 2DPCA needs the number of coefficients for image representation.

Conventional facial expression recognition techniques like principal component analysis (PCA), linear discriminant analysis etc uses statistics in appearance images. The Color information in face images uses by Global Eigen Approach [7]. RGB Color space does not provide any enhancement in recognition rate.

Both Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA) generate spatially global emotional routes. But for main facial expression detection spatially restricted feature routes is required. Therefore ICA generates vectors that arestatistically independent [3]. But ICA is computationally wealthy than PCA.

The recognition proportion of PCA is low and has small model scope problem. On behalf of gray facial expression detection, 2DPCA is extended to Extended 2DPCA. The drawback of this method is that it is not suitable for hue images. Consequently Sub pattern extended 2-Dimensional PCA (SpE2DPCA) is introduced for Color face recognition [8].PCA has the problem in PCA of small sample size is also excluded.This method has the higher recognition rate than E2DPCA, 2DPCA.

Under severe differences in facial expression and enlightenment Fisher's Linear Discriminant (FLD) is extraappropriate. FLD decreases the smattering of predictable sample since it is a class specific method [6]. Error rate is reduced when compared to PCA.

The 1-DLinear Discriminant Analysis AND 2-DLinear Discriminant Analysis are extended in Color space to improve the face recognition accuracy. A 3-D Color tensor is generated using Color Linear Discriminant Analysis (LDA) subspace [11]. The horizontal unfolding used in this method increases the rate of recognition for 2-DLDA whereas vertical unfolding improves on the recognition proportion for 2-D Principal Component Analysis (PCA).

Facial expression recognition needs different attributessuch as expressions, pose, and lighting, to be taken care of. But theconventional PCA addresses only difference in single factor.Multilinear image analysis is used multilinear algebra [10]. Inthis, the thought of "Tensor faces" is functional, which isolatesthe several features used in the making and representation of an image. Multi linear image analysis does not incorporate the Color information. Multi linear Image Analysis method provides recognition rate higher than the PCA approach.

Appearance based features are being used for face recognition since it encodes specific details about human faces. The facial image is separated into sub blocks and its similarities in the sub blocks is acquired [14]. LBP is obtained from Gabor filters for feature vector generation in Local Gabor Binary Pattern (LGBP) method [15]. All techniques have enhanced the performance of the facial expression recognition system. The Color spaces like RGB do not provide provision for head pose and lighting variations. A significant benefit of Local Gabor Binary Pattern (LGBP) is its illumination tolerance. Local Gabor Binary Pattern (LGBP) achieves better performance than Gabor filter technique

The Gabor filtering is considered as one of the most vital feature extraction system in facial expression recognition [12]. The basic limitation of Gabor filter is its bandwidth limitation i.e. Supreme bandwidth is limited to one octave. Gabor filters cost high and low frequency information since it is band pass in nature[15]. Gabor filter bank performs better in terms of recognition rate than the other approaches like principal component analysis, linear discriminant analysis etc.

III. EXTRACTING AUDIENCE FEATURES

Commonly humans rely on different facial actions like head pose, elementary brow raise, eye closure, and upper lip raise to make analysis of engagement [1]. In the audience domains, visualizing components such as visibility of face, used to observe that is audience member is looking at the screen, large body motions, smiling, yawning and sleeping may be indicative of engagement levels.Here, we try visualizing the features of body motion and facingexpression[7].

A. Body Motion:

Body attributes consist of stretching or fidgeting. The final sentiment score is estimated using face only, body only and a combination of face and body features.We calculate the motion magnitudes for each audience member and normalized and scaled according to the image window size. The screening room environment introduced a natural body motion of audience members so each person could watch the movie unclouded and in comfort.

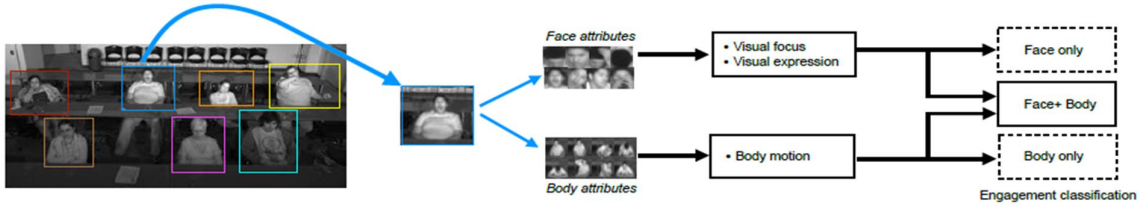

Figure: -The proposed engagement pipeline consists of capturing both face emotion (attributes) and body motions [1].

B. Face Attributes:

Faces provide useful information such as gaze angle like “is the person looking at the screen” and expression like smiling, yawning and sleeping and etc. These multiple attributes are strong reason for estimating engagement level i.e. the person is engaged or disengaged with the movie[4].

1) *Face Detection:* Face tracking is a key area of research; most of theprevious work has only looked for face recognition system.The perceptive method of monitoring audience member would be to use an off-the-shelf face-detector to track detection each frame.[5] To detect the face learnsapproach like Histogram of Oriented Gradients (HOG) [9] template on training images using support vector machines (SVM) which enables training on all the other sub-windows in every training image.
2) *Gaze Angle:* Head pose of an audience member like lookingaway from the screen and looking down, while watching themovie provides useful information since the head pose usuallyindicates the focus of attention [1].To estimate the head pose based on two approaches first is appearance-based and second is model-based approaches.Initiallyappearance-based approaches are quite efficient in terms of computation time, but do not estimate all rotation angles such as roll, pitch and yaw.

IV. ESTIMATING AUDIENCE ENGAGEMENT

The visual appearance of an audience may give an indication of how they are engaged or disengaged during various session of the movie.

A. Engaged

The audience member’s main focus is on the screen. Visual factors of facial expressions like smiles/laughter can be identified askey attributes. Additionally, audience members that look relaxed and have no expression can still be highly engaged.

Figure: - Sample of audience behavior for Engaged [1].

B. Disengaged

The audience member’s focus is not on the movie screen. Visual components like: looking away from the screen, looking at his/her phone or a watch, eating or drinking, sleeping, large-body motions/doodling, yawning can be identified as disengaged attributes.

Figure: - Sample of audience behavior for Disengaged [1].

V. PREDICTING MOVIE RATINGS

Finally, inspect the effect of engagement analysis framework to the assignment of movie prediction. The benchmark of how much the general public likes a particular movie, has an interactive feature that allows people to submit a rating.[1] The numbers of ratings aggregate are based on the rating of crowd-source; they generate an average audience measure. A movie with an average audience measures of 60% or higher a good movie and below 60%denotes a bad movie.

VI. CONCLUSIONS

This Survey paper presents the facial expression recognition process, and its various constraints. Also in this paper, an attempt is made to present various approaches for facial expression recognition. The techniques PCA, ICA, LDA, FLD, LBP ,Multilinear Image Analysis and many more are described. This method is measured on the basis of recognition rate in which

higher the recognition rate, provides better performance like the tensor perceptual Color framework has the highest recognition rate and has highest performance.

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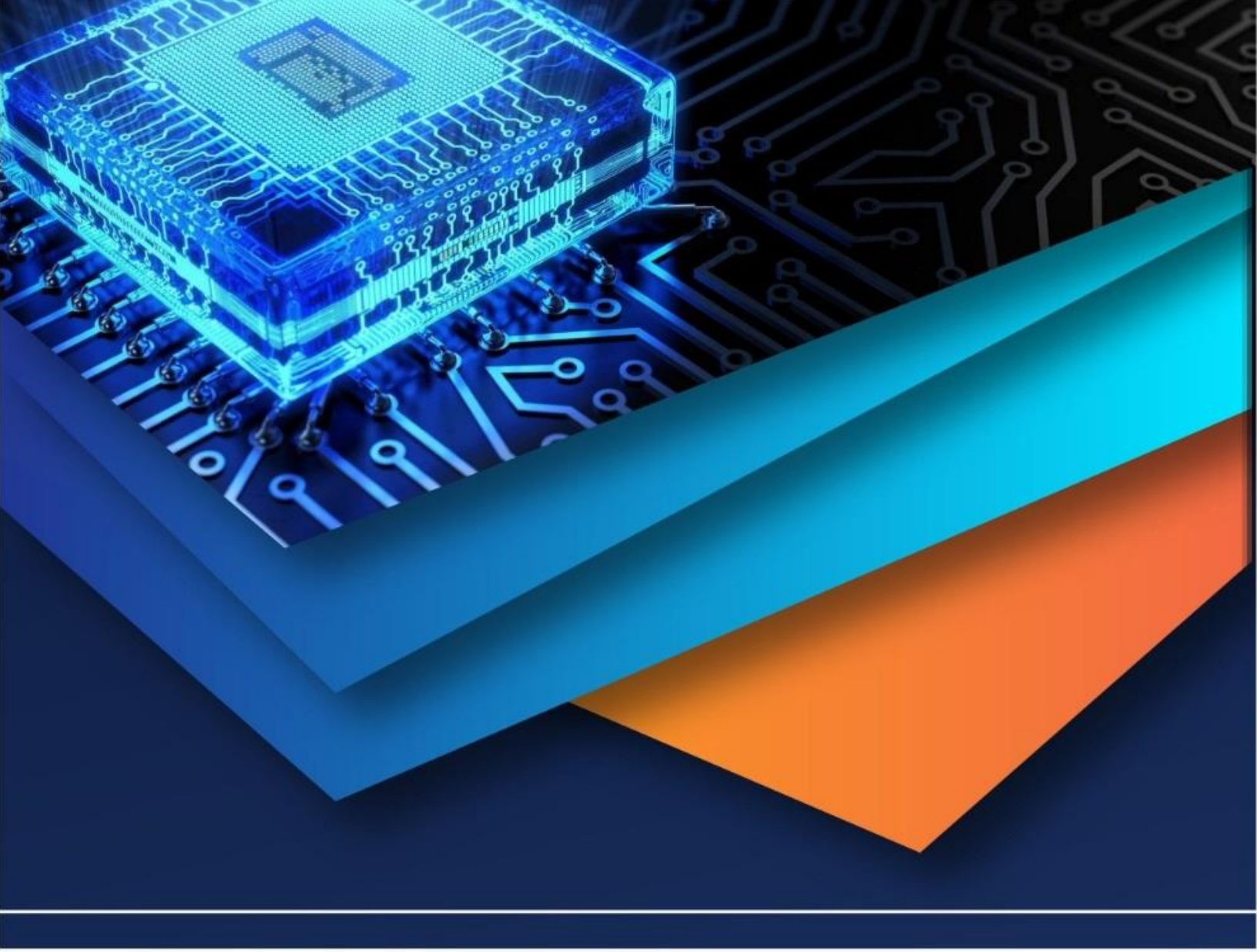

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