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A System for Serving Disability using Facial Expression Recognition

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Abstract: ***In human-human communication the face conveys a lot of information. Analyzing faces in human-computer communication is also becoming progressively important in providing security to the users. In existing system the facial expressions are examined and compared with the face images stored in the database. In proposed system TPCF (Tensor Perceptual Color Framework) is used for skin tone color detection and detected color are converted to gray scale value which is used for classifying skin or non-skin. Based on the skin or non-skin detection, the features are extracted and the emotions are calculated which are used for initiating the assigned task. The proposed system identifies the melancholic, smiling, angry emotions, when melancholic emotions are detected alert messages are sent to the attendees and when smiling emotions are detected, the system responds by playing songs etc.***

Keywords: TPCF, facial expression, disability, melancholic**.**

1. Introduction

Facial expressions play an essential role in human communication. In face-to-face human communication only 7% of the communicative message is due to verbal language, 38% is due to paralanguage, while 55% of it is transferred by facial expressions. Human face analysis plays an important role for the development of social robots. Such scenarios arise when humans and robots are working on some common task. A widely accepted prediction is that computing will move to the background, weaving itself into the fabric of our everyday living and jutting the human user into the foreground. To realize this goal, next generation computing will need to develop human-centered user interfaces that respond readily to naturally occurring human communication. These interfaces will need the capacity to observe and understand objectives and emotions as communicated by signals.

Facial expression is a visible sign of the affective state, intellectual activity, intention, personality of a person; it plays a communicative role in personal relations. Facial expressions, and other motions, convey non-verbal communication indications in face-to-face interactions. These indications may also complement speech by helping the listener to stimulate the intended meaning of spoken words. Automatic facial expression recognition is an active research area with uses in human-computer interfaces and human emotion analysis. It is now moving away from keyboard-given instructions to more natural modes of interaction, using visual, audio and sensorial means. This is the first step in achieving a human-like communication between man and machine. Human communication has two main aspects: verbal (auditory) and non-verbal (visual). Words are the atomic information units of the verbal communication. Occurrences like facial expressions, body movements and physiological reactions are the atomic units of the non-verbal communication. Although it is quite clear that non-verbal gestures are not necessary for successful human interaction (e.g. phone calls), considerable research in social psychology has shown that non-verbal gestures can be used to synchronize dialogue, to signal comprehension or disagreement, to make dialogue smoother and with fewer interruptions . This finding itself suggests that multi-media man-machine communication systems could promote more well-organized performance. At the moment there are several systems available for automatic speech recognition. On the other hand, a complete and accurate system for vision-based facial gesture analysis has not been developed yet.

Some emotions inspire human actions and others enrich the meaning of human communications. Therefore, understanding the users’ emotions is a fundamental requirement of human-computer interaction systems (HCI). Facial expressions are important means of distinguishing several emotions.

2. EXISTING SYSTEM

In Existing system the unique features from the face image are identified extracted and compared. The purpose of the project is to compare the face image of a person with the existing face images that are already stored in the database. The existing system takes any input even if the provided image is non-human. A dictionary- based approach is used for facial expression analysis by decomposing expressions in terms of AU's. An AU-dictionary is constructed using domain experts' knowledge. For expression decomposition, structure-preserving sparse coding is performed by imposing two layers of grouping. The computed sparse code matrix for each expressive face is used for carrying out expression decomposition and recognition. A structure-preserving dictionary learning algorithm is used to learn a structured dictionary as well as divide expressive faces into several semantic regions.

3. PROBLEM DEFINITION

In Existing system the classification systems are designed to output one emotion label per input utterance which may perform poorly if the expressions cannot be captured well by a single emotional label. It involves Multiple Algorithms for finding the Human-emotion. It also requires huge database for storing the images. The stored images are compared with the input image to determine the emotion which may not be accurate in some case. The system also can not detect non-human images. Since the images are compared with the stored images the emotions detected may not be accurate.

4. PROPOSED SCHEME

In proposed scheme, a novel tensor perceptual color framework (TPCF) for Facial Expression Recognition based on information contained in color facial images is used. As in Fig1 the input images are examined for human or non-human by using skin tone detection. The image-based FER systems consist of several components like Face Detection and Normalization, Feature Extraction, Feature Selection and Classification.

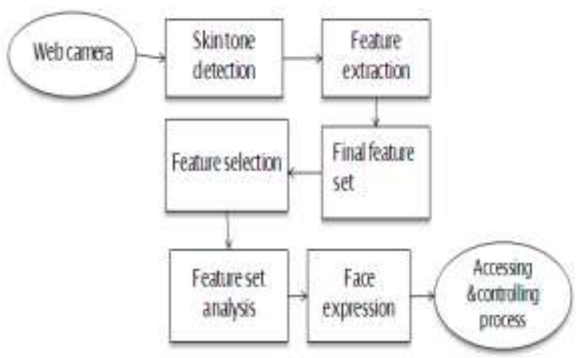


Figure 1: Proposed system architecture

5. WORKING OF PROPOSED SYSTEM

5.1 Skin colour detection

When an image has been captured by camera, it is further pre-processed using skin tone detection. A skin detector converts a given pixel into an appropriate color space and then uses a skin classifier to label the pixel as a skin or a non-skin pixel. A skin classifier describes a decision boundary of the skin color class in the color space. A major challenge in skin detection is that many objects in the real world might have skin-tone color. This causes the skin detector to have much false detection in the background. RGB color space has been used for classifying a pixel and to eliminate illumination conditions to the best extent.

5.2 Feature extraction

In this module, Weber's local descriptor (WLD) act as a texture descriptor which plays an important role as it exploits textural nature of the human face via human visual system (HVS) as well as relationship between component features(eyes, nose and mouth) to detect and recognize faces. This descriptor represents the image as a histogram of differential excitation and gradient orientations and has several interesting properties like robustness to noise and illumination changes, powerful image representation etc. Finally, facial features become darker and used for feature extraction analysis. The end result of extraction task is a set of features.

In Fig 2, represents the feature vector representation which constitutes a depiction of the image and it further classifies as transient (wrinkles, cheeks and nose) and intransient features (eyes, mouth, eyebrows) to reduce the dimension of the feature space as well as computational complexity.

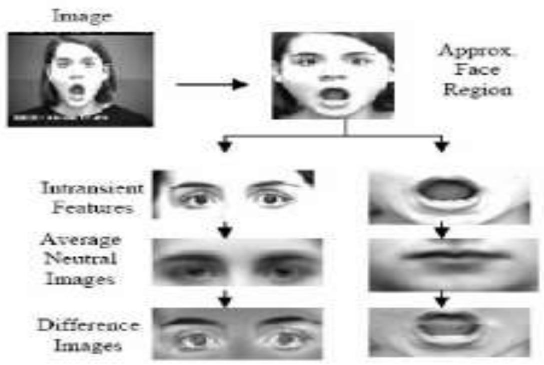


Figure 2: Feature extraction

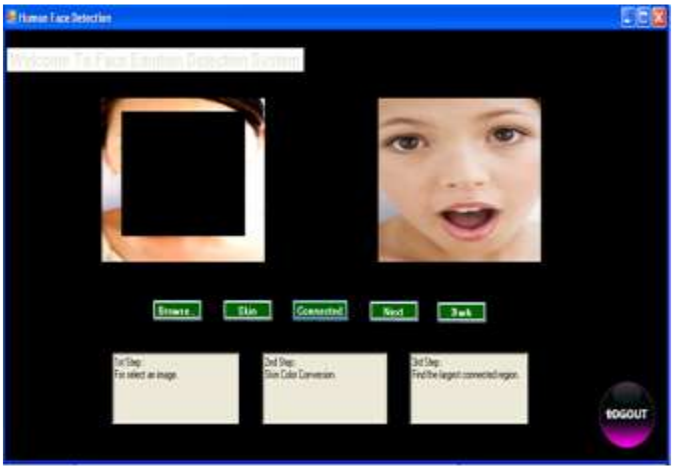


Figure 3: Facial feature extraction

5.3 Feature selection

After feature extraction, Fig 3 helps to reduce the feature space which improves prediction accuracy and minimizes the computation time. This is achieved by removing irrelevant, redundant and noisy features i.e. it selects a subset of available features by eliminating unnecessary features therefore it considers only intransient features. Feature selection can be done based on fuzzy c means clustering which is frequently used in pattern recognition. Once feature selection is analysed information gain on a per emotion class basis is used (e.g., the features for the class of anger differed from those of happiness). Information gain describes the difference between the entropy of the labels in the dataset (e.g., "happy") and entropy of the labels when the behaviour of one of the features is known (e.g., "happy" given that the distance between the mouth corner and nose is known). This feature selection method permit as ranking of the features by the amount of emotion class related randomness. The top features were selected for the final emotion-specific feature sets.

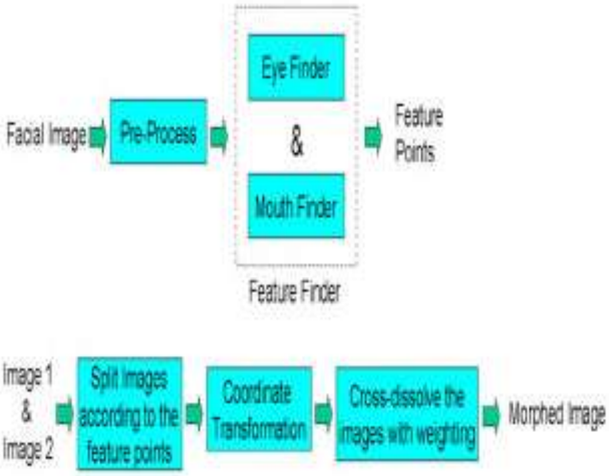


Figure 4: Feature Selection

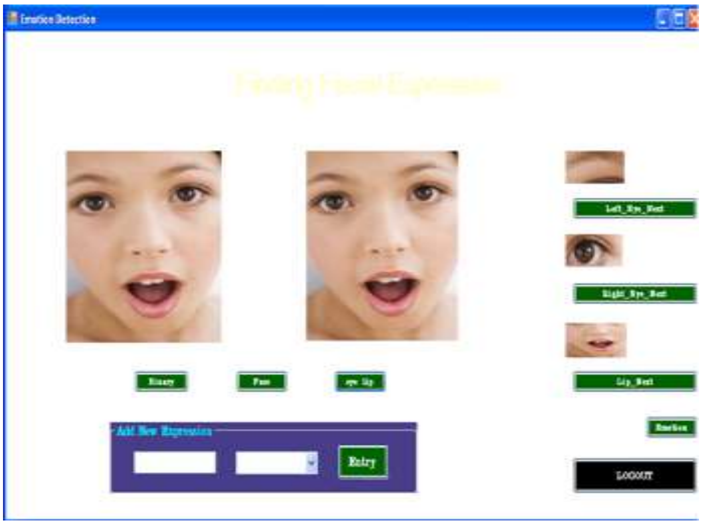


Figure 5: Facial Feature Selection

5.4 Feature filtering

In this module facial features can be filtered out using edge detection technique. Edge detecting an image considerably reduces the amount of data and filters out useless information thereby preserving the important structural properties in an image. There are enormously large numbers of edge operators available each designed to be sensitive to certain types of edges variables involved in the selection of edge detection operator include edge orientation, noise environment and edge structure. According to an edge detection variable, a capable edge detection algorithm "**sobel operator"** is chosen for its minimalism and processing. The result of the sobel operator is either gradient vector or norm of its vector and convolving the image with a small, separable and integer valued filter in horizontal and vertical direction and relatively inexpensive in terms of computation.

Pseudo-codes for Sobel edge detection method

Input: A Sample Image
Output: Detected Edges
Step 1: Accept the input image
Step 2: Apply mask Gx, Gy to the input image
Step 3: Apply Sobel edge detection algorithm and the gradient
Step 4: Masks manipulation of Gx, Gy separately on the input image
Step 5: Results combined to find the absolute magnitude of the gradient as in (1)

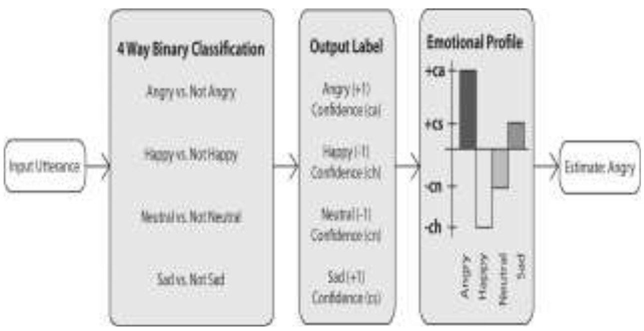
$$|G| = \sqrt{Gx^2 + Gy^2} \quad (1)$$

Step 6: the absolute magnitude is the output edges.

Figure 6: Feature Filtering

5.4.1 Final Feature Set

The number of features was determined empirically, optimizing for accuracy. The final feature set included the top 85 features for each emotion class. The feature sets for anger and sadness are primarily composed of MFB. The feature sets of happiness and neutrality are composed primarily of a mixture of cheek and mouth features. The high representation of audio features in the angry and sad feature sets and the low representation in the happy and neutral feature sets reinforce previous findings that anger and sadness are well captured using audio data while happiness is poorly captured using audio data alone .



6. CONCLUSION

A novel TPCF was proposed for FER system in perceptual colour space. Based on TPCF, the RGB colour images were first transformed to perceptual colour spaces after which the horizontal unfolded tensor was adopted to generate the 2-D tensor for feature extraction. The 2-D tensor was normalized before the features were extracted and the optimum features were selected based on MIQ algorithm. The images under slight illumination variation were used to test robustness of the FER system performance. Experimental results show that the colour components provide additional information to achieve improved and robust performance of the system in terms of recognition rate for all expressions. Furthermore, the TPCF in perceptual colour space has more desirable average recognition rate for facial images under varying illumination situations. In addition, the performance of the TPCF has marked advantages in FER for low-resolution facial images in terms of recognition rate and error rate. To the best of author's knowledge, the achieved average recognition accuracy of the TPCF for FER system is better than any other reported in the literature so far using the BU-3DFE database and the Oulu-CASIA NIR&VIS database.

7. FUTURE ENHANCEMENT

As a extraction are down by taking images form a web cam instead of that we can simply give an expression in front of camera either in normal or mobile cam it should perform some events for that expression. Sudden occurrence of action will be done in future.

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