COMPUTER VISION APPROACH FOR FACE DETECTION

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Abstract— **Computer vision offers many new potential for making machines attentive and responsive to man. In this paper a computer vision approach for multimodal human computer interaction has been developed. As shown in the diagram to previous paper computer vision takes into account modalities. We have taken into account more than one modality --- audio and video. In this paper we are giving an overview of the techniques used in various papers and work done by different researchers in this field over the last few years. It has been divided into three parts. First is the review on papers of Audio visual speech recognition system, second is the discussion on various techniques used in visual front end that is face and lastly we have dealt with the audio part.**

I. INTRODUCTION

An audio-visual recognition system uses the video modality to assist the conventional audio modality to improve the performance of the Automatic Speech Recognition Systems. Visual information is an essential constituent of speech recognition in humans. For example a person in a noisy environment like a mall or a road is able to make out correctly what information the other person is trying to communicate based on the lip movements, which provides additional information to the impaired audio information. These two data together works well especially if the background noise is present in the environment. The visual features provide robust information that is not corrupted by the ambient acoustic noise. Vision of the face is an important feature of human-to-human communication. Computer vision makes it possible to track and recognize faces, detect speech of the person, estimate focus of attention and recognize emotions through facial expressions.

II. BACKGROUND

Face detection is an integral part of the audio-visual speech recognition. Correct detection of the face forms the basis for visual part of the system. Various authors have used various techniques and algorithms for the correct detection of face.

Saurabh Chaudhary, Indrani Pal (2010), developed a new approach to deal with the problem of image segmentation. The algorithm has been implemented on MATLAB. They take an image and call an edge detection function. Then image is converted to HSV and threshold values are determined and applied. Further the image is segmented. After this the edge detection and segmented image is combined. Further, dilation and filling of the edges of the image is done. Then noise is removed from the image and final segmented image is

obtained. This is better than the in-built MATLAB edge detection function [3].

Jiang Youyi, Li Xiao (2010), gave a face recognition algorithm based on wavelet neutral network (WNN). WNN is a feed forward network and combines the wavelet theory and artificial neutral network. The face algorithm exploits the features of both wavelet theory and artificial neutral network. It takes the multi-resolution property of wavelet and the robustness and memorization features of neural network. To speed up the convergence rate of WNN it combines step adjustment algorithm with the wavelet neural network. Experiments conducted showed the effectiveness and accuracy of the algorithm by some experiments [4].

Anima Majumder, L. Behera and Venkatesh K. Subramanian (2011), presented different methods for fully automatic detection of facial features. Viola and Jones' Boosting algorithm and a set of Haarlike cascade is used to detect face. For the detection of eye Haar-like features cascade is used which locates the rectangular regions containing eyes. Then, the corners of the eyes are detected. By using haar-like cascaded features and AdaBoost classification algorithm nose id is detected and then from the nose region of interest, nostrils are detected. For detection of mouth an approach based on the facial geometry along with eye center and nose detected earlier is used. For detection of the lip they made use of Shi-Tomasi's corner detection method. Experiments were conducted on neutral and smiling faces and it gave good results [5].

Padma Polash Paul, Md. Maruf Monwar, Marina Gavrilova (2011), developed an automatic face detector from video sequences. For detection of human skin regions they proposed skin color recursive clustering method. They have used K-means algorithm in this skin model. For detection of face from this skin region they used height width proportion and the neutral network based template matching scheme. For face recognition, first features are attracted from the detected face by using Multilinear Principal Component Analysis (MPCA) and then these features are used to recognize face of a given person. Face is effectively recognized through this method [6].

Khalid Mohamad Alajel, Wei Xiang and John Leis (2011), proposed a new face detection approach which is capable of detecting human faces from complex backgrounds. For finding the skin color pixels the author uses YCbcr method. They constructed a skin color filter. Enhancement process is applied for getting the skin color pixels. Sobel edge detector method is applied for getting the edges and then to see if it is a face or not, Modified Hausdorff distance is used for comparing the

face template with the image. The performance of this face detection system is satisfactory [7].

Zulkifli Musa, Kasmiran Jumari and Nasharuddin Zainal (2012), gave a hybrid method for detecting human skin region. It uses background subtraction and skin color model for getting the skin pixels. The authors choose the background subtraction technique using mixture of Gaussian (MoG) to separate the foreground from background. Next, the authors used skin color method to detect human skin region in the object detected. For this they used YIQ color space. To get the binary image, threshold value is applied on the I channel of the YOQ space. Skin region is shown with black pixel region and non-skin region is shown with white pixel region in the binary image. Finally, to determine the skin region, skin masked is applied to original image. The results show that the authors' objective to develop a simple algorithm, lower cost and high detection rate was achieved [8].

Devendra Singh Raghuvanshi, Dheeraj Agrawal (2012),developed an algorithm using four color spaces. They used a combination of RGB, YCbCr, CEILAB (L*a*b) and HSV color models for skin color segmentation. Certain thresholds were applied on these color models to give skin like pixels. Non-skin pixels were removed. The obtained skin regions were tested for human face features based on knowledge of geometrical properties of human face to see if it contained face or not. Experiments are conducted by authors and it gave satisfactory results [9].

III. MULTIMODALITY/MULTIMODAL INTERACTION:

Multimodal human computer interaction is an emerging technology in HCI. Multimodal interaction aims to enable a computer to understand a user's input made through his/her speech and gestures. Allowing a user to interact with a computer in the similar way to human to human communication is the man aim of HCI researchers.[1]

When we interact with each other in our daily lives, we use multimodalities such as speech, vision, facial expressions etc. this helps us to communicate naturally and follow conversation easily. Communication between humans is always natural and easy but communication among humans and machines has always been a difficult and complex matter. This is attributed to the internal design of the computers which is very complicated. This has in turn forced the designers to make users adapt to machine's way of functioning instead of machine adapting to human[2].

There are various ways through which humans can communicate with a computer. With more emphasis being laid on human senses various interaction/interface using face, hand, gaze, body gestures, speech, handwriting etc are being used.

Here modality means mode of communication according to human senses or type of computer input devices. Different human senses are hearing, vision, tastes etc. Different computer input devices can be mapped to human senses e.g. keyboard, writing tablet etc. A system that uses any combination of modalities in the categories above is multimodal. In our case, however, interest is exclusively on systems that include vision as modality.

IV. COMPUTER VISION

Advanced human computer interaction systems depend largely on computer vision. Vision is the primary sense through which people perceive the world. The importance of visual information during our interactions with people is well known. Vision plays a key role not only in our interaction with humans but also in interaction with machines. In Computer vision any human action like pointing fingers, eye gazing, lip movement etc can be used as a computer input devices. The main aim of our computer vision is to imitate the effect of human vision by electronically perceiving and accepting an image. Different disciplines like AI, mathematics, computer science, electronics, psycho-physiology, pattern recognition and other scientific disciplines are used by computer vision techniques.

Vision is really important and helpful in multimodal human computer interaction. Vision helps in detecting face from any background. Also, through vision, tracking localization of lip, eye movement and eyebrow.

Flapping is possible. Further, vision also helps in speech recognition. The vision part helps in accurate and effective speech recognition. Through computer vision we can track and recognize faces, facial expressions, lip motion and emotions of a person. During the past few decades many researchers have workd in to develop and find out new methods and techniques for computer vision for face detection. But still there is no 100% accurate face detection and recognition system exist.

V. COMPUTER VISION APPROACH FOR FACE DETECTION:

Multimodal interaction is easier for people to use because interface is more natural, but unimodal HCI is easy to implement.
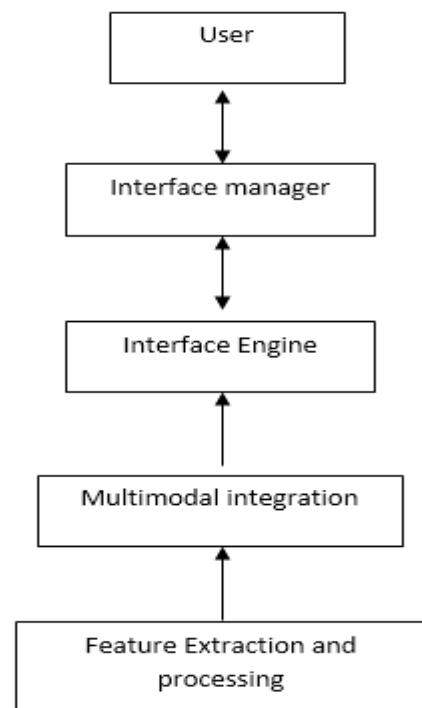
Proposed face detection Algorithm.

Step1:   Input image.

Step 2:   Apply K-means Algorithm for segmentation of skin

Step 3:   Conversion of image to binary image.

Step 4:   Apply morphological operations on created binary image.

Step 5:   Convert the number of regions in the image.

Step 6 :   Do this for each of the region.

Step 7:   Find the no. of holes in each region

Step 8:   If holes >=1 then region can be face, so move to next step else reject the region   and move to step:6 for checking the next region.

Step 9:   Check eccentricity of the region.

If eccentricity is within the range then accept else reject and go to step 6 for Checking the next region.

Step 10:   Calculate height and width for the region.

Step 11:   If height and width ratio is within the range then the region is accepted as a face   else it is rejected and go to step :6

Step 12:   Draw circle around the detected face.

Step 13:   Stop   once all the regions have been processed.

VI. APPLICATIONS

The computer vision approach described above can be of great use in different applications. It can provide a better, natural, easy, efficient and reliable system for human use. Some of the applications where this approach can be used are described below:

1. Person identification
2. Hospitals
3. Lie detector
4. Computer usage for disabled persons.
5. Emotional recognition
6. Defence
7. Home appliances
8. Robot Control

VII. CONCLUSION

Vision of the face is an important aspect of human-to-human communication. Computer vision makes it possible to track and reconnize faces, detect speech acts, track and read the other modalities. A novel method for detection of face has been developed. Generally detection of the face from background and other skin region is a difficult job a new algorithm for face detection has been proposed. The algorithm works wall for the images taken.

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