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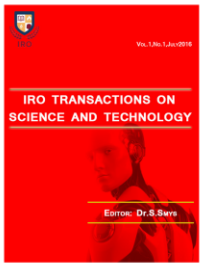

Contact Center feature for Disabled Customers using Customer Entered Gesture

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Abstract—This paper presents Sign language analysis which enables disabled customers in a contact center for conversation over a telephone network through a video call. The Customers Sign language recognition Script consisted of eight processes such as image acquisition, skin color information, background removal, canny edge detection, PCA features extraction, classification of images using support vector machine classifier, training and testing which will run automatically in Customer Voice Portal through a Combo gateway. I have successfully recognized fifteen different hand gestures which includes both single handed gestures and double handed gestures with a detection accuracy of 94.5 %.

Keywords— Contact Center,Sign language recognition;SVM, hand gesture recognition; canny edge detection

1. INTRODUCTION

As population becomes older, it becomes more important for companies to give best services to their customers. Among people of over age sixty 54% are deaf or partially blind. Hand gesture is a nonverbal way of communication. Today hand gesture has been widely used for human-robot interaction and sign language recognition [1, 3]. Gesture recognition is also implemented using artificial neural network [4]. Image Processing has tremendous areas of application such as watermarking, discrete waveform transform [8] etc. In our implemented system, hand gesture is recognized using eight processes such as image acquisition, skin color information extraction for recognizing the hand gesture which is obtained from the arm region of the hand, background removal, canny edge detection, PCA feature extraction, classification of images using support vector machine classifier, training and testing..

This system is used for the disabled people to have a conversation in a contact centre with the agents. The sixteen different hand gestures has been successfully recognized and it can be used for sign language recognition. The system will recognize the hand gesture and the text and speech associated with that gesture is received, Also I are in the process of implementing the complete system using System-C and HDL on FPGA based hardware as implemented in [5-7]

The main contribution of the paper is to achieve a good accuracy of different hand gestures using eight processes such as image acquisition, skin color information extraction, background removal, canny edge detection, PCA features extraction, classification of images using support vector machine classifier, training and testing and to use the system for the security purposes by giving every different hand gesture a special message which can be decoded in the form of text and voice and can be agents of contact center. I have

successfully recognized fifteen different hand gestures which includes both single handed gestures and double handed gestures with a mean detection accuracy of 94.5 %.

The implemented sign language recognition system has an accuracy of 94.5% which is better as compared with the existing results from Yang Quan [1].

The Skin color information is extracted from the hand Gesture region, the Color image is converted to binary image, the background is separated from the area of interest using skin color detection technique, Unwanted area is removed by using filtration method, Canny edge detection is applied to the filtered image to separate the hand gesture from the image, PCA features of sixteen different hand gestures with 100 samples has been extracted .100 different samples with 16 different hand gestures has been trained using SVM classifier
Testing of 20 images has been done with an accuracy of 94.5%

2. SIGN LANGUAGE RECOGNITION IN CONTACT CENTER

It is obvious that contact center agents assumes that the callers can see and callers can hear what they are speaking. But for the disabled customers ,this is not the case; Blind people finds it difficult to give the (CID)caller entered digit and the deaf people finds it difficult to hear the IVR and while talking to the agent as they cannot hear. So for these problems this system will work. At the time of availing these services, the disabled customers have to register their mobile number at the contact center to avail these special services. There will be complete different call flow for the disabled customers as video call has to be processed. It will only create a difference in the CVP signal triggering part. Rest of the design will be same. These services will be different for different customers.

2.1 Blind Customers

As the blind customers cannot enter the Customer entered digit ,so instead of customer entered digit,They have to make hand gestures for the response of IVR in front of the camera of their handset, after the call starts . The symbols for different digits has been shown in Fig 3. The gesture that has been made by the customer is passed through the gateway and Customer entered esture is matched in the CVP where the Sign language Recognition scripts runs and accordingly from CVP the call can then be passed to the UCCE where through intellegent routing the call be passed to next availbale agent where the agent will then be able to provide services to the blind customers.

2.2 Deaf Customers

The callers with disabilities (who cannot hear -Deaf), they are not able to contact the agents and they don't hear the IVR from the CVP. Speech to text conversion is done using HMM. The speech of agents registered in CUCM and is converted to a text file stored in CVP using HMM speech to text conversion, which is then displayed at the customer's side.

2.3 Customers who cannot speak

The callers with disabilities (who cannot speak - dumb), they are not able to contact the agents. As their call when passed to the CUCM in which agents are registered, there is no voice at the agent side. Sign language recognition is used to contact agents. I have successfully recognized Sign language for 100 trained gestures and 25 tested gestures and 94.5 % Accuracy has been achieved for the results. PCA algorithm is used for pattern matching in CVP and SVM is used for the classification of different gestures on MATLAB

3. STEPS FOR SIGN LANGUAGE RECOGNITION

3.1 Image Acquisition

The first step for sign language recognition is image acquisition. The data set of colored images is acquired of size 640*480 through the camera of the customer over the video call and these image will be sent to the CVP through Gateway where the sign Recognition will be done. The data set of 100 images with 16 different hand gestures has been acquired through the camera for this system. In this project the hand gesture that has to be recognized is used as the special hand gesture. So here the data set has been divided into two classes, Class A and Class B. For Class A, 30 images of special hand gestures with different orientation, different lightening conditions has been taken. For Class B, 30 images of different hand gestures like thumb up, thumb down etc has been taken. In total data set of 100 with sixteen different hand gestures has been acquired using the Ib camera of the laptop. Similarly the same process is repeated with different gestures.

3.2 Skin color Extraction

The data set of the 100 colored images has been acquired. Now the next step is to extract the skin color information from the images. The MATLAB R2011a tool has been used to extract the skin color information from the images. The image is first read using imread () then the RGB values of the skin color has been observed and it the maximum and minimum RGB values of skin color was found to be 240,230,220 and 120,110,105 respectively. The color image is converted to binary image and the region that has the values under the above limit is white and rest of the portion of image that does not lie the above limit is black. The area of interest is the arm region so the unwanted region has to be removed. The bwareaopen () command has been used to removed the unwanted area of the skin. The bwareaopen (I, p) removes small objects from binary image that have few pixels than p. The skin color has been extracted of the 60 colored images. The skin color extraction of some of the hand gestures has been shown in Fig 1.

(a) (b) (c)

Fig. 1. Sample 1: (a) Input Image (b) Skin colour extraction of Image (c) Background Noise Removal

3.3 Recognition of Hand gestures

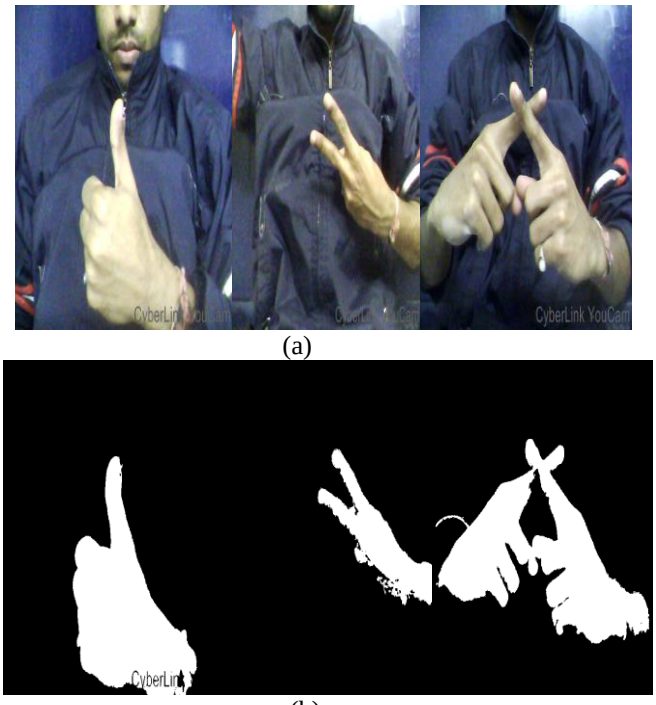
The hand gesture recognition of 16 different hand gestures of 100 data sets has been done following the above steps. Canny edge detection method is used after the skin color information extraction. The sixteen different hand gestures are divided into two classes. Class A and class B. that fill will be used for classification of images, training and testing. The method of recognition is simpler as compared to the existing methods as this method of hand gesture recognition uses only a MATLAB tool, no sensors and no gloves are used for this system for recognizing the hand gestures.

The callers with disabilities (who cannot hear -Deaf), they are not able to contact the agents and they don't hear the IVR from the CVP. Speech to text conversion is done using HMM. The speech of agents registered in CUCM and is converted to a text file stored in CVP using HMM speech to text conversion, which is then displayed at the customer's side. The callers with disabilities (who cannot hear -Deaf), they are not able to

contact the agents and they don't hear the IVR from the CVP. Speech to text conversion is done using HMM. The speech of agents registered in CUCM and is converted to a text file stored in CVP using HMM speech to text conversion, which is then displayed at the customer's side.

3.3 Feature Extraction and Classification

Principal component analysis algorithm has been used to extract the features of images in the dataset. PCA is a way of finding out the features in a data set. It's most often used for reducing the dimensionality of a large data set. PCA uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of uncorrelated variables called principal components.The seven features of 100 images in the dataset has been extracted using Principal component analysis. The matrix of 100*7 has been obtained after extracting the seven features of the sixty images in the dataset. The seven PCA features that has been extracted are mean, entropy, homogeneity, energy, contrast, correlation and standard deviation. The Eigen vectors of sixty images for seven features are obtained in MATLAB R2011 a tool and from the seven extracted features the top two score features are used for the classification, training and testing part. The matrix is now reduced to 100*2 with the top two score features for sixty images. The reduced matrix of 100*2 can be used for the next steps of training and testing.



(a)

(b)

Fig. 2. Sample 1: (a) Input Image (b) Recognition

Training of images in the dataset is an important part of the system to classify images of the dataset into different types. In this system dataset of 100 images has been trained using kernel function of support vector machine classifier. Support vector machine can classify non linear data also. The data set has been divided into two different classes, class A and class B, class A dataset images contains all the special hand gesture images that will be used for banking security and class B dataset images contains image of all different hand gestures. Support vector machine classifier will train the data set accordingly. The classification of 15 different hand gestures has been done using support vector machine. Boundary is created betIen the two classes. Support vector machine finds out to which class the image belongs to accordingly maps it. In Fig. 3 it can be clearly seen the green dots are representing special hand gestures that belongs to the class A and the red dots represents the other different hand gestures. The boundary is created betIen two classes. The values for special hand gesture or the correct hand gesture that will be used for security purposes to inform the nearby police station has the value +1 and the other different hand gestures that are not used for security

purposes or incorrect gestures has the value -1. Thus green dots have the value of +1 and the red dots have the value of -1. The training of images using support vector machine has been done and the data set has been classified into two different classes A and B, now the testing of the images will be done to check exactly the system is recognizing the hand gestures and the accordingly the accuracy of the system is calculated.

The 15 different hand gestures has been successfully recognized with an accuracy rate of 94.5 %.The 15 different hand gestures are recognized one by one using the SVM classifier. The gesture that has to be recognized is put into the class A which is considered as the special gesture and the other different gestures are put in the class B and hence all the different hand gestures are trained and tested. The above 15 different hand gestures that has been shown in Fig. 3 can be used for the special message which is used for the contact center services. The hand gesture message can be decoded using this system. The message can be decoded in the form of text or voice. Any of the above 15 different hand gestures can be used for the special message.

The15 different hand gestures can also be used for blind, deaf, dumb and senior citizens with partial disability. The different hand gestures can be assigned different meaning which should be explained to disabled customer by pre-training .When the disabled customer signals the gesture in a video telecom network, it is recognized by the system and the meaning associated with it is signaled out to the CVP component of the Contact center

Fig. 3. Fifteen Different Hand Gestures for sign language recognition

The 15 different hand gestures that has been used for the sign language recognition has been successfully recognized with an accuracy of 94.5 %. The different sample gestures has different accuracy when it is tested using SVM.

The implemented sign language recognition system has an accuracy of 94.5% which is better as compared with the existing results from Yang Quan [1].

TABLE I : COMPARITIVE GESTURE DETECTION RATE CHART FOR ACCURARY

SAMPLE GESTURE	ACCURACY	SAMPLE GESTURE	ACCURACY
1	95.6%	9	96.4%
2	94.3%	10	94.2%
3	96.7%	11	94.8%
4	97.8%	12	92.2%
5	94.5%	13	94.5%
6	94.2%	14	94.2%
7	93%	15	93.8%
8	95.8%	TOAL AVG	94.5%

4. CONCLUSION

I have proposed a sign language recognition system which uses eight simple steps such as image acquisition, skin color information extraction, background removal, canny edge detection, PCA features extraction, classification of images using support vector machine classifier, training and testing.100 samples of 15 different hand gestures has been taken for the training and 20 samples has been taken for the testing of 15 different hand gesture. The 15 different hand gesture has been successfully recognized with an accuracy of 94.5 % as shown in Table I. The system can be used for contact center services for disabled customers. The system has been successfully implemented and the prototype has been designed.

In Future I are in process of implementing the complete system using System-C and HDL on FPGA based hardware for the sign language recognition.

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Authors Biography

Sanal Malhotra is an Indian Engineer, researcher and inventor. He has published 7 Research papers in International conferences including IEEE and he has been awarded with Best Research paper award and Knowledge creation award in India and he is the author of the book 'The Secrets of Artificial Intelligence'.