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Interact With Computer System Using Real-Time Static Hand Gesture Recognition

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Abstract: - Hand gestures are powerful approach of communication among humans and the sign language is the most effective and natural communication for the peoples. In this work, the hand gesture system is developed. The setup of the proposed system needs fixed position webcam with 20 mega pixel resolution. It captures snapshot using RGB colour space from static distance. This work is divided in different stages, which are image pre-processing, the region extraction after that feature extraction & last feature matching. First stage converts captured input image into binary image using gray threshold, followed by morphological operations. At Second stage, blob extracts hand region and crop is applied for getting extracted region and then "Sobel" edge detection is applied on the above extracted region. Third stage gives feature vectors as area of edge, which will be compared with feature vectors of a dataset by using Euclidian distance in the further stage. Minimum Euclidian distance gives accurate recognition of perfect matching gesture for performing corresponding activity. This paper have experiments for static hand gestures related to all 26 alphabets. The Training dataset having number of samples of each symbol in different shapes, different positions and conditions of environment. It can reliably recognize single hand gestures in real time. It can achieve upto 82.88% of recognition rate in static background with least Euclidian distance.
Keywords: - Image Preprocessing; Region Extraction; Feature Extraction; Median Filter;

I. INTRODUCTION

The sign language recognition is a research area involving pattern recognition, natural language processing. Sign language recognition is comprehensive problem because of the complexity of the visual analysis of hand gesture and the highly structured nature of sign languages. In many practical communication applications, it is considered as very important function, like understanding of sign language, entertainment, and human computer interaction. Among natural human gestures comes during non-verbal communication, pointinggesture can be identified and included in more natural new HCI's. The streams of backgrounds are frequently influenced by the background changes such as changes in light and changes by removing or adding parts of the background. Therefore, the quality of the extracted foreground and the segmented image of hand gesture critically drop. The novel method proposed in is based on difference background image between each consecutive frames, by using the "3σ-principle" of normal distribution for hand gesture detection to deal with the problem. The automatic threshold selection based on the method of maximal between class variance is proposed to select optimal threshold for hand gesture segmentation. method to identify hand gestures extracted from images. This method is to obtain the image through subtract one image from another sequential image, by measuring the entropy, hand region separation from images, tracking the hand area and identifying hand gestures. The limitation for this segmentation method is, the background should be plain and uniform. Rokade proposed RGB segmentation which is more sensitive to light influence and thethreshold value for conversion of image to binary image that value is different for different lighting conditions. Fang proposed a robust real-time hand gesture recognition method which is based on hand detection followed by hand tracking, later hand is fragmented using color and motion. Messer proposed static hand gesture recognition, which mainly consists of the recognition of predefined signs based on a posture of the hand. Hand gesture recognition system is proposed in which is fast, accurate and an effective recognition system. Rokade uses Euclidean distance for similarity for hand gesture recognition. Ren proposed Contour retrieve to get the object's contour. Feng proposed research on use of hand gesture contour algorithm (HGCA) for Features Extraction from Frame Image Sequences. Howe proposed comparison of hand. segmentation methodologies for hand Gesture recognition

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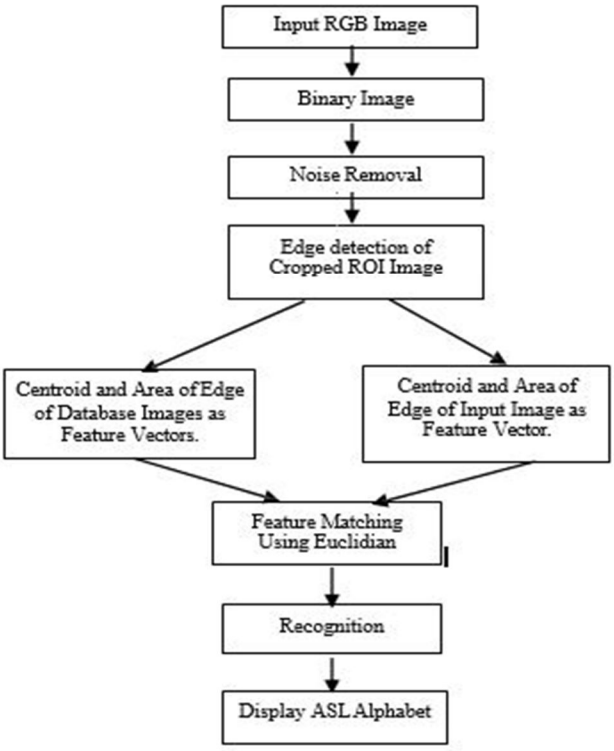

Figure 1. ASL symbols.

Figure 2. Face2Face Webcam.

Figure 3. ASl symbols

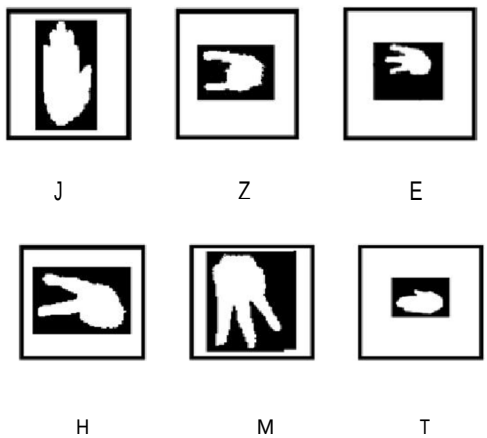

Figure 4. Modified ASL symbols

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II. FLOW OF HAND GESTURE RECOGNITION SYSTEM

Within This section, the flow of hand gesture recognition system algorithm is as shown in **Figure 1**. The hand image with a resolution of 320 × 180 is first captured using Iball Face2Face webcam **Figure 2**. A hand region gets extracted from image using SIFT algorithm. Feature extracted from filtered binary image and feature vectors matching compares both trained and input images. **Figure 3** shows ASL symbols, but as this system supports static gestures only so some of them symbols taken as different sign. And to avoid ambiguity while calculating features, some of the signs are changed. Changed ASL symbols are shown in **Figure 4**.

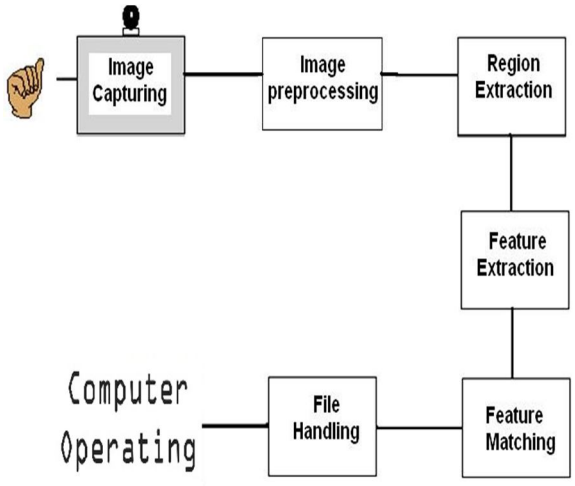

Figure 5. System architecture for hand gesture recognition.

III. PROPOSED HAND GESTURE RECOGNITION SYSTEM

System Architecture as shown in **Figure 5** consists stages of Hand gesture recognition system Maintaining the Integrity of the Specifications.

A. Image Capturing

First, to confirm that you have the correct template for your paper size. This template has been fitted for output on the US letter paper. Color is a robust feature. It is vulnerable to changing lighting conditions and it differs from each people. First of all, the snapshot of RGB image is captured by the 20 megapixel web camera. In this database, the image size is 320 × 180. If this size of image is used for the processing, the computation time will be very high.

B. Image Preprocessing

Skin probabilities (minimum and maximum) of input RGB image are calculated for skin detection purpose. To get binary image data using normalized skin probability used for producing gray threshold at the zero. To minimize “salt and pepper” using normalized skin probability, Median filtering is applied.

Guassian filter for smoothing of image. Zeros removal are applied on normalized image. Morphological operations like IMCLOSE is gets applied on filtered images. Which delivers the binary image closing and close operation is a dilation followed by erosion, using structuring element.

C. Region Extraction

bwlebel is use to find 8-Component connectivity of binary image is calculated and the regionprops is use to identify bounding box for white pixels of hand image by using and imcrop is applied to extract region of interest. The “Sobel” method use to find edge detection of extracted image using the Sobel approximation to the derivative edges where the gradient of input binary image I is maximum.

D. Feature Extraction

By using centroid given by (Cx, Cy) the Feature vector is formed . And bwarea gives the area of hand edge region.

$$(C_x, C_y) = \frac{1}{n}\left(\sum_{t=1}^{n} x_t, \sum_{t=1}^{n} y_t\right)$$

Feature vectors of Training image are stored in mat files of MATLAB and feature vectors of input hand gesture image are calculated

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at run time.

E. Feature Matching

The Euclidian distance is use for Feature vectors matching. following formula is use to find Euclidian distance between feature vector of input real-time image and feature vector of each training image is calculated

$$Lsc_t = \sqrt{(x_{t+1} - x_1)^2 + (y_{t+1} - y_1)^2}$$

For perfect matching hand gesture, The minimum Euclidian distance is considered.

F. File Handling

The recognized hand gestures are used to perform corresponding activity.

IV. EXPERIMENTAL RESULT

In this section,real time static hand gesture recognition system performance in static background is evaluated for each of the hand gestures 100 samples are stored in database. And the input image is used for the performance evaluation.

Based on the proposed algorithm the graph of recognition results of 26 hand gestures is shown in **Figure 3** and the recognition result is reported in **Table 1** and. The overall success rate is 82.88% with the recognition time about 0.5 seconds using 20 megapixel web camera and MATLAB 8.5

V. CONCLUSION

For real-time static hand gesture recognition, The single hand gesture recognition system works successfully.

Sign	Perfect Matched	Sign	Perfectly Matched
A	80	N	83
B	90	O	81
C	89	P	85
D	87	Q	88
E	78	R	81
F	83	S	80
G	80	T	82
H	82	U	85
I	85	V	81
J	80	W	83
K	81	X	78
L	84	Y	87
M	82	Z	80

The results are more accurate with low-cost 20 mega pixel IBall Face2Face as compared to 1.3 megapixel USB web camera is determined by the Experiments. Fixed position of Web camera mounted on the top of any surface produces more accurate results for RGB color images captured from the distance of 1 meter from camera in static background.Ability of computation & works efficiency while matching feature vectors of real-time hand gesture images reduces because of Low-level feature extraction from extracted region . The number of samples of hand gestures are collected having different samples per gestures of 26 gestures in different conditions with different persons hand produces more accuracy by calculating Euclidian distance for feature matching. Total work is implemented in MATLAB 8.5. The experiments gives the conclusion that the minimum Euclidian distance identifies accurate matching of hand gestures and system get 80% recognition rate.

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VI. ACKNOWLEDGEMENT

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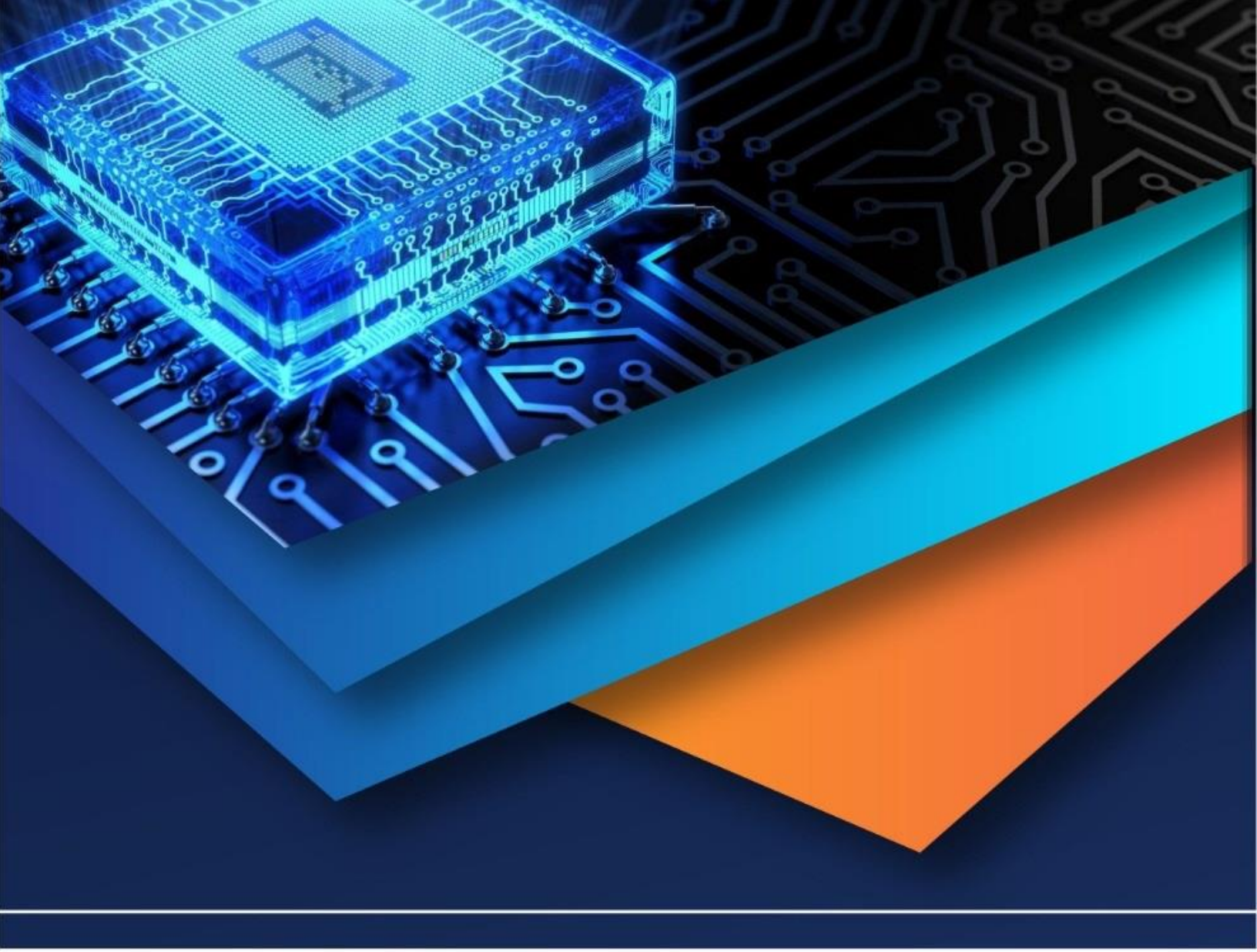

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