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### HAND GESTURE RECOGNITION SYSTEM FOR THE UNDERPRIVILEGED

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### **ABSTARCT:**

User's Hand Gesture is captured and a salient feature set is extracted; these features are associated with the user identity and stored as a template in a database. User's gesture is captured and the extracted feature set is compared with either (i) all the templates in the database (identification), or (ii) the templates associated with a claimed identity (verification). The hand gesture recognition technique based on the pattern of the human hand is well suited to be applied to access control and provides strong security. In this paper we focus on an efficient methodology for identification and verification for gesture detection, even when the images have obstructions, visual noise.etc. Efficiency is acquired from gesture detection and recognition when its performance evaluation is accurate. In this paper we will discuss few hand gesture recognition methods that are currently being practised, out of those which are the efficient techniques.

Keywords: Image Capturing; Pre-Processing; Gesture Recognition; Pattern Recognition; Image segmentation.

### 1. INTRODUCTION

Interaction with computers is not a comfortable experience even in the present time. Computers should communicate with people with body language. Gesture recognition can be seen as a way for computers to begin to understand human body language, thus building a richer bridge between machines and humans than primitive text user interfaces or even GUIs (graphical user interfaces), which still limit the majority of input to keyboard and mouse. Hand gesture recognition becomes important .Interactive human-machine interface and virtual environment is the need of effective means of communication between human-machine. The Proposed Block Diagram for the Hand Gesture Recognition system is shown in the Figure 1



Figure 1 Proposed block diagram of hand recognition system

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### **2. IMAGE CAPTURE**

Hand gesture is a form of non verbal communication found to be reliable and accurate means of humanmachine communication. Hand gesture recognition systems have been previously described. US Patent No. 4,988,981 (Zimmerman et. al) teaches how a glove based device using three sensors could be used as a computer data entry apparatus. This has been expanded upon and several papers, such as [1] & [2]. Paper [3] has shown that multiple sensors, such as cameras, can be used to find the 3D position of the object, such as a hand. These systems have the disadvantage that they require multiple sensors, which increase the costs of the system, and also mean that complex processes must be performed to integrate the information from these multiple sensors. Reference paper [3] has shown how it is possible to construct 3D images using a single sensor by moving the sensor to different positions and viewing the object. However, this also has the disadvantage that complex data processing is required, as well as a mechanism to move the sensor. It also has the disadvantage that tracking fast moving objects, such as hands, would require that the sensor move at an even faster speed.

### **3. PRE PROCESSING**

Pre-processing is a common name for operations with images at the lowest level of abstraction -- both input and output are intensity The aim of pre-processing is an improvement of the image dataoimages. that suppresses unwanted distortions or enhances some image features important for further processing. Four categories of image pre-processing methods according to the size of the pixel neighborhood that is used for the calculation of a new pixel brightness, pixel brightness transformations, geometric transformations, pre-processing methods that use a local neighborhoodvtransformations, image restoration that requires knowledgevof the processed pixel, and Other classifications of image pre-processingoabout the entire image methods exist. Image pre-processing methods use the considerable redundancy in images. Neighboring pixels that are corresponding to considerable redundancy in images. One object in real images have essentially the same or similar. Thus, distorted pixel can often be restored as anobrightness value. Average value of neighboring pixels. Gray Scale Transformations: Grey scale transformations do not depend on the position of the pixel in the image, Grey scale transformations are mostly used if the result is viewed by a human brightness transform. Negative transformation b – contrast enhancement (between pland p2).

### 4. IMAGE SEGMENTATION

**Image Segmentation** is the process of partitioning a digital image into multiple segments (sets of pixels, also known as super pixels). The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyse. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics. Thresholding: The simplest method of image segmentation is called the thresholding method. This method is based on a clip-level (or a threshold value) to turn a gray-scale image into a binary image. The key of this method is to select the threshold value (or values when multiple-levels are selected). [3]A new hand gesture recognition method based on Input- Output Hidden Markov Models is presented. This method deals with the dynamic aspects of gestures. Gestures are extracted from a sequence of video images by tracking the Skin-color blobs corresponding to the hand into a body-Face space centered on the face of the user [4]. In thresholding, pixels are allocated to categories according to the range of values in which a pixel lies. Fig 3. Shows boundaries which were obtained by thresholding the muscle fibers image. Pixels with values less than 128 have been placed in one category, and the rest have been placed in the other category. The boundaries between adjacent pixels in different categories have been superimposed in white on the original image. It can be seen that the threshold has successfully segmented the image into the two predominant Fiber types.

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Figure 2. Thresholding Image Segmentation

In **edge-based** segmentation, an edge filter is applied to the image, pixels are classified as *edge* or *non-edge* depending on the filter output, and pixels which are not separated by an edge are allocated to the same category. Fig4. Shows the boundaries of connected regions after applying Prewitt's filter and eliminating all non-border segments containing fewer than 500 pixels.



Figure 3. Edge-based segmentation

To overcome the noise sensitiveness of conventional fuzzy c-means (FCM) clustering algorithm, a novel extended FCM algorithm for image segmentation is presented in this paper. The algorithm is developed by modifying the objective function of the standard FCM algorithm with a penalty term that takes into account the influence of the neighboring pixels on the centre pixels. The penalty term acts as a regularizer in this algorithm, which is inspired from the neighborhood expectation maximization algorithm and is modified in order to satisfy the criterion of the FCM algorithm. The performance of our algorithm is discussed and compared to those of many derivatives of FCM algorithm. Experimental results on segmentation of synthetic and real images demonstrate that the proposed algorithm is effective and Robust.

### **5. COLOR SPACE**

A colour space is a mathematical representation of a set of colours. The most popular colour models are 1.RGB (used in computer graphics); 2.YIQ, YUV, or YCbCr (used in video systems); 3. CMYK (used in colour printing). However, none of these colour spaces are directly related to the intuitive notions of hue, saturation, and brightness. All colour spaces can be derived from the RGB information supplied by devices such as cameras and scanners

### 5.1 RGB Colour Space

The red, green and blue (RGB) colour space is widely used throughout computer graphics. Red, green and blue are three primary additive colours: individual components are added together to form a desired colour and are represented by a three dimensional, Cartesian coordinate system as shown in **Figure5**.

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Figure 4. RGB Colour Cube.

#### 5.2 YCbCr Color Space

YCbCr is a family of colour spaces used in video systems. Y is the **luma** component and Cb and Cr are the **chroma** components. The YCbCr colour space is a scaled and an offset version of the YUV colour space. Y is defined to have a range of 16–235; Cb and Cr are defined to have a nominal range of 16–240 [5]. The basic equations to convert between RGB and YCbCr are:

 $\begin{array}{l} Y=0.257R+0.504G+0.098B+16\\ Cb=-0.148R-0.291G+0.439B+128\\ Cr=0.439R-0.368G-0.071B+128 \end{array}$ 

The above equations have been used to generate the logic used in the colour conversion module.



Figure 5. RGB Color Model

#### **6. GESTURE RECOGNITION**

It mainly includes Sign Language. The two main elements of gesture recognition are (i)Low and simple level signed alphabet, mimics the letters of the native spoken language.(ii)Higher level signed language, using actions to mimic the meaning or description of the sign. The following figure 4. is American Standard hand gestures for English alphabets.

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Figure 6: Hand gestures for English alphabets.



Figure 7: Input / Output image1 in YCbCr colour space.

No. of Images	Miss	False Alarms	Detection rate(High/Low)
Image1	0	~4%	84.0%
Image2	0	~2%	92.0%

Table 1: Skin colour classification rate for YCbCr colour space.

Based on Table[1] we assume that the skin colour is determined mostly by its chrominance components Cb and Cr so the luminance component depends only on lightning conditions. There is also assumption that the skin colour of various human individuals and also human skin colour types is the same in its chrominance components. The difference is only according to the luminance parameter variation. This implicates that there is no need to trace luminance component probability function in skin colour detection in YCbCr colour space. Advantage of this method is its simplicity and minor computational costs. The method described in this paper finds it difficult to differentiate when background colour of image is similar to skin colour (red).

### 7. APPLICATION

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- Entrance time and attendance control, banking service, PC security.
- Traffic control systems
- Video surveillance
- Brake light detection
- Image controlling & Scaling
- To control Mouse(3D mouse)
- Sign Language Recognition
- Gaming Interface
- Robot Control
- Controlling Machines
- In mobile phone e.g. Samsung Galaxy S4



Figure 8.. Gesture Recognition in Samsung Galaxy S4

### **8. FUTURE SCOPE**

- National border controls: the hand gesture & iris recognition as a living passport
- Computer login: a particular gesture as a living password
- Cell phone and other wireless-device-based authentication
- Human-Machine Communication- Enable deaf people to lead a normal life.
- Access to machines using gestures for under privileged
- Secure access to bank accounts at cash machines
- Ticketless travel; authentication of rights to services
- Premises access control (home, office, laboratory, etc)
- Driving licenses; other personal certificates
- Entitlements and benefits authorization
- Forensics; birth certificates; tracing missing or wanted persons
- Credit-card authentication
- Automobile ignition and unlocking; anti-theft devices
- Anti-terrorism (e.g. Security screening at airports)
- Secure financial transactions (electronic commerce, banking)
- Internet security; control of access to privileged information
- "Biometric-Key Cryptography" (stable keys from unstable templates) any existing use of keys, cards, pins, or passwords

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### 9. CONCLUSIONS

Proposed algorithm focus on the algorithm for rapid and accurate hand gesture recognition. People, who are physically disabled, sometimes are unable to use other forms of man-machine communication. In that case persons hand gestures recognition plays important role. Systems like this, gesture recognition is very much useful for all physically disabled people.

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