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A Survey On Hand Gesture Recognition System For Human Computer Interaction(HCI)

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ABSTRACT

As Computers turn out to be more unavoidable in the public eye, encouraging characteristic human– Computer Interaction (HCI) will positively affect their utilization. Subsequently, there has been developing enthusiasm for the advancement of new methodologies and innovations for crossing over the human computer hindrance. A definitive point is to convey HCI to an administration where associations with PCs will be as normal as a connection between humans, and to this end, incorporating gestures in HCI is a crucial research area. Gestures have for some time been considered as a collaboration strategy that can conceivably convey more innovative, pure and natural strategies for speaking with our computers. This paper gives an examination of provisional surveys done in this area. The adoption of hand gestures as a characteristic interface fills in as a spurring power for look into in gesture anatomy, its portrayals and recognition strategies, programming stages and structures which are examined in this paper. It centre's around the three principle periods of hand gesture recognition i.e. discovery, tracking and recognition. This paper likewise gives an examination of existing writing identified with gesture recognition frameworks for human PC cooperation by classifying it under various key parameters. The primary objective of this review is to give analysts in the field of gesture based HCI with an outline of advance accomplished to date.

Keywords: Recognition, Gesture recognition, Hand, Human computer interaction, vision based

I. INTRODUCTION

We have entered a period of upgraded advanced network. PCs and the Internet have turned out to be so installed in the day by day texture of individuals' lives that we cannot even think to live without them. We utilize this innovation to shop, work, convey, search out new data, and engage ourselves. With the increasing dissemination of PCs into society, human-computer Interaction (HCI) is ending up progressively fundamental to our day by day lives. A gesture is a spatiotemporal example which might be static, dynamic or both and is a type of non-verbal correspondence in which real movements pass on data. Gestures incorporate movement of fingers, hands, head or other body parts. Gesture Recognition on the whole alludes to the entire procedure of tracking human gestures, to their portrayal and change to semantically important commands. Gesture Recognition and more pointedly Hand gesture recognition can be worn to upgrade Human-Computer Interaction (HCI) and raise the adequate use of the accessible dataflow.

There are two noteworthy methods that are utilized for hand gesture Recognition,

1. Vision based methods
2. Contact based methods

Vision based methods are situated in light of association of the client with single or different camera setups, these cameras can fluctuate incomprehensibly in nature from basic webcams,

infrared cameras to stereographic cameras. This communication is utilized as a part of the type of a video by the framework for hand gesture recognition. vision based procedures are effective.

Contact Based methods depend on physical collaboration of the client with a physical gadget that goes about as input gadget for the framework that perceives motions. These gadgets for the most part have segments like accelerometer and gyroscope that measure the powers following up on the hand and in this way intrinsically attempt to outline movement of hand.

II. METHODOLOGY

For blind people new dactylology is developed, based on their gesture preference[1]. This method include,

A. User Interface Design[1]

B. Dactylology[1]

1. User Evaluation Study
2. Gesture Performance Measure
3. Gesture Preference Measure

C. Recognition System[2]

a) Pre-Processing

(I) Illumination compensation

(II) Skin segmentation and binarization

(III) Hand-forearm segmentation

(IV) Boundary extraction and filtering

b) Feature Extraction

a. Reduced Shape Signature[2]

Which consider only palm portion. This technique processes only finger boundary so it reduces the number of feature-sets essential to describe a hand gesture so there is no unnecessary peak point because of wrist portion.

RSS is obtained from this reduced boundary βr(A) and a shifted centroid (Cxi,Cyi). It is a one dimensional distance function denoted by R(k) and is given by

$$R(k) = \sqrt{\left(X_r(k) - C_x(i)\right)^2 + \left(y_r(k) - C_y(i)\right)^2}$$

$$C_x = \frac{1}{N}\sum_{i=0}^{N-1} x\,(i)$$

$$C_y = \frac{1}{N}\sum_{i=0}^{N-1} y\,(i)$$

where N is the pixel count on the boundary β(A) and x(i), y(i) is the corresponding x, y coordinate of i^{th} number of boundary point, respectively.

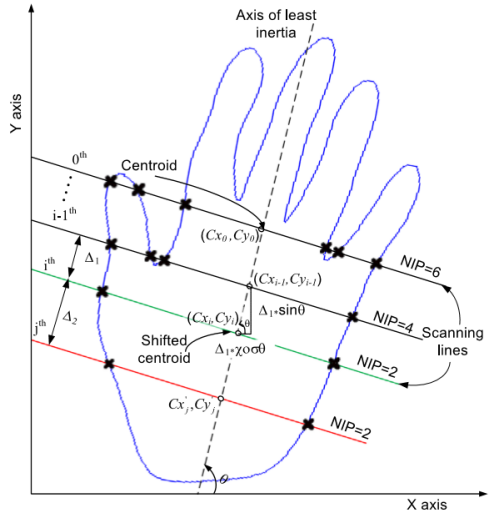

Figure 1. Illustration of finger extraction[2]

c) Classification

Rule based Classification[2]

So, blind people can handily collaborate with computer with the use of this method.

All vision based technique mostly consider white or black background for gesture recognition.to overcome this and make it dynamic 2nd stage of skin color detection[3] technique used. For 2nd stage of skin color detection following formula are used, the two estimations of Cb and Cr for the rest of the protest in picture are summed exclusively. At that point their mean esteems and standard deviations can be ascertained as

$$\sigma_i = \sqrt{\frac{1}{n}\sum_{(x,y)} (hand_i(x,y) - \mu_i)^2}$$

$$\mu_i = \frac{1}{n}\sum_{(x,y)} hand_i(x,y)$$

At that point, every pixel is analyzed. Those whose Cb and Cr esteems are inside the scope of 2 standard deviations from the mean esteems are kept, while others are prohibited as

$$Higher\ Boundary_i = \mu_i + n\sigma_i$$
$$Lower\ Boundary_i = \mu_i - n\sigma_i$$

Skin = Highter Boundary< Pixels of Hand$_i$ <Lower Boundary, i=C_b,C_r

While 2nd stage of skin color detection helps in eliminating noises that connect to the hand region but it often result in holes in hand region so region filling technique carried out.

$$X_k = (X_{k-1} \oplus B) \cap A', k = 1, \dots, n$$

where X_k is the region after the k^{th} dilation, B is the structuring element, which is a 8-connected mask in our implementation, and A' is the complement of A.

For Dynamic Hand Gesture Recognition, Various techniques are used like Hidden markov model[4], support vector machine etc. Dynamic gesture recognition through hidden markov model include,

(I) Gain Gesture Images[4]
- A. Hand Segmentation
- B. Spotting Algorithm

(II) Feature Extraction[4]
- A. Hand Position
- B. Hand Velocity
- C. Hand Size
- D. Hand Shape

(III) Recognition Using HMM[4]
- A. Hidden Markov Model
- B. Data Aligning Algorithm

One other technique of Real time dynamic hand gesture recognition is motion history image. Dynamic hand gesture Recognition was led by receiving movement data. Varieties among edges could be gathered in the motion history picture. A straightforward course discovery technique for moving hand in view of motion history picture is then proposed. Four gatherings of directional examples are characterized for estimating the amounts of bearings.

1) Motion History Image: Fig. 2(a) and 2(b) demonstrates two persistent edges and Fig.2(c) is the distinction outline in which the subsequent locales are the motion areas. To collect movement data in a solitary picture, we get the motion history picture as appeared in Fig. 2(d). The advantage of motion history picture is that it could safeguard objects directions in a single edge. Movement data are utilized to refresh the motion history Image MHI ,where DF is the difference frame and α is set as 15. The qualities in MHI are 0-255.

$$MHI(x,y)_t = MHI(x,y)_{t-1} + DF(x,y)_{t-1} - \alpha$$

2) Haar-like Patterns for Direction Detection: Four haar-like directional examples as appeared in Fig. 3 are utilized to distinguish whether hands are going up, down, left, or right. For instance, the motion history picture as appeared in Fig. 2(d) is utilized for characterization. The counter of left would be increased lots of times because the patterns in Fig. 3(c) coordinate with the

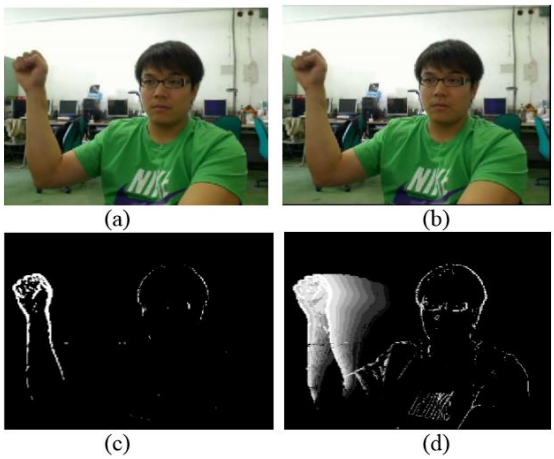

Figure 2. (a) Previous frame. (b) Current frame. (c) Difference frame. (d) The resulting motion history image [5] motion history. That is, if the left component is brighter than the right component, the counter of left direction would be expanded by one. The dynamic hand gestures would be classified as the direction counter with the greatest esteem.

$$Sum = Count_{up} + Count_{down} + Count_{left} + Count_{right}$$
$$UP = {(Count_{up})^2}/{Sum}$$
$$Down = {(Count_{down})^2}/{Sum}$$
$$Left = {(Count_{left})^2}/{Sum}$$

$$Right = {(Count_{right})^2}/{Sum}$$

Here sum is used to normalize the motion pixel count in all direction. Then classify the direction according to pixel count in each direction[5]. haar like features is unique approach to discover direction of hand movement.

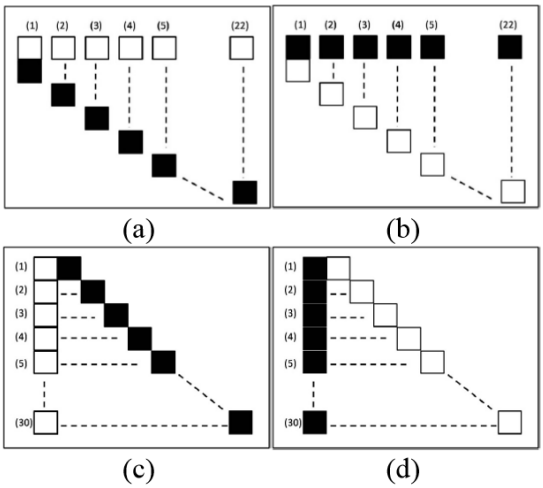

Figure 3. Moving hand direction detection patterns. (a) Up. (b) Down. (c) Left. (d) Right.[5]

III. COMPARISON AND RESULT ANALYSIS

Paper	Key Points	Result
A New Dactylology and Interactive System Development for Blind–Computer Interaction[1]	Performance measure, Preference measure index	Recognition rate: 97.53%
Pattern Recognition Towards hand gesture based Writing support system for blinds[2]	Reduced shape structure, rule based classifier	Recognition rate: 98%
Vision-based Hand Gesture Recognition System for a Dynamic and Complicated Environment[3]	Component Labeling and scan line,2nd stage of skin color detection	Recognition rate: 98%
Dynamic Hand Gesture Recognition Using Hidden Markov Models[4]	Data Aligning algorithm	96.67%
A Real Time Hand Gesture Recognition System Using Motion History Image[5]	Adaptive skin color model; motion detection; motion history image.	Accuracy:93.13%
Vision based hand gesture recognition for human computer interaction: a survey[6]	Possible solution for each Method review	All methods are described

IV. CONCLUSION

This survey provides the information about various vision based technique that are used for gesture recognition. The proposed dactylology uses optimal gestures set obtained through performance and preference measure. Reduced Shape signature feature extraction technique reduces 35% of feature set and provides good accuracy in recognition.2nd stage of skin detection provides flexibility of dynamic and complicated background for gesture recognition. For dynamic hand gesture recognition, state-based spotting algorithm can isolate constant motions adequately. Furthermore, data aligning algorithm makes our preparation information usable. The test comes about demonstrate the viability of our strategies. There are four dynamic hand gestures moving up, moving down, moving left, and moving right characterized. These hand motions are characteristic and basic. Haar-like features were intended to distinguish the four directional dynamic hand motions.

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