Enhanced Hand Gesture Recognition System

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ABSTRACT
This paper implements a hand gesture recognition technique by using the SIFT based feature extraction. The matching point threshold has been calculated by using the neural network on the basis of the input gesture and the training. The paper implements the work by using the MATLAB and analyzes the results on the various sign of ASL. The system shows the accuracy of 93.3% i.e. improved by approx. &% as compared to the existing 85.9%. The system discussed in the paper is also robust as it shows the accurate results on the manipulated gestures.

Keywords
ASL, Hand Gesture, SIFT, Neural network, Threshold.

1. INTRODUCTION
The human computer interaction is the most opportunistic field to work on. The HCI includes the interaction using the sign languages. The interaction with the machine by using the sign language needs the accurate recognition of the hand gesture by the system. Various hand gesture techniques can be divided in two categories i.e. vision based and the data glove based technique. The data glove based technique needs the data glove i.e. extra hardware; it leads to the enhanced cost of the system. Due to this the vision based technique are used. This paper implements a vision based hand gesture recognition technique by using the neural network and the SIFT. The rest paper is divided in four sections. First section describes the related work i.e. the work already has been done in the domain. The next section introduces the proposed system. The proposed system is implemented using the MATLAB in the next section of the paper. The final section describes the results and the future scope.

2. RELATED WORK
The paper discusses only few existing works. The work discussed in the paper already have proved their effectiveness. The existing work can be easily discussed by using the following table:.

Table 1: Related Work

Author	Reference	Finding
Yikai Fang et al.(2007)	[1]	• Fast multi scale feature detection used to speed up computation. • Computation time decreases with result obtain in dataset & gesture image database.
M. A. Moni et al.(2009)	[2]	• Gesture recognition using HMM. • Edge detection mark point at which image intensity change sharply. • Explore hand motion, posture,orientation.
Alsheakhali, M. et al(2011)	[3]	• Proposed a new technique to increase adaptability of a gesture recognition.
Meenakshi Panwar et al.(2012)	[4]	• Shape based approach for hand gesture recognition. • Higher recognition rate with minimum computation time.
Gurjal, P. et al.(2012)	[5]	• Identify gesture given by american sign language. • Scale invariant feature tranform to extract the features. • Decode a gesture video into appropriate alphabet.
Abhinandan Julka et al.(2013)	[6]	• Develop hand gesture recognition system recognize static character from american sign language with good accuracy.
Yongjing Liu et al. (2013)	[7]	• Feature extaction & classification. • Hand gesture recognized by template matching. • Average recognition rate is 0.859.

The above discussed work provides the maximum recognition rate of 85.9%. In the existing technique the system is not adaptive i.e. the variation in the scale of the image doesn't recognize the gesture. The system must be robust enough to tolerate such errors.

3. PROPOSED SYSTEM
The proposed work completes the process in two phases one is the training phase and the other is testing phase. The work is also explained by using the following flowchart. The features of the input gesture are extracted by using the SIFT i.e. scale invariant feature extraction. The SIFT is also applied on the each image within the database. The extracted features of the input images are compared with the features of the selected database image. If the number of points matched are greater than the threshold value then image is stored as the matched image. The threshold value is calculated by using the neural network. The neural network gets the fixed threshold and the gesture as the input value in the testing phase and provides the threshold value on the basis of the training done. The neural network is trained by using the database images.

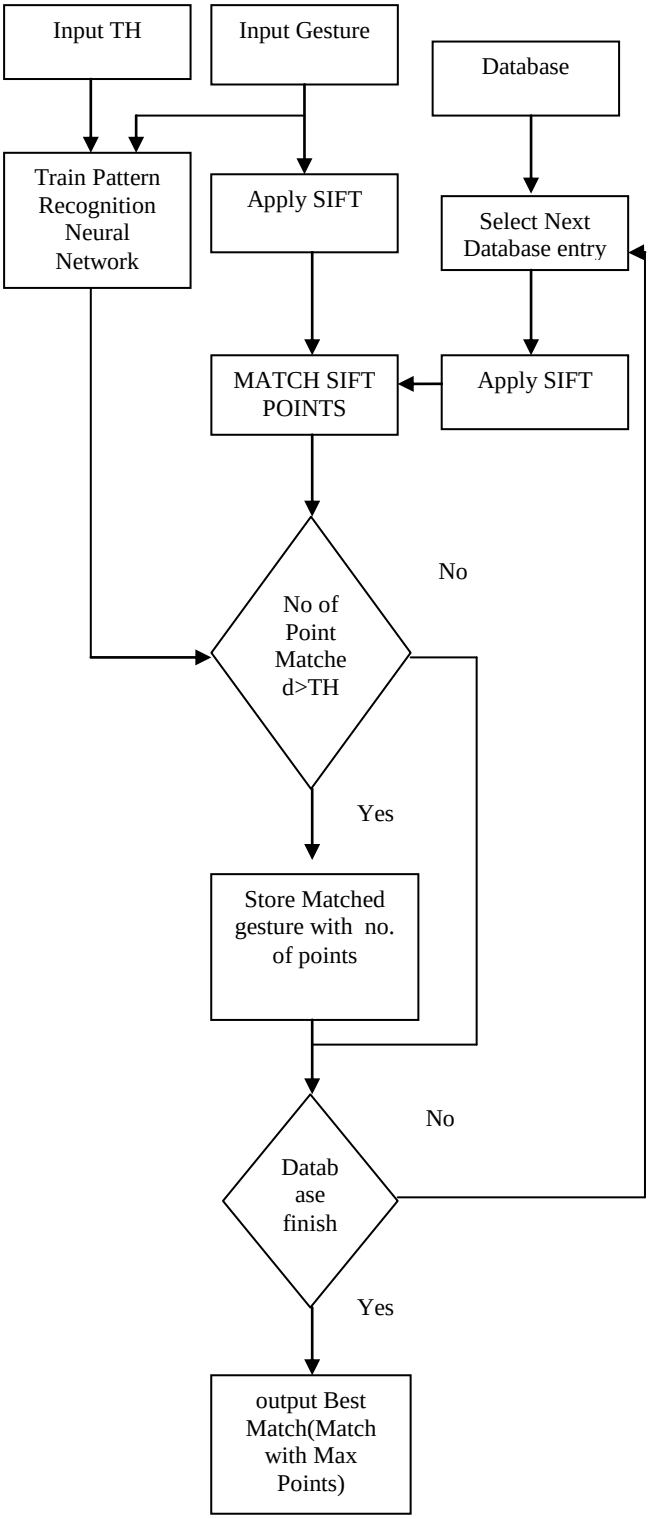


Fig 1: Proposed Flow Diagram

Each image features are compared with the input image one by one. The database image with maximum matched points is displayed as the resultant image. The process is shown below:

The above process can also be explained by using following algorithm:

1. Input Gesture.
2. Train neural network to get threshold value.
3. Extract SIFT points of input image.
4. For each database image
5. Extract SIFT points of selected database image
6. Match sift points of database image with input image sift point
7. If matched points> threshold
8. The store image as matched
9. End if
10. End
11. Select image with maximum matched points from the matched images as output image.

The work is implemented by using the MATLAB described in the next section.

4. IMPLEMENTATION & RESULT

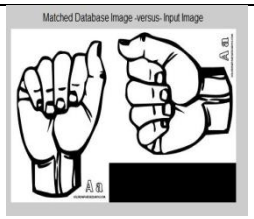
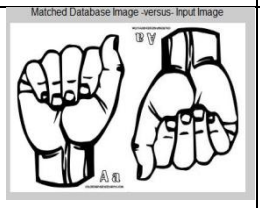
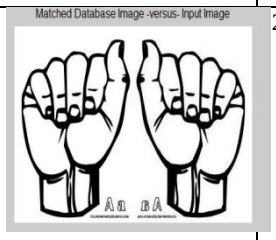
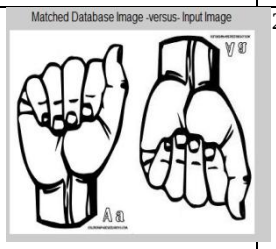
The work is implemented by using the MATLAB. The work is performed by creating the script files within the MATLAB with extension .m. We have executed the system for various input images. If the result images is matched with the input image i.e. required character is displayed then the system shows the true match otherwise false match. If no results displayed then no match found. The results of various characters are shown in the following table:

Table 2: Results of Various Characters

Character	**Match**	**Maximum keyPoint in sample Images**	**Number of Keypoint Matched**
A	True Match	243	217
B	True Match	79	79
C	True Match	62	62
D	True Match	175	175
E	True Match	105	105
F	True Match	89	89
G	True Match	91	91
H	True Match	220	220
I	True Match	85	85
J	True Match	112	112
K	True Match	72	72
L	True Match	63	63
M	True Match	84	84
N	True Match	97	97
O	True Match	63	63
P	True Match	45	45
Q	True Match	64	64
R	True Match	58	58
S	True Match	106	106
T	False Match	-	-
U	True Match	76	76
V	TrueMatch	57	57
W	True Match	124	124
X	True Match	85	85
Y	True Match	55	55
Z	No match Found	-	-

The table also shows the number of key points matched along with the maximum key points within the image.Sometimes, the system can be present in the manipulated images. The system must be robust enough to get the correct character given from manipulated images. We have manipulated the images of character A. Various operations like rotation on different degrees and flip are applied .The results on the manipulated images are shown in the following table:

Table 3: Results on Manipulated Images

operation	Images	Maximum keyPoint in sample Images	Number of Keypoint Matched
Rotate 90		253	221
Rotate 180		242	215
Flip Horizontal		232	19
Flip vertical		233	17

The above table shows that the accurate results have been obtained even in the case of the manipulated images. The overall system performance can be given as:

- True Match Rate= (True Match/Total)*100

  i.e. rate=(28/30)*100=93.3%(approx)

- False Match Rate= (false match/total)*100

  i.e. (2/30)*100 =6.66% (approx).

It means the proposed system shows the accuracy above than 93%.

The following graph shows the % calculated by proposed v/s existing system.

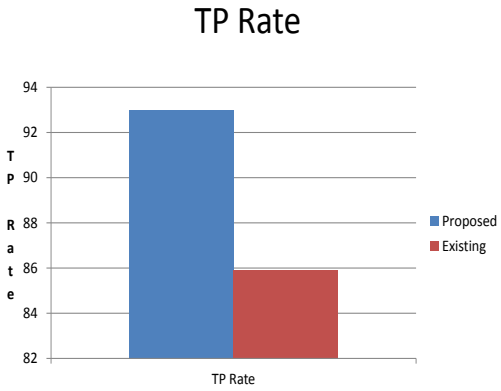


Fig 2: TP Rate Vs FP Rate

5. CONCLUSION AND FUTURE SCOPE

The paper implemented a sift and neural network based hand recognition technique. The technique shows the accuracy greater than the 93% while the existing system shows only the accuracy of 85.9. It means 7% increase in the accuracy. Moreover, the system is robust as it shows the accurate results on the manipulated gestures. This proves the effectiveness of the system. In future the system can be enhanced by using the neuro fuzzy or the swarm intelligence based technique. The Future work must improve the TP rate without increasing the FP rate.

6. REFERENCES

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