IJRECE VOL. 4 ISSUE 2 APR.-JUNE 2016 ISSN: 2393-9028 (PRINT) | ISSN: 2348-2281 (ONLINE)
DOI: 10.13140/RG.2.1.3186.6481

Robotic Control Technique for Hand Gesture Recognition

Rajinder Kaur[1], Naveen Kumari[2]
Student (M.Tech), Punjabi University Regional Center for Information Technology and Management Mohali
Assistant Professor, Punjabi University Regional Center For Information Technology and Management Mohali

Abstract- Hand Gesture recognition systems have been considered as the able-bodied and well made systems with the goal of interpreting gestures, making use of suitable algorithms to accomplish the recognition task. So far, various techniques were used to identify the gestures; many have their own advantages but also have few shortcomings like responsiveness, classification, accuracy etc. Therefore, there arises a great demand of overcoming the existing problems to achieve greater accuracy, faster response time and the difficulties faced in handling the training data inputs and testing outputs. Hence, gives the need to use such algorithms each of which is unique in its own effective and creative way and try to bring out the best possible results. Our proposed work focuses on extracting the features using Principle Component Analysis (PCA) algorithm, optimizing those features using Genetic Algorithm and finally classifying the gestures using Support Vector Machine (SVM). By doing this our system obtains better performance in terms of classification and faster response time or delayed outputs.

Keywords **-** Gesture Recognition, Principle Component Analysis, Genetic Algorithm and SVM.

I. INTRODUCTION

Hand gesture recognition plays an outstanding role in spotting the gestures and acts as a bridge between humans and computers so that computers can come to know human body languages and provide an efficient intercommunication. The image is actually a function of f(x, y) and takes its magnitude at a location (x, y)[1]. Researchers have presented many techniques to monitor the captured gestures [2].Every gesture recognition system has three main building constituents based on which it carries the recognition process.

The very first step in the recognition phase is called segmentation. Segmentation partitions the captured image into discrete parts by bounds [3], [4]. Subdivision of the image is done so as to get a noise free and clear image. This is done to reduce the number of pixels in the image so that the image size reduces and segmentation becomes easy to perform for the input image. The easiest and beneficial way used for segmentation of hand is the skin colour, for it is changeless to size, translation, and rotation features of the hand [5],[6].

Once the image is segmented, the next step is extracting the unique properties or features from the segmented image. Finally, gesture classification method is used to interpret the reconstructed gesture with proper classification algorithm. Classification of gestures degrades the image quality and leads to poor performance of the system.

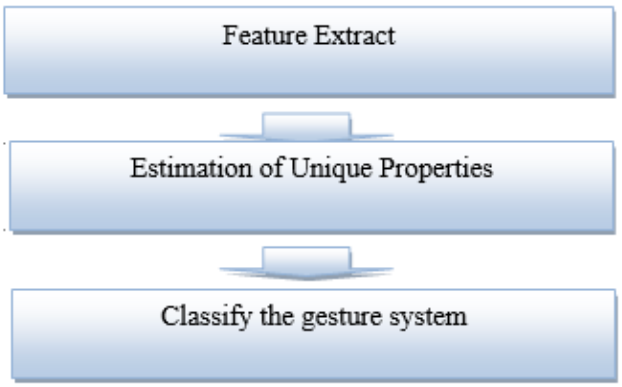

Fig.1 Process of Gesture Recognition

The proposed work discusses the issues of handling hand gestures and providing better alternatives for the same. These [10] systems serve a wide range of applications on various domains including medical systems, virtual environments, smart examination, sign language translation etc. [7].

Gesture recognition is a significant, yet problematic task. It is vital since it is a versatile and natural way to progress new, more natural and more mortal centred forms of human machine interface. At the same time, it is demanding because it involves the solution of many inspiring subtasks, such as robust documentation of hands and other body parts, gesture modelling, tracking, pattern appreciation and organization [2].

An originally aiming sign language gestures, exposed that gestures can be considered based on four dissimilar aspects:

- Shape,
- Motion,
- Position and
- Orientation.

Therefore, all gesture recognition methods try to approach the problematic by absorbed on one or more of the above four aspects.

II. EXISTING ISSUES IN HAND GESTURE RECOGNITION

DOI: 10.13140/RG.2.1.3186.6481

During the study of many approaches, it has been found that gesture verification issues many problems and need further improvements in order to get efficient pattern matching. The problems encountered areas:

- *Variation of illumination conditions*: It means any change in the lighting conditions has a bad impact on the extracted skin region.
- *Rotation Problem*: It is the problem faced when the hand posture is moved in any order in the scene.
- *Background Problem***:** A complicated background also creates problems when there are other objects around with the hand objects and may have similar skin colour.
- *Scale Problem***:** This problem occurs if the hand poses have varying sizes[11][12].
- *Rotation problem*: this difficulty arrives when hand is moved in any order in the backdrop [11].
- *Translation Problem***:** The changing hand positions in differing images also leads to false depiction of the features.
- *Difficulties in handling the training input and testing output***:** Artificial Neural Network (ANN) creates one network on only one layer which causes delay in response time.

Recent work in the field of hand gesture recognition for feature extraction was performed using Principal Component Analysis (PCA).PCA is a mathematical algorithm and has the trait to conclude the Eigen Values and Eigen Vectors directly in the form of a matrix. However, due to its massive matrices formation it becomes tedious to compute the Eigen values and Eigen vectors and is relatively sensitive to scaling. Also intelligent techniques like Artificial Neural Networks was used as a mechanism for gesture classification and matching but lead to delayed response time and hampered system performance. Since, hand gesture systems are used for security purpose, it is vital that the system becomes efficient [8],[9].

III. PROPOSED ALGORITHMS

We are using a research work algorithm in hand gesture recognition system like PCA, GA and SVM.

a) PCA Algorithm

PCA is the system of classifying pattern in data, and express the information in such a method as to emphasize their resemblances and changes. The move three is to compute the co-variance matrix of the record. We might not compute the co-variance matrix of the original medium, since it is too enormous. So we have to discover a method to locate out the main eigenvectors without scheming the big co-variance matrix. The method consists in choose a new co-variance matrix. Our co-variance medium for A was describing D and D is distinct by [11]:

E = D* D'

The Eigen Vectors and the Eigen values of E are the main mechanisms of our data set.

Pseudo Code of the Analysis Algorithm:

a) Guidance Phase

Step 1: Attain the guidance images I1, I2, ..., IM
Step 2: Signify each image Ii as a vector Gi
Step 3: calculate the standard image vector Ψ:
$\Psi = 1/M \sum^{M}_{I=1}$ ⌈i
Step 4: Take from the denote image:
$\phi_{i} =$ ⌈i – Ψ
Step 5: Compute the co-variance matrix C :
$C= 1/M \sum^{M}_{I=1} \phi_n\text{-}\phi_n^T – AA^T$ (N^2* N^2 matrix)
Where A=ϕ1, ϕ2,…..ϕn], (N^2* M matrix)
Step 6: Calculate the eigenvectors ui of AAT
The matrix AAT is very great. So, calculate Eigen Vectors vi of ATA, which has same Eigen, values and Eigen vectors [12].
Step 7: Calculate the M best Eigen Vectors of AA :ui = A vi
Step 8: Remain only K Eigen Vectors (corresponding to the K largest Eigen values).

---

b) Testing Module

Agreed an unidentified image G,
Step 1: Compute: ϕ= ⌈Ψ

Step 2: Compute: ϕ' = -⌈Ψ

Step 3: Calculate e^d= ϕ ⌈ ϕ' |

PCA algorithm is using for feature extraction like identify the unique properties. Genetic Algorithm is using for optimize the best solution in hand gesture recognition system and Classification Further Explain in other Paper.

b) Genetic Algorithm:

Genetic algorithm is computer programs that simulator the processes of natural evolution in order to solve difficulties and to model evolutionary systems. Different types of three operators:

- The collection operator selects those genes in the populace that will be sanctioned to replicate, with better genes produce on average more mechanism than less ones.
- Intersect interactions subparts of two genes, approximately imitating biological recombination connecting two single-genes organisms;
- Mutation casually changes the allele values of some positions in the chromosome; and transposal reverses [13] the order of a connecting section of the chromosome, thus re-arranging the order in which genes are organised.

DOI: 10.13140/RG.2.1.3186.6481

c) SVM for Classification

SVM it is a novel division of education machine which use support vectors and kernel for knowledge. The most important part machines [14] supply a structure which can be adapted to dissimilar tasks and domains by choose proper kernel purpose. The main idea of SVM is that; it finds the most favourable separating hyper smooth such that error for unseen decorations is minimized. Consider the problem of separating the set of training vectors belonging to two divide classes.

IV. RESULT ANALYSIS

The datasets used in object classification are presented. The datasets can be divided in three groups: Hand images and the implementation will takes place in MATLAB 7.10 environment using various parameters like FAR, FRR, Accuracy. Various parameters can be defined as following:

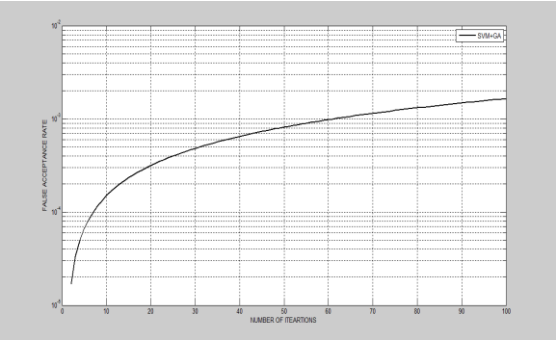

Fig 2: False Acceptance Rate

FAR normally is assured as the relation of the number of copied acceptances separated by the numeral of classification attempt. Same here, we plot a graph which uses the FAR parameter for the proposed approach.

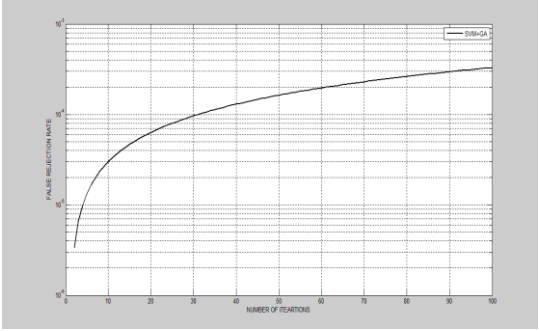

Fig 3: False Rejection Rate

FRR normally is fixed as the relation of the numeral of copied rejections alienated by the number of detection attempt. Above figure shows the charge of FRR for proposed approach.

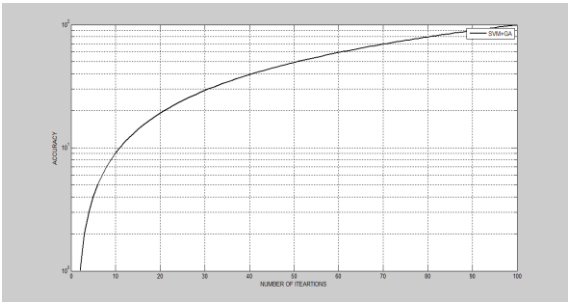

Fig 4: Accuracy

Accurateness is how secure a calculated value is to the authentic (true) charge. Above figure shows the accuracy value for proposed method and it has been clearly seen that accuracy for proposed method is good.

Table.1: Proposed Parameters Values

Cat no.	Far	Frr	Accuracy
Cat 1	0.0001649	1.754	97.89
Cat 2	0.000227	5.54	98.67
Cat 3	0.0005163	6.982	96.78
Cat 4	0.0006712	0.000234	96.89
Cat 5	0.0006433	0.000268	97.89
Cat 6	0.002015	0.0001031	98.89
Cat 7	0.0021	0.00014	97.99
Cat 8	0.00013	0.0001719	98.98
Cat 9	0.002532	0.0002063	98.89
Cat 10	0.0001704	0.0023408	97.99

V. CONCLUSION

The hand gesture recognition system that is considered is tested with different gestures and is able to categorize it correctly. The input image to be confidential during testing phase has to be taken at same distance as that of training phase. The system is able to productively classify the hand gesture on behalf of number and the system can be further extended to recognize alphabets, expressions, etc. A new technique is planned to increase the accuracy of gesture recognition system using Support Vector Machine, GA and PCA. We have compared proposed method with previous implemented method. From the results, it has been clearly

DOI: 10.13140/RG.2.1.3186.6481

seen that results for proposed method are good in comparison to old method.

In future Scope, the results can be improved using BFO instead of Back propagation neural network and Support Vector Machine. In future instead of offline recognition system an online recognition system can be designed. Dynamic images in background independent environment can be used.

VI. REFERENCES

[1]. Dardas, Nasser H., and Emil M. Petriu. "Hand gesture detection and recognition using principal component analysis." Computational Intelligence for Measurement Systems and Applications (CIMSA), 2011 IEEE International Conference on. IEEE, 2011.

[2]. Swapna, Bhavsar, FutanePravin, and V. Dharaskar Rajiv. "Hand gesture recognition system for numbers using thresholding." Computational Intelligence and Information Technology. Springer Berlin Heidelberg, 2011. 782-786.

[3]. Lamberti, Luigi, and Francesco Camastra. "Real-time hand gesture recognition using a color glove." Image Analysis and Processing–ICIAP 2011. Springer Berlin Heidelberg, 2011. 365-373.

[4]. Reddy, K. Sivarajesh, P. SwarnaLatha, and M. RajasekharaBabu. "Hand Gesture Recognition Using Skeleton of Hand and Distance Based Metric."Advances in Computing and Information Technology. Springer Berlin Heidelberg, 2011. 346-354.

[5]. Suarez, Jesus, and Robin R. Murphy. "Hand gesture recognition with depth images: A review." RO-MAN, 2012 IEEE. IEEE, 2012.

[6]. Kim-Tien, Nguyen, Nguyen Truong-Thinh, and Trinh DucCuong. "A Method for Controlling Wheelchair Using Hand Gesture Recognition." Robot Intelligence Technology and Applications 2012. Springer Berlin Heidelberg, 2013. 961-970.

[7]. Premaratne, Prashan, et al. "Dynamic Hand Gesture Recognition Framework." Intelligent Computing Methodologies. Springer International Publishing, 2014. 834-845.

[8]. Teimourikia, Mahsa, et al. "Personalized Hand Pose and Gesture Recognition System for the Elderly." Universal Access in Human-Computer Interaction. Aging and Assistive Environments. Springer International Publishing, 2014. 191-202.

[9]. Rautaray, Siddharth S., and AnupamAgrawal. "Vision based hand gesture recognition for human computer interaction: a survey." Artificial Intelligence Review 43.1 (2015): 1-54.

[10]. Jalab, Hamid A., and Herman Omer. "Human computer interface using hand gesture recognition based on neural network." Information Technology: Towards New Smart World (NSITNSW), 2015 5th National Symposium on. IEEE, 2015.

[11]. Zhou, Yimin, et al. "Hand Gesture Recognition Based on the Parallel Edge Finger Feature and Angular Projection." Computer Vision-ACCV 2014 Workshops. Springer International Publishing, 2014.

[12]. Justina, J. P., and SangeethaSenthilkumar. "A Survey Analysis on: Vision-Based Hand Gesture Recognition." International Journal 4.1 (2014).

[13]. Wu, Chih-Hung, Wei-Lun Chen, and Chang Hong Lin. "Depth-based hand gesture recognition." Multimedia Tools and Applications (2015): 1-22.

[14]. Sharma, Ram Pratap, and Gyanendra K. Verma. "Human Computer Interaction using Hand Gesture." Procedia Computer Science 54 (2015): 721-727.