Scheme for Single-Hand Gestures of Sattriya Dance based on Two-Level Classification

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***Abstract*: Indian classical dance's single-hand movements are called 'Asamyukta Hastas' which is a combination of two Sanskrit phrases, asamyukta meaning 'single' and 'hand gestures. This paper introduces a simple two-level classification method for Sattriya dance asamyukta hastas which is an Indian classical style of dance. Twenty nine grades of hastas in the first level are grouped into three categories based on their structural similarity. And in the next step hastas within the category are identified separately from the database. The proposed approach extracts the Medial Axis Transformation (MAT) from the images captured to classify first level classes. One of the applications of this research work's outcome could be the e-learning and self-learning of the dance hand movements (mudras or hasta). Here we are proposing the identification of some more distinguishing features from these Hastas to improve the recognition accuracy.**

***Index Terms*: Asamyukta Hastas, Medial Axis Transformation (MAT), Indian classical dance's, 'hand gestures, Sattriya dance**

I. INTRODUCTION

Sattriya dance had its roots in Assam state. It is one of the common styles of dance among the 8 types of Indian Classical Dance. Many hand movements are used in this classical dance, most of which are identical to other classical dances performed by male and female dancers. In Karuna Borah's book 'Sattriya Nrittyar Rup Darshan'[1] it is stated that around 29 single-hand gestures and 47 double-hand gestures are used to perform Sattriya dance. The single-hand gestures are known as Asamyukta hastas and double-hand gestures are divided into two parts: samyukta hastas and hastas nrittya. This paper focuses on classifying single-hand movements. The main objective of this paper is to introduce a two-level classification system that can better identify the hand gestures. Support Vector Machine (SVM) is used in the first level to classify an unknown before image into one of three classes, and in the second level Decision Tree classifier it is used to identify the up within the group.

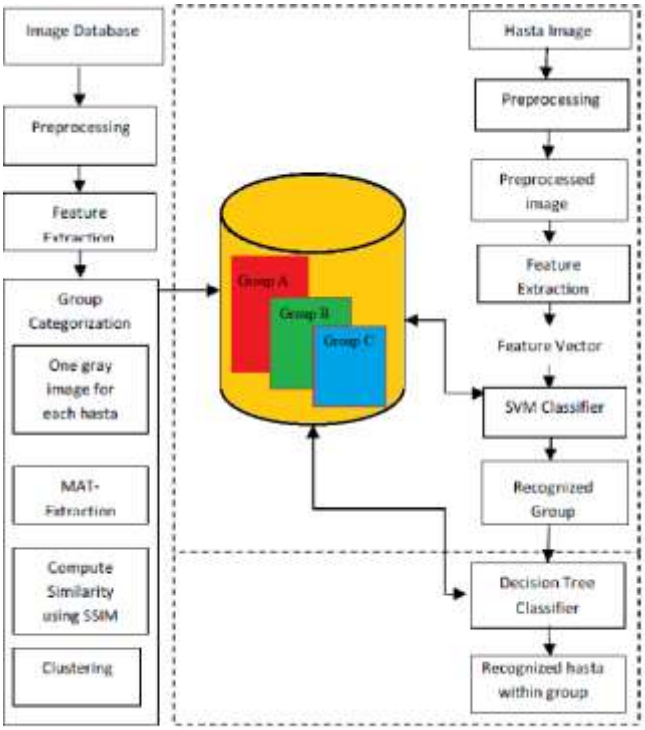

Fig. 1 Proposed System

II.RELATED WORK

[1] K. Borah, "Sattriya Nrityar Rup darshan," Grantha-Sanskriti Tarazan, Jorhat, pp. 113-135, 2009 Datasets are important for validation of any method or technique. The effectiveness of a method or technique can be well judged using an unbiased, complete and correct dataset. This paper presents a novel dataset to support validation of any computer vision method for recognition of Sattriya dance hand gestures, a fifteenth-century major Indian classical dance of the state of Assam. The dataset fulfils all the major requirements and has been established using five well-known classifiers.

[2] S. Mitra and T. Acharya," Gesture recognition: A survey," IEEE Transactions on Systems, Man, and Cybernetics, Part C, Applications and Reviews, vol. 37(3), pp. 311-324, 2007 Gesture recognition pertains to recognizing meaningful expressions of motion by a human, involving the hands, arms, face, head, and/or body. It is of utmost importance in designing an intelligent and efficient human-computer interface. The applications of gesture recognition are manifold, ranging from sign language through medical rehabilitation to virtual reality. In this paper, we provide a survey on gesture recognition with particular emphasis on hand gestures and facial expressions. Applications involving hidden Markov models, particle filtering and condensation, finite-state machines, optical flow, skin color, and connectionist models are discussed in detail. Existing challenges and future research possibilities are also highlighted.

[3] M.Hasan and P. K. Mishra, "Hand gesture modeling and recognition using geometricfeatures:Areview,"CanadianJournal onImageProcessingand Computer Vision, vol. 3(1), pp. 12-26, 2012 The use of the gesture system in our daily life as a natural human-human interaction has inspired the researchers to simulate and utilize this gift in human-machine interaction which is appealing and can take place the bore interaction ones that existed such as television, radio, and various home appliances as well as virtual reality will worth and deserve its name, this kind of interaction ensures promising and satisfying outcomes if applied in systematic approach, and supports unadorned human hand when transferring the message to these devices which is more easiest, comfort and desired rather than the communication that requires frills to deliver the message to such devices, the gesturing is also important between human-human interaction especially with hearing impaired, deaf and mute peoples, in this study, we have presented different researches that done in this area regarding the geometric features which considered as a live features compared with non-geometric features which considered as blind features, and we have focused on the researches gathered to achieve this important link between human and his made machines, also we have provide our algorithms for overcome some shortcomings existed in some mentioned algorithms in order to provide a robust gesture recognition algorithm that does not have a rotation hinder which most of current algorithms have.

[4] M. Devi, S. Saharia and D.K. Bhattacharyya, "Dance Gesture Recognition: A Survey," International Journal of Computer Applications, vol. 122(5), pp. 19-26, 2015Gesture recognition means the identification of different expressions of human body parts to express the idea, thoughts and emotion. It is a multi-disciplinary research area. The application areas of gesture recognition have been spreading very rapidly in our real-life activities including dance gesture recognition. Dance gesture recognition means the recognition of meaningful expression from the different dance poses. Today, research on dance gesture recognition receives more and more attention throughout the world. The automated recognition of dance gestures has many applications. The motive behind this survey is to present a comprehensive survey on automated dance gesture recognition with emphasis on static hand gesture recognition. Instead of whole body movement, we consider human hands because human hands are the most flexible part of the body and can transfer the most meaning. A list of research issues and open challenges is also highlighted.

III.PROPOSED SYSTEM

However, no research works on recognition of Sattriya dance gestures are reported in the literature. So in our proposed system Sattriya danace gestures recognition is introduced. The basic steps involve for any hand gesture recognition system are preprocessing, feature extraction and classification. The main purpose of this two blevel classification system is to get better recognition accuracy.

IV. METHODOLOGY

A. **Preprocessing** This step is an important step to do any further processing. In this method, the preprocessing step is done in two sub steps: background removal and Gaussian filtering. Background removal is done by using GMM on RGB images. Then, a Gaussian filter approach has been used to make the images smooth and noise free.

B. **Feature Extraction** The main aim of feature extraction is to transform the input image into set of numeric values which is also known as feature vector. The extracted features are used to find out the meaning of gestures. In this paper, geometrical features like centroid, eccentricity, orientation, bounding box, major axis length, minor axis length, aspect ratio and perimeter are used. These features are found out by using feature vector region props techniques.

C. **Grouping** Similar Hastas This section mainly focuses on the group categorization. To classify the hasta images in the database into three groups, the following steps are performed. • Take one image for each type of hasta. • Extract the Medial Axis Transformation (MAT) for each image. • Apply Structural Similarity Index Method with window size 11X11. • Create 29X29 similarity matrix and covert into distance matrix. • Apply hierarchical agglomerative clustering algorithm on distance matrix. • Draw a complete linkage dendrogram for clustering. • Cut at threshold point as per requirement of number of group. The above steps are carried out in order to classify the twenty nine images into three groups.

D. **Classification** In this phase, the two level classification methods is described as shown in Fig 1. Here, the input image is first preprocessed and then sent to the feature extraction step. The output of this step gives the feature vector centroid, eccentricity, orientation, bounding box, major axis length, minor axis length, aspect ratio and perimeter. These values of feature vector are then compared with those in the database. The group with which the input image matches the most is returned as the output of this step. Support Vector Machine is used for this first level classification. The SVM classifier is used as it gives better result compared to other classifiers. Similarly, decision tree classifier is used at the second level as best results are observed with this classifier at this level. In this level, the classification is narrowed down to the group to which the image matches the most as identified in the first level classification. And with the help of decision tree classifier the image is classified within its relevant group.

V. EXPERIMENTAL RESULTS

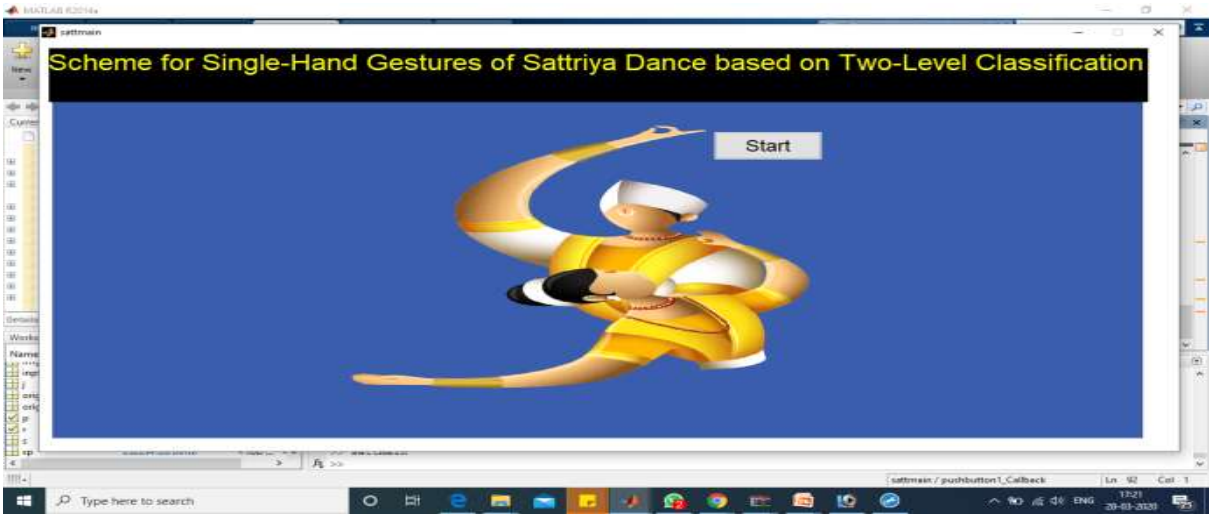

Fig 2:Home Screen

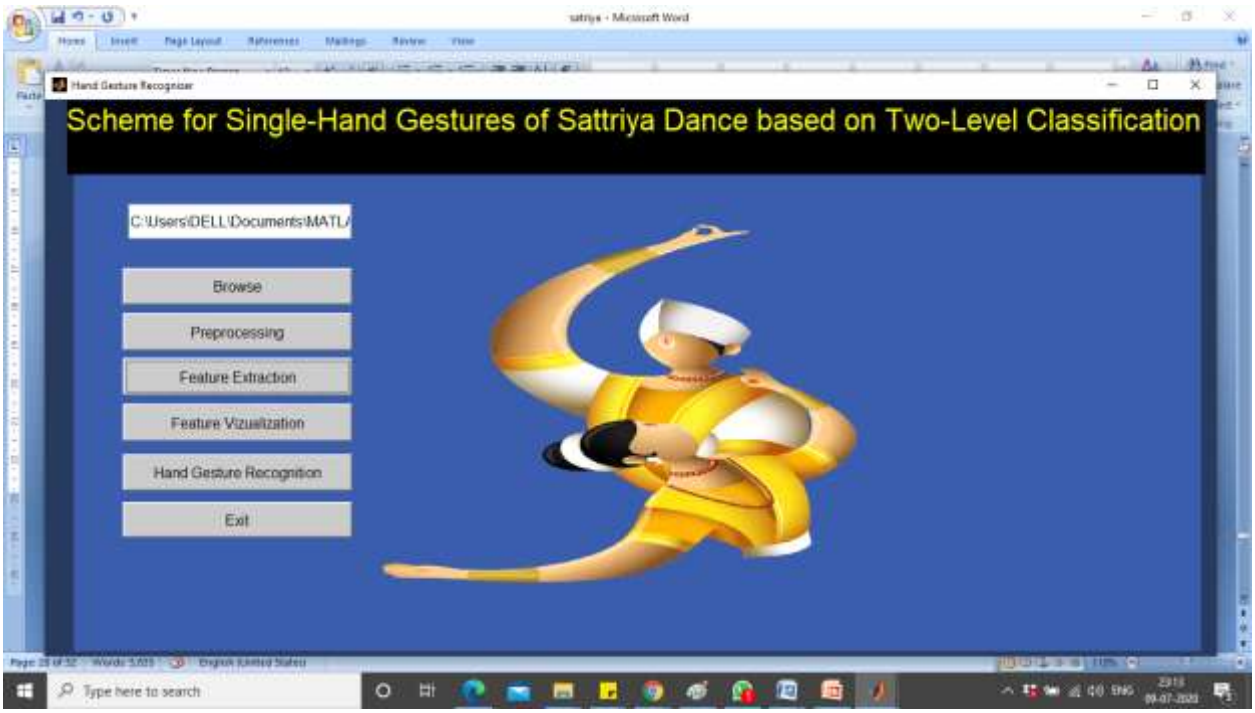

Fig 3: Menu

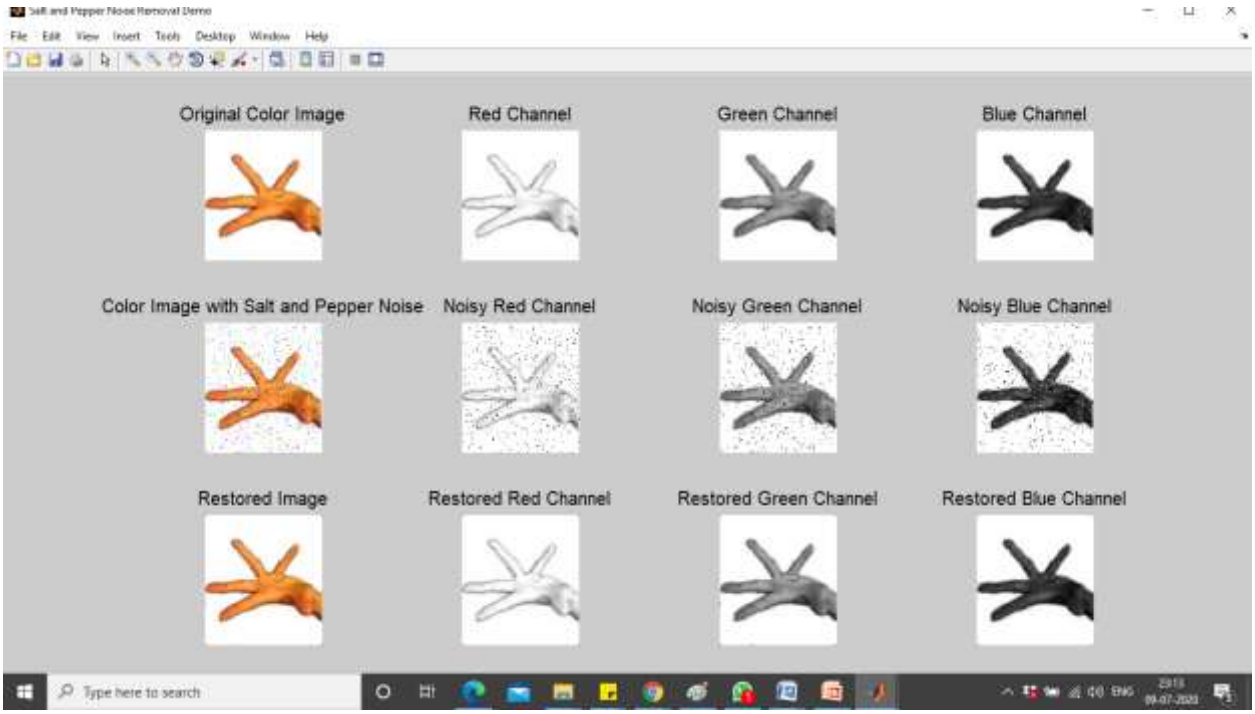

Fig 4: Preprocessing

Preprocessing involves removal of noise from the images of input hastas and segmenting the image to extract the hasta image from the background. Some existing techniques will be used in this step.

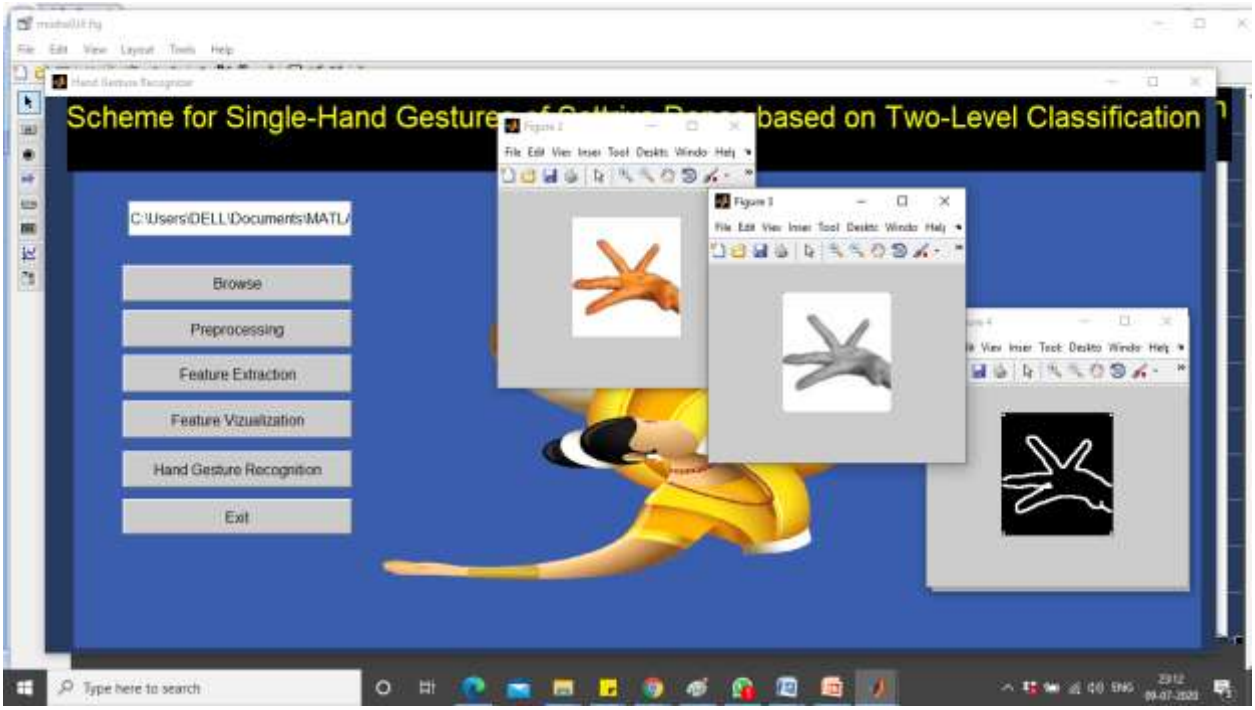

Fig 5: Feature Extraction

Extraction of invariant features from the preprocessed image to represent the hastas.

VI. CONCLUSION

A two-level classification system for the identification of Sattriya dance single-hand movements (asamyukta hastas / mudras) is proposed in this paper. At the first point, an unknown up of Sattriy a dance is classified into one of the three groups using multiple vector machines supporting. At this level, the observed recognition accuracies are 71.54%, 75.29% and 79.51% for group A, Group B and Group C respectively. The average recognition accuracy obtained at the second level is 75.45%. The recognition accuracy at second level is not very encouraging. The reason may be that most of the asamyukta hastas are very similar to each other and therefore are chances of misclassification is very high. We will focus more on the identification of some more distinguishing features from these Hastas to improve the recognition accuracy.

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