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Feature Analysis using Spiking Neurons with Improved PCA appoach for Hand Gesture Recognition

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Abstract

Gesture recognition allows a computing device to mathematically present human motion. Recognizing gestures makes communication more natural and providing them as an input makes computers more accessible for the physically-impaired. Our work focuses on hand gesture recognition. The presented work is about to recognize the hand gesture by using the concept of spiking neuron approach and PCA approach. The presented work is divided in two main stages. In first stage, the hand gesture image analysis is performed and the feature set is generated. To generate this feature set, spiking neuron approach is applied over the image. This approach is based on the segmented centroid oriented analysis approach so that effective detection of the ROI area and intensity over the area will be identified. This obtained feature set is represented in the form of a neuron curve. The spiking neurons are used for feature extraction. At second stage, the spiking neuron curve for the training dataset and testing input image is classified using PCA approach. Based on this classification process, the prediction value of input image is identified. Now the match of this predicted value is performed with input image. The hand gesture image having the maximum match is considered as the result image.

Keywords: Hand Gesture Recognition, Spiking Neurons, Region of Interest, Feature Extraction, Boundary Identification, Principal Component Analysis

1. INTRODUCTION

The identification of the hand gesture recognition based on some defined classes is a challenging task. These kinds of systems are used to read or identify the person hand activity to define some meaningful task or words. The complexity of the work is also increased as the number of classes of hand gesture increases based on which the recognition and the classification work will be performed. The recognition task is comprised of two major image processing approaches called the recognition and the classification approaches. The recognition approach is basically a process which is used to match the input image in the dataset and to find the similar dataset image. Once the dataset image is identified, the next work is to identify the class of the image. In this present work, we have defined the human activity recognition under six classes. In this work, a hybrid model is represented to perform the recognition and the classification. To perform the recognition, the spiking neuron based object analysis will be done and later on the classification will be performed on these neurons using PCA based approach. The presented model will be performed on the digits dataset to identify the digits form by using the hand. We will implement our work in Matlab environment. The basic model for the work flow is shown in figure 1.

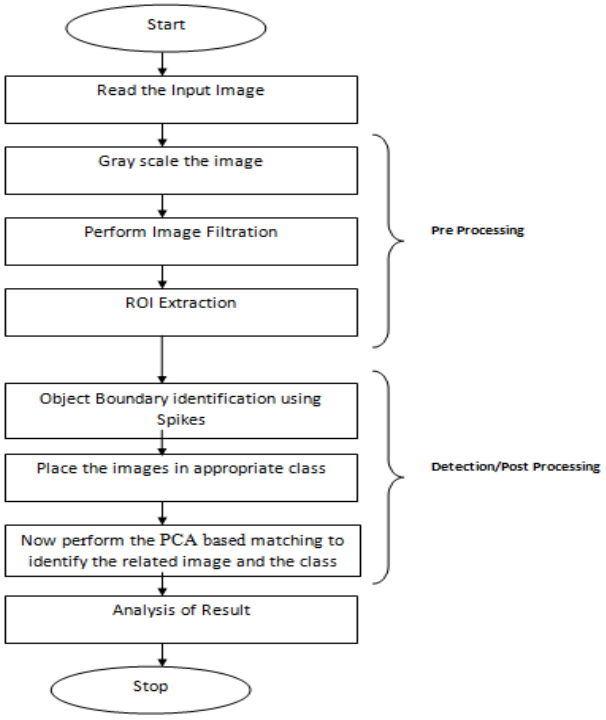

Fig.1: Work Flow

2. LITERATURE SURVEY

Ioana Sporea [1] presented Supervised Learning in Multilayer Spiking Neural Networks. The current article brings out a supervised learning algorithm for multilayer spiking neural network. Here the algorithm overcomes the limitation of existing algorithms as it can be applied to neuron firing multiple spikes. By identifying the limitations of algorithm, the author defined the spiking neuron model that can be used for recognition. Qiang Yu [2] presented a Pattern Recognition Computation approach based on Spiking Neural Network with Temporal Encoding and Learning. For pattern recognition, the author brings in a spiking neural network of integrate and fire neurons. As author introduces the integrated recognition model using firing neurons, which

improves the recognition rate and analysis can also be done. Kshitij Dhoble [3] presented Online Spatio-Temporal Pattern Recognition with Evolving Spiking Neural Networks utilizing Address Event Representation, Rank Order, and Temporal Spike Learning. The author presents a new Essen model dynamic Essen (design) that utilizes both rank order spike coding (ROSC), likewise known as time to first spike, and temporal spike coding (TSC).The learning model which is defined by author under plasticity analysis so that artificial intelligence will be applied for effective object recognition. Soumitra Samanta [4] presented Detection and Description of Space-Time Interest Points is a new method for Human Activity Classification. The analysis approach described by the author in which author performs efficient object identification and activity recognition. For efficiently detecting the interest points over the video, the author defined a space time based approach. For generalized identification, the author described human activity approach. Yan Meng presented Human Activity Detection using Spiking Neural Networks Regulated by A Gene Regulatory Network.[5**]** for effective object classification and recognition , the author described spiking neuron model. The neuro modulation effective model described by author for object generation and recognition for gene network generation and object recognition, the author explained the weight specification and analysis approach. Matthias Oster presented A Spike-Based Saccadic Recognition System **[6**] under the multi neuron classifier the author has explained the neuron based recognition process.The system with effective recognition process has been enhanced by author. Susumu Nagatoishi [7] presented Effect of Refractoriness on Learning Performance of a Pattern Sequence**.** The approach which is used for recognition of hand object is sequence analysis and for efficient object recognition, the author produced neuron sequence model. For best recognition rate, the author described a layered scheme for correlation identification and activity analysis.

3. OBJECTIVES

The following milestones are required to achieve in this proposed work.

1. Maintain a Database of hand gesture images.
2. Define a spiking neuron based approach to perform the object identification
3. Define a PCA based approach to perform the Recognition and the class identification based on distance analysis.
4. Performing the analysis using Graph

4. RESEARCH METHODOLOGY

In this paper, a new methodology for hand gesture recognition is proposed to identify various types of hand postures from the collected database. To identify a particular image and class, a hybrid model is presented in which the concept of spiking neurons will be used with PCA approach. There are mainly three basic components associated with this approach: Input Image, Image Data Set and Recognition process. As we have collected images from different sources, so their properties differ from each other for the defined attributes. To improve the similarity ratio of these properties, some preprocessing operations need to be carried out before passing the images through the recognition process. This pre-processing stage is defined to measure the correctness of the system. In short, the preprocessing operations will be performed to achieve better efficiency and accuracy in order to improve the effectiveness of the system. And to measure the reliability of the system, a post processing stage is defined. There are two factors which contribute to the reliability of the system. The matching ratio is one of the two factors that is used for correct character identification. A more challenging task is to detect hand gesture across a large dataset than with a fixed view, e.g. frontal view, owing to the significant non-linear variation caused by rotation in depth, self-closure and self-shadowing. The partitioning of view area is done into several small sections. A face detector is constructed on every segment. For the classification of input image in the form of relational images, a classification approach will be used. All the co related images will be maintained as a single class. Once the dataset is maintained the next step is to perform the matching process.

There are three stages which will be used for performing the hand gesture recognition.

- Preprocessing
- Neuron Generation
- Recognition

4.1 PREPROCESSING

The preprocessing work includes the conversion of the image to the normalized image as well as to extract the features from the image. The filtration process includes the adjustment of brightness, contrast, etc. Once the filtration process is done the normalized image can be used for the further process. Figure 1 show the steps involved in preprocessing stage.

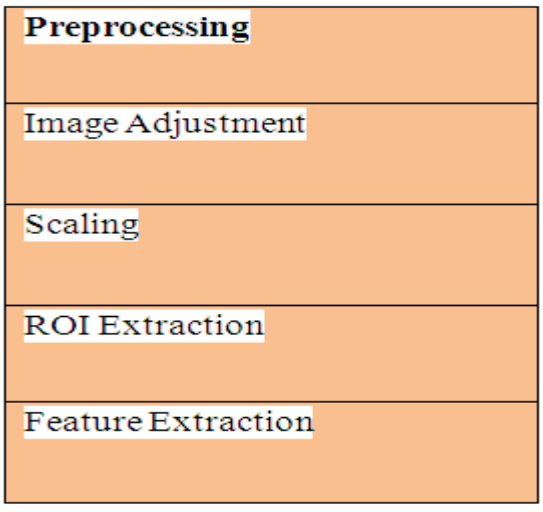

Fig.1: Preprocessing Steps

4.2 NEURON GENERATION

Another task is performed on the available database. The spiking neurons are used to identify the boundary points over the hand gesture objects. The actual match will be performed on these spikes. Again, we have to generate a class oriented dataset for the hand gesture images. This spiking neuron approach will be used for feature detection over the image set. This methodology is based on the area identification. The next step after area identification is the intensity based analysis over the segment. On the basis of this analysis, the spiking neuron curve will be generated. This spiking neuron approach will be provided as an input dataset. After the generation of feature dataset, recognition will be performed. We will be performing recognition through PCA approach. The methodology defined in figure 2 will be used to perform the presented work.

4.3 RECOGNITION

Third and the final process is to perform the match i.e. recognition process. The match is performed on the dataset images. PCA approach will be used for the recognition purpose.

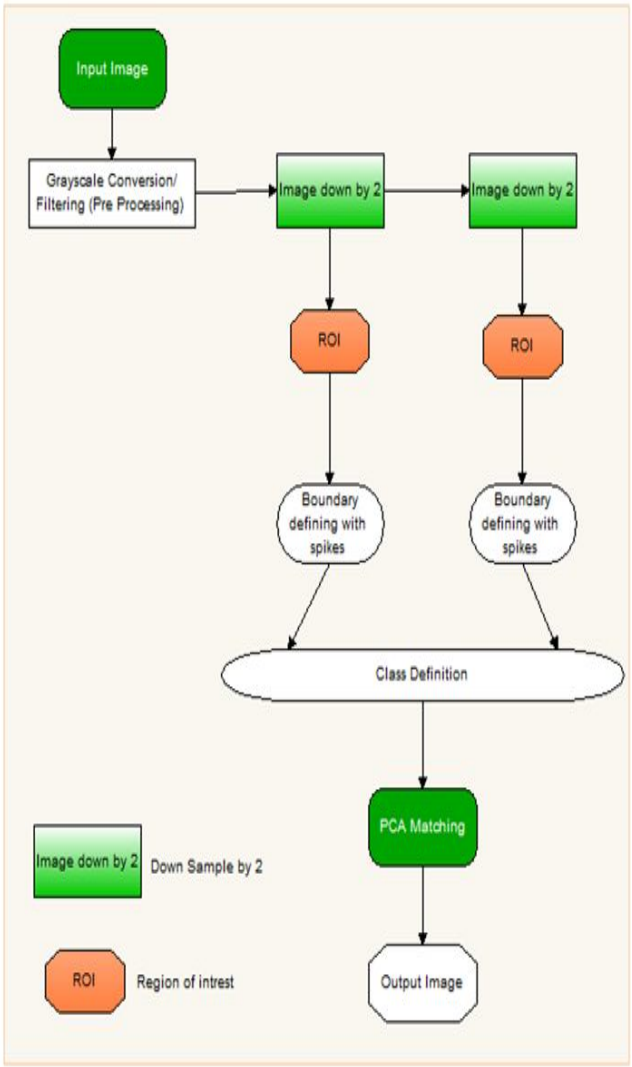

Fig.2: Flow Sequence of the Proposed Design Methodology

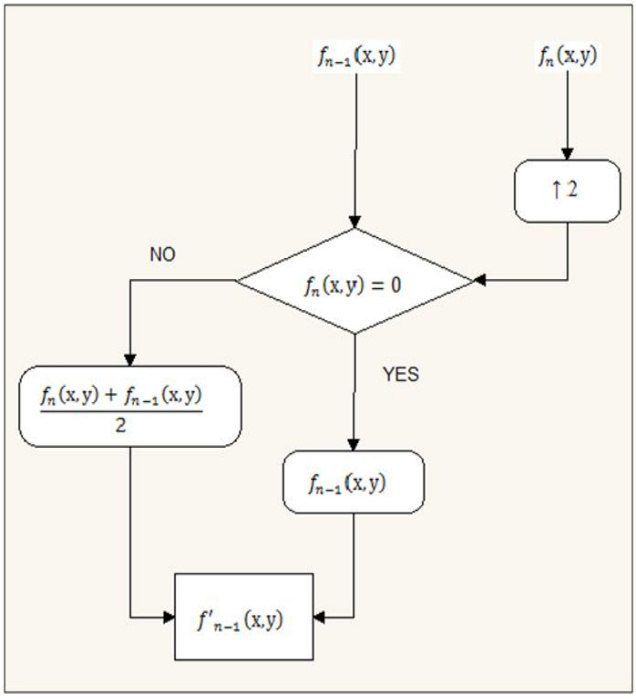

Fig. 3: Flow Chart for Obtaining Segmented image

5. CONCLUSION AND FUTURE WORK

In the presented work, a new feature extraction approach using spiking neurons is proposed for hand gesture recognition. ROI segmentation will be used for boundary identification. The proposed work is shown with flow structure of the whole process which shows that the extraction and segmentation based on spiking neurons would be an effective process to carry. We will be working on hand gesture recognition. For this purpose we will use segmentation as a preprocessing step for feature extraction. To recognize hand gestures, we will develop an improved feature analysis approach in which spiking neurons will be used for enhancing the accuracy of recognition. The spiking neurons are represented in the form of neuron curve and will be considered as main innovation in gesture recognition process. In future we will implement this proposed model in Matlab Environment and will show that the results are better for recognition in comparison to existing approach recognition. The spiking neurons are represented in the form of neuron curve and will be considered as main innovation in gesture recognition process. In future we will implement this proposed model in Matlab Environment and will show that the results are better for recognition in comparison to existing approaches.

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