Research Methodology on Modified RBF Neural Networks for Pattern Recognition

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Abstract
This research review paper discusses about a systematic research methodology on Modified RBF Neural Networks for Pattern Recognition.

Keywords
Pattern Recognition, Neural Networks, Modified RBF.

I. INTRODUCTION

Machine recognition by human beings from still and video images has become a very important and vigorous area of research in the communities of image processing, pattern recognition, neural networks and computer vision. Image recognition is one of the most extraordinary abilities of human vision. The core and central part of the image research is classification and extracting.

Although image recognition by human beings and computer machines are developed, it is still challenging to design an automatic system for the given task. The reason is that illumination, complex background, visual angle and variation expression for images are highly variable in the real world. Several techniques have been proposed for image detection including graph matching, neural networks and geometric features. Even though researchers of Psychology, Neural Sciences, Engineering, Image Processing and Computer Vision have investigated a number of issues related to image recognition by human beings and machines, still there is need to design an automatic system for this task, especially when real-time identification is required. The reasons for these difficulties are: 1.Images are highly variable and 2.Sources of variability includes individual appearance, three-dimensional variation expression, variation hair, makeup, and so on and these issues change from time to time. In addition, the lighting, background, scale, and parameters of the acquisition are all variables in variation images acquired under real-world situations. The variations between the images of the same image due to illumination and viewing direction are almost always larger than image variations due to changes in the image uniqueness. This makes image recognition as a difficult problem. Pattern recognition is an important area of image processing and research in this area will be useful in solving problems in medical image processing, automated object recognition, information retrieval, automated object recognition etc [2]. Pattern recognition is an approach of categorizing/classifying a given image from large data set; the efficiency, estimation accuracy and computational speed lies in the algorithm used for processing, categorizing/classifying, recognition. A variety of approaches were proposed in the literature to recognize a query image based on the content information of the image using non-learning and learning methods [3].

In the current Pattern Recognition System, learning methods were pre-dominantly in use than direct map methods. The Direct mapping process is lower on correctness and it is highly time consuming. Adaptive learning methods were used for faster and accurate image recognition [4]. In the field of image classification, several neural networks are proposed to image classification in the last few years. Artificial neural networks are models which can solve linear and nonlinear problems. The best suitable learning algorithm is the back-propagated feed forward Neural Network (NN) [10]. This algorithm requires more time for both learning as well as testing. Hence image classification algorithms should require less time to process and its accuracy should be more. Two important steps in the classification process are train the data and another one is train the methods using parametric and non parametric. There are two main questions in image recognition and they are: 1.What features can be used to represent an image under environmental changes? 2. How to classify a new image based on the chosen representation?

The first step in the classification is feature extraction process, in the existing content-based image retrieval systems the most common features are Color, Shape, and Texture [5]. In Color features, extract the mean value of each of the color spaces are chosen as color features. In the Texture Features, extract the feature in both spatial domain and transform domain. Variance, Coefficient of Variation, Energy and Entropy features computed in the spatial domain. These four features from each color space are taken as texture features in the spatial domain. In the transform domain consider the wavelets transformation to decompose an image into sub-bands at various scales and frequencies which is useful to detect edges with different orientations.

This research focuses on identification of different existing and new ways of extracting features of natural images. The main aim is to provide a method for

recognizing and classifying natural images using Modified Swarm Optimization RBF model.

The main objectives of this work is

- To develop two novel methods Particle Swarm Optimization (PSO) and Modifiedi Swarm Optimization Radial Basis Function Neural Network in the image retrieval process for the calculation of weights and bias values.
- To demonstrate that proposed methods perform better than the existing and traditional methods
- To prepare the training and test data from the Corel image database
- To extract the features like Color, Shape, and Texture by using training data.
- To implement the traditional Radial Basis Function Neural Network (RBFNN) for above different training sets and accuracy evaluation.
- To analyse and implement Centroid using K-Means clustered algorithm.
- To summarize the analysis of accuracy for the above proposed algorithms.

II. LITERATURE SURVEY

The main step in the classification is the methodology to find the similarity. Over past several years different methodologies are proposed in the image retrieval process. In those methodologies one of the most important one is Neural Networks, it can solve different types of the nonlinear problems in image classification and retrieval process. In the Neural Network, one of the most popular and traditional algorithm is Back propagation (BP) Algorithm. The Idea behind BP algorithm is quite simple, that is the output of Neural Networks is evaluated against desired output [10]. If results are not satisfactory, connections (weights) between the layers are modified and this process is repeated again and again until error is small enough. New implementation of BP algorithm is emerged and there are few parameters that could be changed to improve performance of BP. Back propagation is an iterative process that can often take a great deal of time to complete, because of complexity of the hidden layers. Radial Basis Function (RBF) Networks consisting of a single hidden layer of locally-tuned units which is fully interconnected to an output layer of linear units. Sums of radial basis functions are typically used to approximate given functions. The following Figure 1 represents RBF network. This is consisting of three layers they are, input layer, hidden layer and output layer.

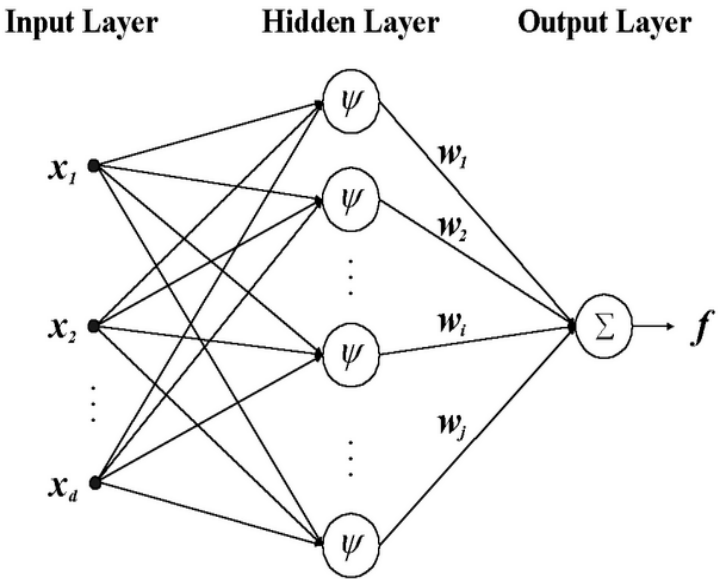

Fig 1: Traditional Radial Basis Function Network outline

This approximation process can also be interpreted as a simple kind of neural network. RBFs are also used as a kernel in support vector classification. RBF networks have strong tolerance to input noise, which enhances the stability of designed systems. Therefore, it is reasonable to consider RBF network as a competitive method of nonlinear controller design. But in RBF the main problem is equal importance is given to all input parameters. RBF networks act as local approximation networks and the network outputs are determined by specified hidden units in certain local receptive fields, while BP networks work globally and the network outputs are decides by all the neurons. It is characterized by single best approximation, only local minimum, less calculation and fast learning, and is widely applied to pattern classification, system identification and functional approximation.

RBF neural network design is dependent on three parameters. The first one is Centroid, normally it is one of the input data point and number of Centroids to be equal to number of hidden layer node in RBF [11]. In basic RBF Neural Networks Centroids are defined randomly using rand functions. The second parameter is Weights, Weights are in between hidden layer and output layer. It is defined using inverse matrix in basic RBF NN. Last parameter is Bias values, normally Bias values are in between -1 and 1, but in the basic RBF Bias values are defined as 1. Centroid definition shows more impact on results when it is randomly defined. In this research used K Means algorithm for defining Centroids for RBF, called K-Means RBF Neural Networks.

This research work is first proposed Particle Swarm Optimization RBF Neural Networks into image retrieval process using local minimum (pBest) and

global minimum (gBest). This is used to find weights and bias values of the RBF NN [12]. Particle Swarm Optimization (PSO) is a recently developed numerical method for optimization, which is simple, easy to apply and has a strong smart background, and it has been used in many fields such as function optimization, and pattern recognition. PSO algorithm in the training of RBF neural network, proposed PSO-RBF neural network method. Particle Swarm Optimization algorithm is used to proceed global dynamic searching. PSO uses only one Swarm. Swarm is a collection of particles [14]. In this results are depend on a large extent on the starting position of the particles. PSO is used for local optimization but it covers the small area only. In the next step of this research introduced a new method called Modified Swarm Optimization RBF Neural Networks to overcome the PSO RBF Neural Networks performance issues.

The proposed Modified Swarm Optimization uses several swarms of particles rather than a single swarm [15]. This approach helps to overcome the sensitivity to initial positions. This is very robust and one of the most advanced numerical optimization algorithms. At the same time, Modified Swarm Optimization updates positions by following multi-gbest and multi-pbest instead of single gbest and single pbest [16]. Finally, this research shows that accuracy of classification of images is improved using Modified Swarm Optimization RBF Neural Networks.

III.PROPOSED METHODOLOGY

This research analysis proposes to improve the accuracy of the image extraction process using the Radial Basis Function Neural Network, K-Means RBF Neural Network, Particle Swarm Optimization Radial Basis Function Neural Network and Modified Swarm Optimization Radial Basis Function Neural Network. The heart of the research is to improve the image extraction for large data sets using advanced RBFNN. Radial Basis Function Neural Network is constructed using basic functionality.

This research analyzed in different design of the Radial Basis Function Neural Network using K-means, PSO and Modified particle swarm optimization.. The training phase used different data sets. Basically four types of Radial Basis Function Neural Network were performed in that two of them are novel methods for Image extraction process.

- Radial Basis Function Neural Network
- K-Means RBF Neural Network
- Particle Swarm Optimization RBF Neural Network
- Modified Swarm Optimization RBF Neural Network

IV.CONCLUSION

This research review paper discusses about a systematic research methodology on Modified RBF Neural Networks for Pattern Recognition. Further work includes validations and results on proposed research methodology on the specified theme.

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