Performance Analysis of Artificial Neural Network and K Nearest Neighbors Image Classification Techniques with Wavelet features

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ABSTRACT
The classification process of image plays vital role in computer vision and many multi-mediums and dominated image analysis process. The increasing rate of multi-media data increase the utility of content based image classification. Content based image classification used in different field such as multimedia search in online application, automatic medical diagnose ,video classification and annotation and many more field in current scenario. The performance of content based image classification basically depends on lower content of features of image database. now a days in current research trend researchers focus on the high-level semantic investigation of the image content along with the visual content of the image such as colors, textures, and shapes. Feature selection and feature optimization play vital role in content based image Classification. The optimized feature of database image improves the searching capacity of content based image classification. In current research trend various method of feature selection and feature optimization are used such as particle of swarm optimization, genetic algorithm and neural network. In this paper we proposed a hybrid method for content based image classification, the proposed method is a combination of KNN and RBF function. The extracted feature is optimized with RBF function. The proposed method implements in MATLAB software and used coral image database. For the empirical evaluation used some standard parameter precision and recall. Our empirical result shows better performance in comparison of exiting methods.

Keyword: - Image Classification, KNN, RBF, SVM.

INTRODUCTION

In the context of today's scenario the use of digital technologies produces a lot of digital images. Large collections of images are becoming available to the public, from photo collection to web pages, or even video databases. Since visual media requires large amounts of memory and computing power for processing and storage, there is a need to efficiently index and retrieve visual information from image database [1]. In recent years, image classification has become an interesting research field in application. Efficient indexing and retrieval of large number of color images, classification plays an important and challenging role [2]. Digital images can be formed by a variety of devices like digital scanners, cameras, co-ordinate measuring machines, digital video recorders, digital synthesizers and airborne radars. Among the various media types, images are of prime importance. Not only it is the most widely used media type besides text, but it is also one of the most widely used bases for representing and retrieving videos and other multimedia information. Usually, images are automatically recorded in meaningless alphanumeric filenames [3]. Mostly, people attempt to manage their digital images by annotating them manually, but at the time of retrieval are very time consuming and often subject to individual interpretation. Alternative solution for this can be, the images can be archived in file system folders according to their semantics such as an event, a venue and a person of interest. During the time of searching, one has to visually scan through all the images in the collection manually, possibly by viewing them as a slideshow. The searching task is manageable when we have a small image collection. However, the vast amount of images has the problem of locating a desired image, especially in a large and varied collection [4]. Meanwhile, the large amount of images has the problem of locating a desired image, especially in a large and varied collection. Therefore commercial organizations, researchers and users are exploring new and compelling ways to access stored images [5]. In content based color image classification systems, images are usually represented by high-dimensional visual perceptive feature vectors, and the similarity between two images is defined by a distance function, e.g., Euclidean distance. Content based color image classification is usually implemented as searching the k images whose feature vectors are most similar to the feature vector of the query image, namely k-nearest neighbor (k-NN) searching [6]. The content based color image classification faces two severe challenges. The first one is that, there is no efficient indexing method for large-scale visual feature data represented by high-dimensional vectors. As the searching performance of content based color image classification systems descends sharply with the increase of the scale and the dimensionality of data. This problem is commonly known as the so-called curse of dimensionality. And the second one is that, the users of image searching engines generally expect to classify images with relevant semantic concepts, such as “tiger”, “football game”, and “building”. But the visual features of the images with relevant semantics may not locate closely enough in the corresponding feature space; even the images with similar visual features may come from different semantic classes. This is the gap between visual features and semantic concepts, i.e. the so-called semantic gap, which halter the precision of CBIC systems [7]. A traditional CBIC system automatically extract visual attributes (color, shape, texture and spatial information) of each image in the database based on its pixel values and then stores to them in a different database within the system called feature database. Consequently the feature data for each of the visual attributes of each image is very much smaller in size compared to the image data. The feature database contains an abstraction of the images in the image database; each image is represented by a compact representation of its contents like color, texture, shape and spatial information in the form of a fixed length real-valued multi-component feature vectors or signature [8]. The users usually prepare query image and present to the system. A DCD also plays an important role in image processing. DCD is the MPEG-7 color descriptors. DCD describes the salient color distributions in an image or a region of interest, and provides an effective, compact, and intuitive representation of colors presented in an image [9]. Although, DCD similarity matching does not fit human perception very well and it will cause incorrect ranks for images with similar color distribution. Section-II gives the information of about image classification principles process. In section III discuss the about Classification terminology. In section IV discuss the proposed method. In section V comparative result finally, in section VI conclusion and future scope.

II PRINCIPLES OF IMAGE CLASSIFICATION

Image classification is basically the task of classifying the number of images into (semantic) categories based on the available training data. The objective of digital image classification procedure is to categorize the pixels in an image into land over cover classes [10]. The output is thematic image with a limited number of feature classes as opposed to a continuous image with varying shades of gray or varying colors representing a continuous range of spectral reflectance [11]. The range of digital numbers in different bands for particular features is known as a spectral pattern or spectral signature. A spectral pattern can be composed of adjacent pixels or widely separated pixels. Digital image classification technique can generally be classified into two types: Unsupervised classification Techniques and Supervised classification Techniques [12]. Classification approaches deal poorly on content based image classification tasks being one of the reasons of high dimensionality of the feature space. A common approach to image classification involves addressing the following three issues: (i) image features: how to represent the image, (ii) organization of feature data: how to organize the data, and (iii) classifier: how to classify an image.

III CLASSIFICATION TERMINOLOGY

SUUPORT VECTOR MACHINES

For the classification of lower content of image we used support vector machine. A Support vector machine is linear and bilinear classifier [1]. Machine Learning is considered as a subfield of Artificial Intelligence and it is concerned with the development of techniques and methods which enable the computer to learn. In simple terms development of algorithms which enable the machine to learn and perform tasks and activities [2]. Machine learning overlaps with statistics in many ways. Over the period of time many techniques and methodologies were developed for machine learning tasks. Support Vector Machine (SVM) was first heard in 1992, introduced by Boser, Guyon, and Vapnik in COLT-92. Support vector machines (SVMs) are a set of related supervised learning methods used for classification and regression [3]. They belong to a family of generalized linear classifiers. In another terms, Support Vector Machine (SVM) is a classification and regression prediction tool that uses machine learning theory to maximize predictive accuracy while automatically avoiding over-fit to the data. Support Vector machines can be defined as systems which use hypothesis space of a linear functions in a high dimensional feature space, trained with a learning algorithm from optimization theory that implements a learning bias derived from statistical learning theory. Support vector machine was initially popular with the NIPS community and now is an active part of the machine learning research around the world. SVM becomes famous when, using pixel maps as input; it gives accuracy comparable to sophisticated neural networks with elaborated features in a handwriting recognition task. It is also being used for many applications, such as hand writing analysis, face analysis and so forth, especially for pattern classification and regression based applications. The foundations of Support Vector Machines (SVM) have been developed by Vapnik and gained popularity due to many promising features such as better empirical performance. The formulation uses the Structural Risk Minimization (SRM) principle, which has been shown to be superior to traditional Empirical Risk Minimization (ERM) principle, used by conventional neural networks. SRM minimizes an upper bound on the expected risk, where as ERM minimizes the error on the training data. It is this difference which equips SVM with a greater ability to generalize, which is the goal in statistical learning. SVMs were developed to solve the classification problem, but recently they have been extended to solve regression problems.

FEATURE DESCRIPTOR

A Feature Description is the core of the content based image classification. Feature Descriptor can be defined as the act of mapping the image from image space to the feature space. Although, finding good features that effectively represent an image is still a difficult task. A wide variety of features can be used for image retrieval from the database. Image content can differentiate between visual and semantic content. Features generally represent the visual content. According to the fact, raw image data that cannot be used directly in most computer vision tasks [12]. Traditionally two reasons behind this first one, the high dimensionality of the image makes it difficult to use the whole image. Another reason is that a lot of the information embedded in the image is redundant and/or un-useful. Therefore instead of using the whole image, only an expressive representation of the most important information should extract. The process of finding the expressive representation is called feature extraction and the resulting representation is called the feature vector.

VISUAL DESCRIPTOR

MPEG-7 visual standard is used to provide standardized descriptions of streamed or stored images or video-standardized header bits (visual low-level descriptors) that help users or applications to identify categorize or filter images or video [14]. As these low-level descriptors can be used to compare, filter or browse images or video purely on the basis of non-textual visual descriptions of the content or in combination with common text-based queries. They will be used differently for different user domains and different applications environments. Among this diversity of possible applications the MPEG-7 visual feature descriptors allow users to perform different tasks, for instance it could be possible to draw a square and obtain a set of images containing objects or graphics similar to it; or to select some color structures and obtain images with these color relations. Moreover, it is possible to describe actions, for example “football matches” and get a list of videos in which football actions happen. Although MPEG-7 Visual Descriptors focuses on the basic audiovisual media content on the basis of visual information. For images and video, the content may be described, for example by the shape of objects, object size, texture, color, movement of objects and camera motion[11]. Once the MPEG-7 descriptors are available, suitable search engines can be employed to search, filter or browse visual material on the basis of suitable similarity measures. The MPEG-7 descriptors can be broadly classified into general visual descriptors and domain-specific visual descriptors [19]. The former include color, texture, shape, localization and motion features, while the latter are application-dependent and include a face-recognition descriptor. A brief description of the general visual descriptor classes is given below.

1. Color descriptors: Color is one of the most widely used visual features in image and video retrieval. Color features are relatively robust to the viewing angle, translation and rotation of the regions of interest [16]. The MPEG-7 standard defines five color descriptors which represent different aspects of the color feature, including color distribution, spatial layout of color and spatial structure of color.

2. Texture descriptors: Texture refers to the visual patterns that have properties of homogeneity or not, that result from the presence of multiple colors or intensities in the image. It is a visual property of any surface, including clouds, trees, bricks, hair and fabric. It contains important structural information of surfaces and their relationship to the surrounding environment.

3. Shape descriptors: In many image database applications, the shape of the image objects provides a powerful visual clue for similarity matching. MPEG-7 provides region and contour descriptors suitable for a variety of applications as well as a 3-D shape descriptor that is useful for invariant to geometric transformations recognition of object shapes.

4. Motion descriptors: Description of motion features in video sequences can provide powerful clues regarding its content. MPEG-7 has developed descriptors that capture essential motion characteristics into concise and effective descriptions.

5. Localization descriptors: The location descriptor enables localization of regions within images or frames as well as to describe spatio -temporal regions in a video sequence, such as moving object regions. Also provides localization functionality.

6. Face descriptor: Human face perception is an active area in the computer vision community. There are many applications in which automatic face recognition is desirable and different specific techniques were proposed. Among these methods, Principal Component Analysis (PCA) is a popular technique that is widely used and the MPEG-7 face descriptor is based on that.

IV PROPOSED METHODOLOGY

In this section we described a proposed method for improved KNN algorithm for classification of image data. The classification of image data process through two different processes one is KNN and other is RBF neural network. The radial biases function (RBF) is Gaussian nature. The nature of mixture data correlation measured by KNN algorithm. The combination of RBF and KNN algorithm perform well feature reduction cum classification process over image data. The RBF [14] function incases the size of sample selection. The incasing size of sample selection incases the range of feature attribute of intruder data. RBF function is creating for sample selection for reduces and unreduced categories data sample for dealing out of KNN classification. The input processing of training phase is data sampling technique for classifier. Single-layer RBF networks can potentially learn virtually any input output relationship; RBF networks with single layers might learn complex relationships more quickly. The function netKNN creates forward networks. The network-layer network also has connections from the input to all cascaded layers. The additional connections might improve the speed at which the network learns the desired relationship. RBF artificial intelligence model is similar to feed-forward back-propagation neural network in using the back-propagation algorithm for weights updating, but the main indication of this network is that each layer of neurons related to all previous layer of neurons. The process of feature extraction and classification process are given below

1. input the image dataset
2. Apply DWT (2) transform function for feature extraction.
3. Applied transform function decomposed image data into HF and LF component. The component of HF is

preserve and the component of LF proceeds for the feature extraction.

4. The decomposed transformed measured in terms of H (T), V (T) and D (T).
5. Combined all transform value and creates the texture feature matrix.
6. estimate the feature correlation attribute as $\mathrm{Rel}(a,b) = \frac{\mathrm{cov}(a,b)}{\sqrt{\mathrm{var}(a) \times \mathrm{var}(b)}}$ Here a and b the feature attribute of input data
7. the estimated correlation coefficient data passes through RBF function as

$$x(t) = w0 + \sum_{j=1}^{\text{total data}} wj \exp\left(\frac{-(\text{total} - xj)}{\sigma^2}\right)$$

8. create the relative feature difference value $Rc = \sum_{k=1}^{r} \sum_{i=1}^{m} (hi - h)(eik - et)$
9. After sampling of feature data get reduces set of feature attribute of feature matrix.
10. generate feature attribute of each matrix
11. compute the similarity of feature attribute for the each feature
12. $\mathrm{Sim}(s) = \sqrt{|xi - yi|}$
13. Measure the min and max similar value and estimate Xs.

$$Xs = \frac{X - Min}{Max - Min}$$

14. Determine Xs value to individual class and passes RBF feature to classifier.
15. Image data are classified in assigned class
16. estimate the classification ratio
17. exit

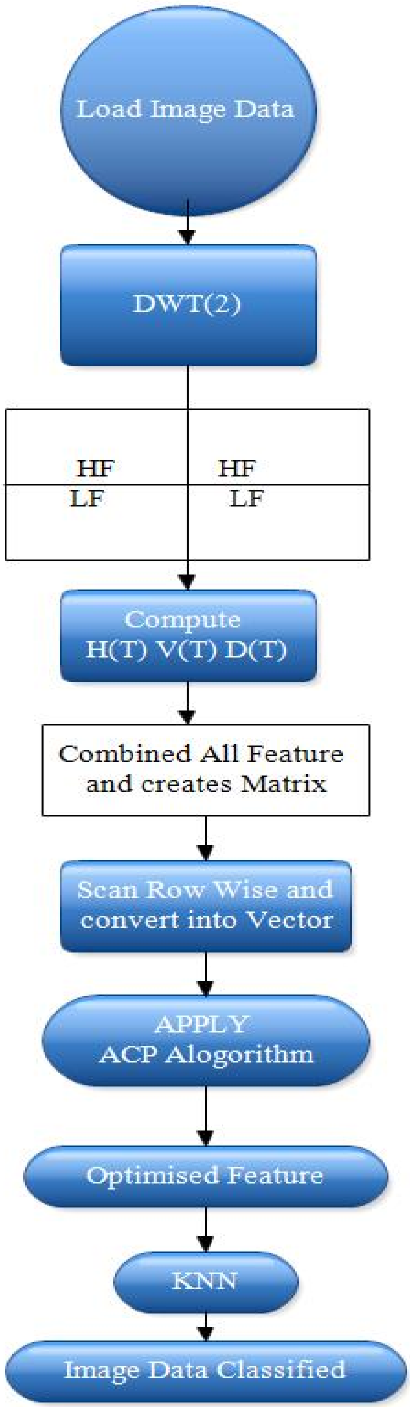

Figure 1: Proposed model of image classification based on KNN and RBF.

V EXPERIMENTAL RESULT AND PERFORMANCE EVALUATION

In this section we discuss the about our experimental result and comparative result analysis based on image classification techniques. The experimental result partitioned by three methods one is KNN, and second is RBF classification technique.

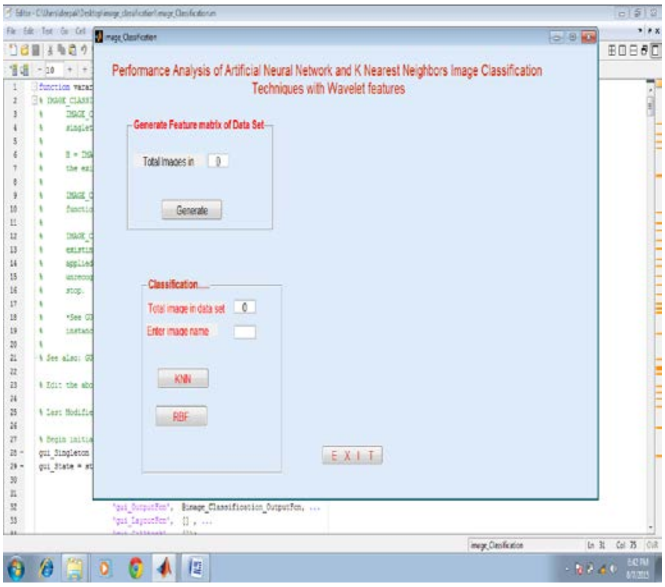

Figure 2: Shows the main window for implementation of image classification.

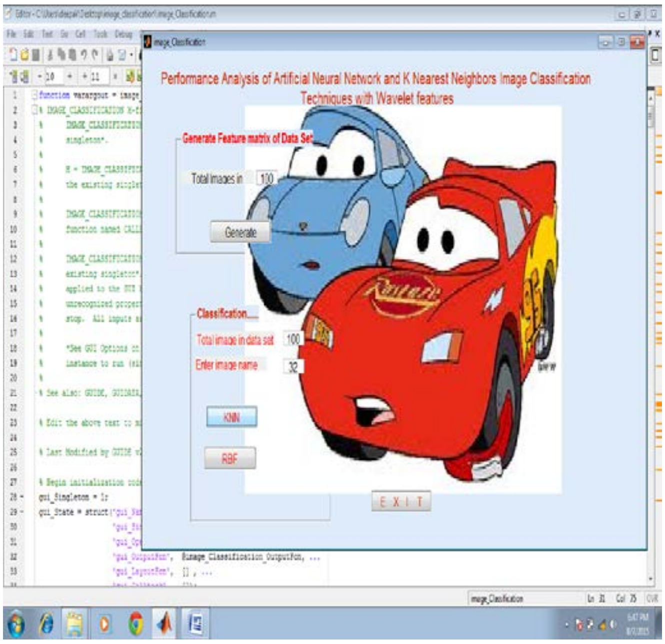

Figure 3: Shows the first classification of Data set 1 which includes total 500 images and contains 100 images of car.

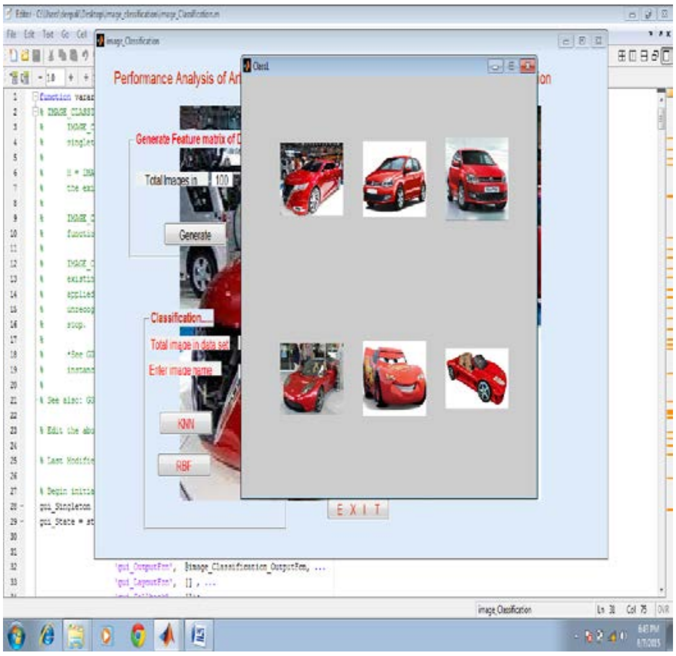

Figure 4: Shows the classification of Data set 1 which includes total 500 images and contains 100 images of car.

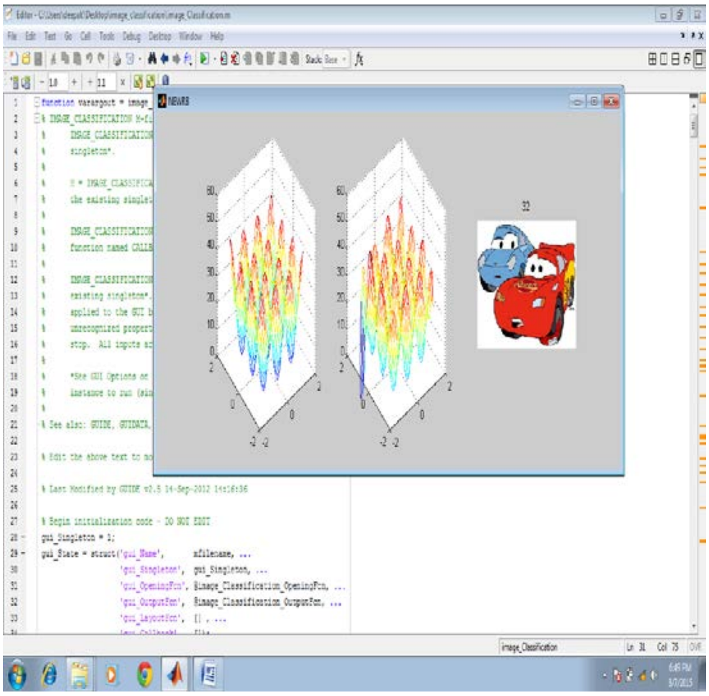

Figure 5: Shows the classification of Train Neural Network for Data set 1 which includes total 500 images and contains 100 images of car with using RBF method.

The result analysis of image classification based on number of class of image based on two methods. The total number of image in classification window is 500 and count the number of actual recall image in result windows.

Data set	Method	Precision (%)	Recall (%)
Data set 1	KNN	86.66	80.21
	RBF	91.33	83.60
Data set 2	KNN	90	91
	RBF	93	96.06
Data set 3	KNN	83.33	79.81
	RBF	80	79
Data set 4	KNN	83.33	76.83
	RBF	93.33	83.33
Data set 5	KNN	86.66	78.66
	RBF	90	78.6

Table 1: Shows the comparative Precision and Recall of image classification.

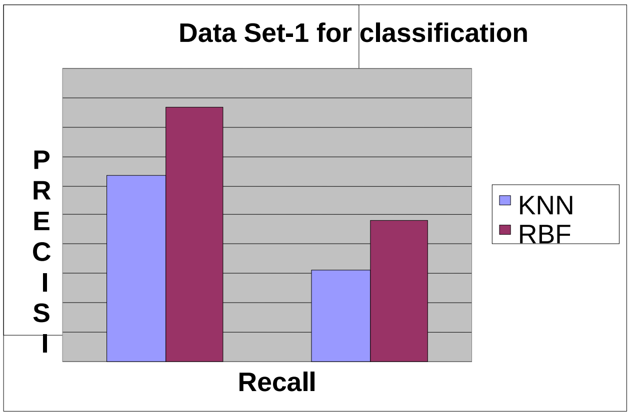

Figure 6: Shows that performance of data set 1 counts of data and rate of precision 91.33 % and recall is 83.60 %.

VI CONCLUSION AND FUTURE WORK

In this paper we proposed a hybrid method for content based image classification. The hybrid method is combination of KNN and RBF function. The KNN well knows classification technique in data mining. For the feature optimization used RBF function is used. RBF technique improves the efficiency of classification. The feature of texture creates more feature space for the classification of image. The process of optimization considers the large feature space in two sections one is feature space and another one is feature sub space for the optimization process. The process of optimization considers the process of feature for the artificial neurons. The artificial neurons move around the feature space and consider the mapping of feature space. The dissimilar feature of input image according to the index of data not matched the process of feature removed these data as optimized. For the valuation of performance used coral image data set and experimental software is MATLAB. Our experimental result shows better performance instead of shape based technique and some other technique. In this research achieved average precision is 98%. In future improve the efficiency of precision is 100. In this paper we proposed a hybrid method for image classification for color image. Our experimental result shows that better result in compression of old and traditional method of image classification. But the computational time of process is increase. In future we used optimizations method for the reduction of time and improvement of image classification. And another work of future is used SOM model for sampling process applied in combined feature classification for image classification.

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