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An Optimized Feature Selection for Image Classification Based on SVM-ACO

Priyanka Dhasal[1], Shiv Shakti Shrivastava[2], Hitesh Gupta[3], Parmalik Kumar[4]
Department of Computer Science and Engineering[1,2,3,4]
Patel College of Science and Technology, Bhopal (M.P.), India[1,2,3,4]

Abstract

Multi- class classification plays an import role in image classification. Multi-class classification used different classifier for the classification of data, such as binary classifier and support vector machine. In this dissertation we proposed a feature sampling technique of image classification. Our sampling technique optimized the feature selection process and reduced the unclassified region in multi-class classification. For the process of optimization we used ant colony optimization algorithm for the proper selection of feature sub set selection. Ant colony optimization is very famous meta-heuristic function inspired by biological spices. For the classification of image data used support vector machine. Support Vector Machines are designed for binary classification. When dealing with several classes, as in object recognition and image classification, one needs an appropriate multi class method. Different possibilities include: Modify the design of the SVM, as in order to incorporate the multi-class learning directly in the quadratic solving algorithm. Combine several binary classifiers: "One-against- One" (OAO) applies pair wise comparisons between classes, while "One-against-All" (OAA) compares a given class with all the others put together. OAO and OAA classification based on SVM technique is efficient process, but this SVM based feature selection generate result on the unclassified of data. When the scale of data set increases the complexity of preprocessing is also increases, it is difficult to reduce noise and outlier of data set. Ant Colony Optimization (ACO) meta-heuristic is an effective tool in finding quality data and that's the main reason to use it as a feature selection for SVM.

Keywords

Image Classification, SVM, ACO

1. Introduction

Image Processing is one of the important fields for the various advancements in context of various aspects of images. Although all the advances in image capturing, storage, and internet technologies have made vast amounts of image data available [1]. Image information systems are becoming increasingly important with the advancements in broadband networks, high-powered workstations etc. However 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 [2]. Now a day the use of digital technologies produces a lot of digital images. Normally Images are automatically recorded in meaningless alphanumeric filenames. A huge variety of images are becoming available to the public, from photo collection to web pages, or even video databases. Since visual media needs large amounts of memory and computing power for processing and storage, there is a requirement for efficiently index and retrieve visual information from image database. In recent years, image classification has become an interesting research field in application [3]. Efficient indexing and retrieval of large number of color images, classification plays an important and challenging role. The main motive of this research work is to find suitable representation for images and Classification generally requires comparison of images classification capability depending on the certain useful methods [4]. Image classification is defined as the task of classifying the number of images into (semantic) categories based on the available training data. The main objective of digital image classification procedure is to categorize the pixels in an image into land over cover classes [5]. 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[6,7]. The wide 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. Traditionally the digital image classification technique can be classified into two types: Unsupervised classification Techniques and Supervised classification Techniques [8]. On the other hand an image classification can also be classified in to two types: Linear Classification and Non-Linear Classification [10]. The rest of this paper is organized as follows. In section 2 related techniques for image classification. Section 3 gives a proposed method. Section 4 experimental result analysis 5 concludes this paper.

2. Related Work and Image Classification

Wei-jiu Zhang, Li Mao and Wen-bo Xu etld [2] Automatic Image Classification Using the Classification Ant-Colony Algorithm To enhance the versatility, robustness, and convergence rate of automatic classification of images, an ant-colony-based classification model is proposed in this paper. According to the characteristics of the image classification, this model adopts and improves the traditional Ant-Colony algorithm. It defines two types of ants that have different search strategies and refreshing mechanisms. The stochastic ants identify new categories, construct the category tables and determine the clustering center of each category. Soo Beom Park, Jae Won Lee, Sang Kyoon Kim et al. [1] Content-based image classification using a neural network A method of content-based image classification using a neural network. The images for classification are object images that can be divided into foreground and background. To deal with the object images efficiently, in the pre-processing step we extract the object region using a region segmentation technique. Features for the classification are shape-based texture features extracted from wavelet-transformed images. The neural network classifier is constructed for the features using the back-propagation learning algorithm. Among the various texture features, the diagonal moment was the most effective. Hong bao Cao, Hong-Wen Deng, and Yu-Ping Wang et al. [4] Segmentation of M-FISH Images for Improved Classification of Chromosomes With an Adaptive Fuzzy C-means Clustering Algorithm An adaptive fuzzy c-means algorithm was developed and applied to the segmentation and classification of multicolour fluorescence in situ hybridization (M-FISH) images, which can be used to detect chromosomal abnormalities for cancer and genetic disease diagnosis. The algorithm improves the classical fuzzy c-means algorithm (FCM) by the use of a gain field, which models and corrects intensity in homogeneities caused by a microscope imaging system, flairs of targets (chromosomes), and uneven hybridization of DNA. Other than directly simulating the in homogeneously distributed intensities over the image, the gain field regulates centers of each intensity cluster. Sai Yang and Chunxia Zhao etld[5] A Fusing Algorithm of Bag-Of-Features Model and Fisher Linear Discriminative Analysis in Image Classification A fusing image classification algorithm is presented, which uses Bag-Of-Features model (BOF) as images' initial semantic features, and subsequently employs Fisher linear discriminative analysis (FLDA) algorithm to get its distribution in a linear optimal subspace as images' final features. Lastly images are classified by K nearest neighbour algorithm. The experimental results indicate that the image classification algorithm combining BOW and FLDA has more powerful classification performances. In order to further improve the middle-level semantic describing performance, we propose compressing the BOF distribution of images distributing loosely in high-dimensional space to a low-dimensional space by using FLDA, the images are classified in this space by KNN algorithm. Ajay Kumar Singh, Shamik Tiwari & V.P. Shukla et al. [6] Wavelet based Multi Class image classification using Neural Network, A feature extraction and classification of multiclass images by using Haar wavelet transform and back propagation neural network. The wavelet features are extracted from original texture images and corresponding complementary images. The features are made up of different combinations of sub-band images, which offer better discriminating strategy for image classification and enhance the classification rate. Liping Jing Chao Zhang Michael K. Ng et al. [3] SNMFCA: Supervised NMF-based Image Classification and Annotation A novel supervised nonnegative matrix factorization based framework for both image classification and annotation (SNMFCA). The framework consists of two phrases: training and prediction. In the training phrase, two supervised nonnegative matrix factorizations for image descriptors and annotation terms are combined together to identify the latent image bases, and represent the training images in the bases space. These latent bases can capture the representation of the images in terms of both descriptors and annotation terms. Based on the new representation of training images, classifiers can be learnt and built.Sancho McCann David G. Lowe et al. [7] Local Naive Bayes Nearest Neighbor for Image Classification An improvement to the NBNN image classification algorithm that increases classification accuracy and improves its ability to scale to large numbers of object classes. The key observation is that only the classes represented in the local neighbourhood of a descriptor contribute significantly and reliably to their posterior probability estimates. Lexiao Tian, Dequan Zheng, Conghui Zhu et al. [8] Research on Image Classification Based on a Combination of Text and Visual Features A text-image co-occurrence data become available on the web, mining on those data is playing an increasingly important role in web applications. Utilizing description information to help image classification and propose a novel image classification method focusing on text-image co-occurrence data. In general, there are three main steps in our system: feature extraction, training classifiers and classifier fusion. Shaohua Wan et al. [9] Image Annotation Using the Simple Decision Tree Automatic image annotation is an important but highly challenging problem in semantic-based image retrieval. In this paper, they formulate image annotation as a supervised learning image classification problem under region-based image annotation framework. In region-based image annotation, keywords are usually associated with individual regions in the training data set.

3. Proposed Method for Image Classification

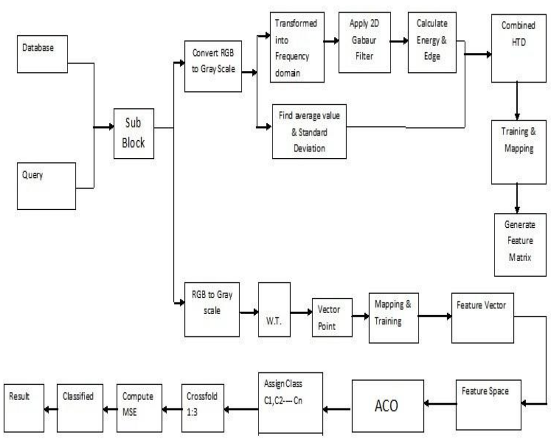

Figure 1: Block diagram of proposed method

4. Experimental Result Analysis

To evaluate the performance of proposed method of content based image classification we have use MATLAB software 7.8.0 with a variety of image dataset used for experimental task. The coral image data set is very famous image data set for research purpose for image retrieval. The coral images are relatively easy to annotate. We have used 1000 coral images and grouped them into a set of 500 images. In our result we have used total 1000 coral images and they are subdivided into five datasets. Then we have performed an image classification method on each dataset using SVM-DAG and SVM-RBF. The evaluated result using both the methods is presented in the table shown below:

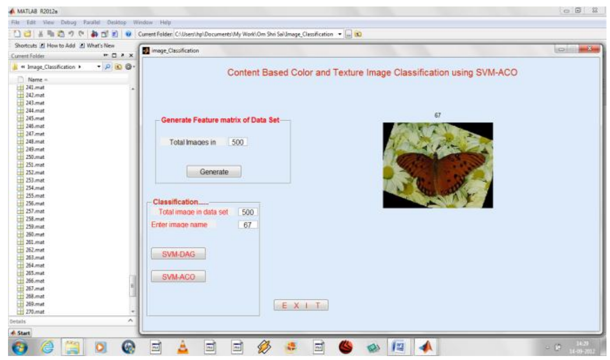

Figure 2: Implementation of image classification

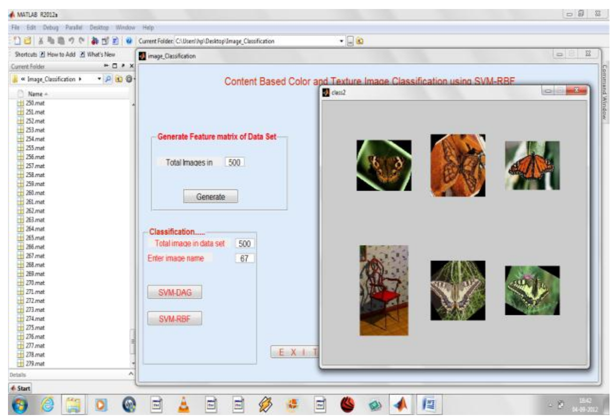

Figure 3: shows the output of class 1 and the input image is of butter fly using SVM-DAG

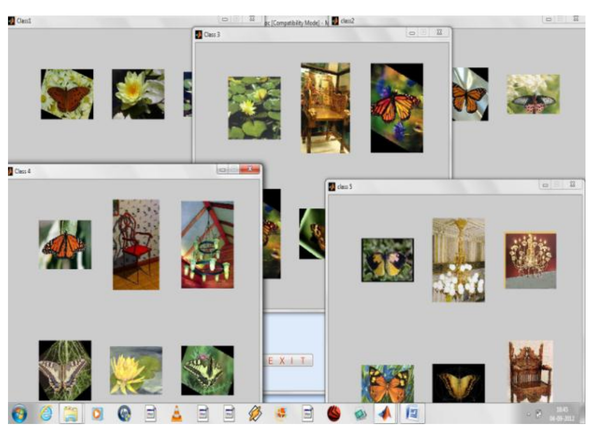

Figure 4: shows the windows of multi class in data set butter fly, chair, chandelier etc. inclusive of all classes.

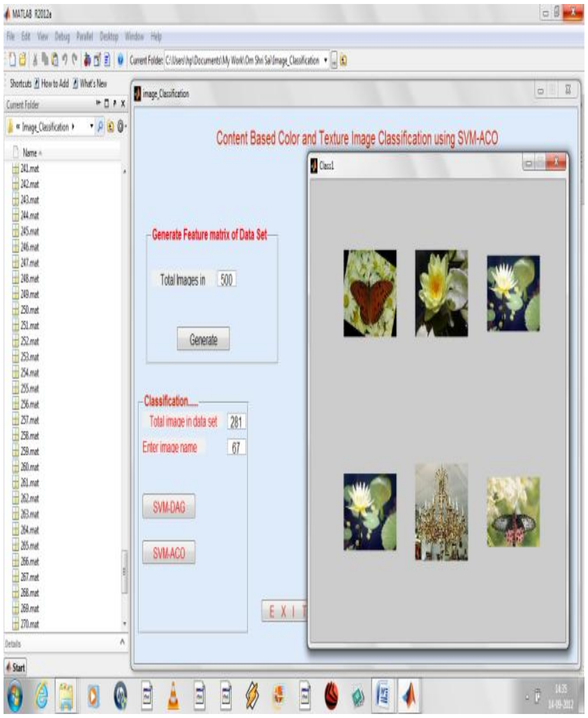

Figure 5: shows the class 1 classification using SVM-ACO

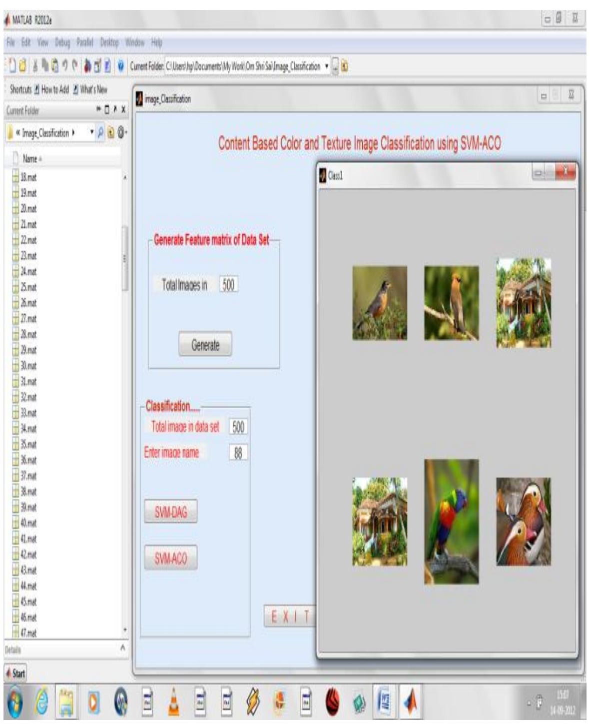

Figure 6: shows the class 1 of Dataset 2 classification using SVM-DAG

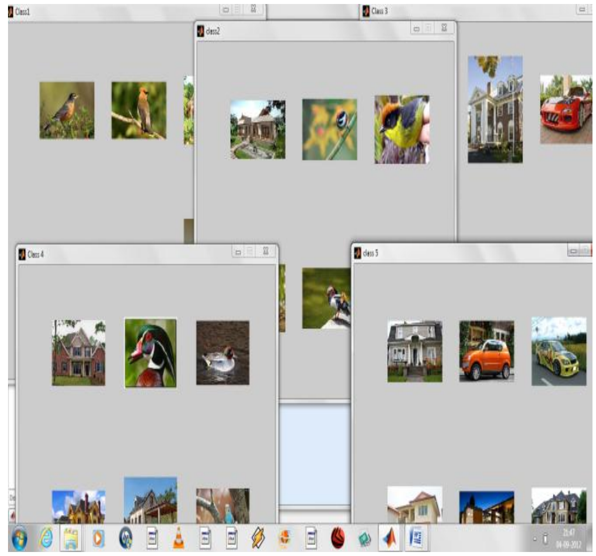

Figure 7: shows the multiclass of Dataset 2 classification using SVM-ACO

Figure 8: shows the multiclass of Dataset 5 includes images of cup, cellphones etc

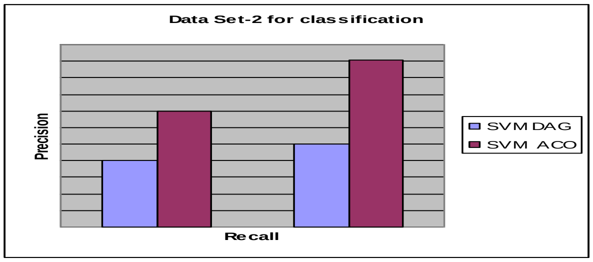

Figure 9: shows the comparative result of SVM-DAG and SVM-ACO

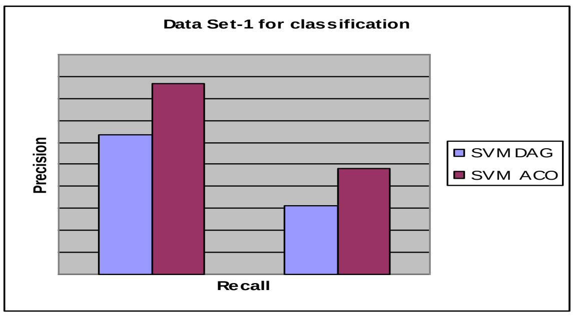

Figure 10: shows that performance of data set 1 counts of data and rate of precision 91.33 % and recall is 83.60 %.

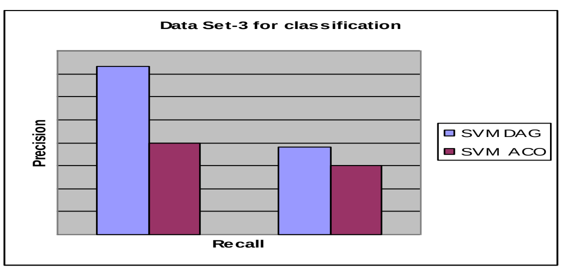

Figure 11: shows that performance of data set 2 counts of data and rate of precision 93% and recall is 96.06 %.

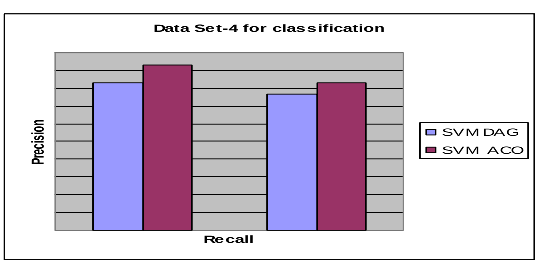

Figure 12: shows that performance of data set 3 counts of data and rate of precision 80% and recall is 79%

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

Figure 13: shows that performance of data set 4 counts of data and rate of precision 93.33% and recall is 83.33%

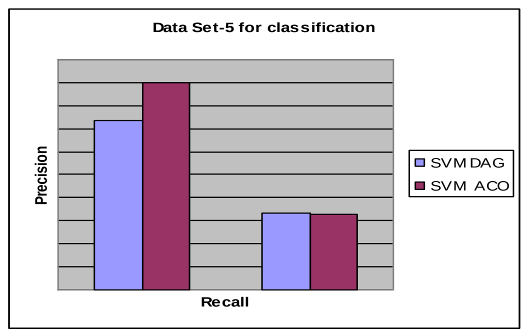

Figure 14: shows that performance of data set 5 counts of data and rate of precision 90% and recall is 78.6

5. Conclusions

ACO-SVM reduces the semantic gap and enhances the performance of image classification. However, directly using SVM scheme has two main drawbacks. First, it treats the core point and outlier equally, although this assumption is not appropriate since all outlier share a common concept, while each core point differs in diverse concepts. Second, it does not take into account the unlabeled samples, although they are very helpful in constructing a good classifier. In this dissertation, we have explored unclassified region data on multi-class classification. . We have designed ACO-SVM to alleviate the two drawbacks in the traditional SVM. Here ACO play a role of feature sampling technique. The sampling of the feature technique reduced the unclassified region of multi-class classification. DAG based support Vector machine perform a better classification in compression of another binary multi-class classification. DAG applied a graph portion technique for the mapping of feature data. The mapping space of feature data mapped correctly automatically improved the voting process of classification. But DAG suffered a little bit problems with mapping of space data into feature selection process. Performance of result evaluation shows that our ACO-SVM is better classifier in compression of DVM-Dag.

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Priyanka Dhasal is M.Tech scholar in the Department of Computer Science & Engineering, Patel College of Science & Technology, Bhopal. Her research interest lies in Image Processing.

Shiv Shakti Shrivastava (Assistant Professor- Department of Computer Science & Engineering, Patel College of Science & Technology, Bhopal) obtained his MCA Degree from Bhoj University Bhopal (M.P.) in 2000. He has about 12 years of experience in teaching. He has a number of papers in various National and International journals to his credit. His field of interest is Data Mining, Image Processing and Network Security.