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Two Tier Architecture for Content Based Image Retrieval Using Modified SVM and knn-GA

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Abstract: -Image retrieval is one of the most interesting and fastest growing research areas in the field of digital image processing as well as for the information retrieval from web contents. In most Content-Based Image Retrieval (CBIR) systems, an image is represented by a set of different level of visual features, by which can manage large databases. Most of the popular database removes the high-level semantic information.Here we this paper an novel approach named content based image retrieval using two tire architecture, to maintaining and reducing the exists gap between high-level and low-level features, where SVM classification is used in first layer after feature generation, therefore proceed it output as input into the second layer, where the resultant images again classified and will produce more accurate result while retrieval. And finally most similar images will retrieved according to the user specified query image.

Keywords*:* - Digital Image Processing, SVM, Fuzzy, CBIR, KNN, Semantic gap, colour feature.

I. INTRODUCTION

In the content based image retrieval the semantic gap between pre-processed stored images and query image reduces. In image retrieval, basically image is retrieved based on three attributes such as colour, texture and shape. This is known as feature selection process. This feature selection process generates a negative result of query processing [1]. In Content-based image retrieval system, we have notice that the problem of searching large image based on content searching still takes much time [9] [10]. And become the most important topic of research in last few decades. Image retrieval is an active field of study because many databases that contain number of images have examines unexpected growth both in number of images and size they contain.

Labeling images into one of some predefined categories is refers to as image retrieval. Image retrieval is generally challenging for machines not for humans. Sometimes it suffers with uncontrolled conditions, complicated and difficult to understand objects in an image. Categorization is a technique which categorized images into multiple groups. Retrieval of an image enable us to analysis our surroundings efficiently. Sometimes image classification becomes one of the most complex areas. Especially it becomes more complex when it contains blurry or noisy image. We have lots of methods to classify the images and most of the time they provide good output but they fail to provide satisfactory output because image contains noisy and blurry content. It is very hard to achieve betterresult with the noisy and blurry image than with normal image.The main aim of this paper is to give a brief overviewabout some of most common image retrieval methods. The main methods which we are discussing in this paper are RF-SVM, NB-NN, Fuzzy Decision Tree and BMMA.

RF-SVM has the power to generate both the optimal feature subset and SVM parameters at the same time. To optimize the parameters and feature subset selection process, without losing the SVM classification performance [2] is our basic aim when using this method.

1. Naïve Bayes Nearest Neighbor approach is an nonparametric approach. NBNN is very simple, efficient, and it does not require any learning/training phase. It is important image classifiers. Nonparametric approach is an approach which is also known as no learning approach. Or it required no training and learning.
2. Fuzzy Decision Tree approach for image classification uses a non parametric approach and depends on hierarchical rule based method. This method is more reliable; because the nature of this method is fuzzy.
3. BMMA and semi-BMMA are two approaches which overcomes all the disadvantages of RF-SVM. It is a content based image retrieval method. It is easily distinguish between positive and negative feedback.

Here we are going to discuss our scheme, where we planned to build our system to more efficient and produce more accurate result. So for it we are using a layered by process as svm in first layer and another very popular classification knn classifier. In the second chapter we'll discuss it in detail.

II. CLASSIFICATION METHODS

In this section we briefly discuss about the previous developed four methods and our this paper method of image retrieval i.e. RF-SVM, NB-NN, Fuzzy and BMMA. First subsection defines about the RF-SVM and its advantages and disadvantages. Second subsection defines about the NB-NN

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and its advantages and disadvantages. Third subsection defines about the Fuzzy and its advantages and disadvantages. Forth subsection defines about the BMMA and its advantages and disadvantages.

1. RF-SVM

If we are using support vector machine as an image classifier, it suffers with two major problems-
First it does not determine the best kernel parameter.
Secondly it does not know how to select the optimal feature sub-set input of these two problems support vector machine does not perform better and does not able to provide the accurate result. To reduce the feature selection process of support vector machine for image classification it uses the pre-sampling of feature. SVM classification performance is modifying by the feature selection, proper parameter adjustment. Parameter C and the kernel function parameters such as the gamma (g) for the radial basis function (RBF) kernel defined by the parameters that should be optimal include [3]. Three steps are very important to use a SVM, First is we must choose a kernel function, Second is to set the kernel parameters and third one is to determine a soft margin constant C which is also known as penalty parameter. To finding the best C and gamma when using the RBF kernel function classification algorithm refers to as best alternatives. RF algorithms have the potential that they generate at the same time both the optimal feature subset and SVM parameters. Main aim is that we can optimize the feature subset selection process and parameters, without losing the SVM classification performance [4].

If RF is used with the SVM so it has narrow down the so called Semantic Gap. Or we can say that to fill the semantic gap low level features and high level semantic concepts Relevance Feedback (RF) scheme becomes a powerful technique. So RF-SVM improves the performance of CBIR system.

ADVANTAGES:

- It improves the performance of content based image retrieval system.
- It provides computationally efficient and good hyper plane in hyper space [5].

DISADVANTAGES:

- It treats all positive and negative feedback equally.
- Although RF-SVM is a good classifier but it does not able to take unlabeled samples into the account.

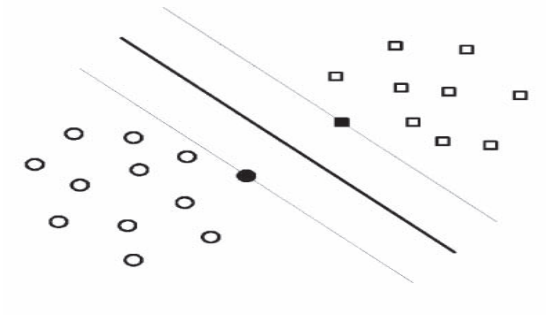

FIG.1: SEPRATING HYPERPLAN USING SVM

2. NB-NN

If we uses only Nearest-Neighbour (NN) based image classification technique so we does not require any training because it is a nonparametric approach. But NN suffers with some drawbacks:
First is local image descriptor's quantization which is used to generate "bags-of-words".
Second it generally calculate the distance of 'Image-to-Image',instead of 'Image-to-Class' distance.

Naive-Bayes Nearest Neighbor (NBNN) easily and effectively overcomes the disadvantages of NN technique. NBNN computes direct 'Image-to-Class' distances instead of 'Image-to-Image' distance without descriptor quantization. NBNN theoretically optimized image classifier which can be accurately approximated. NBNN method of image classification is a very simple, efficient, and non-parametric approach which requiresno learning/training phase.
NBNN is based on simple methodology: Take a query image,Compute all its local image descriptors *d*1*; :::; dn*.
Search for the class *C* which minimizes the sum *n*
i=1 *k di ¡* NN*C*(*di*) *k*2 (where NN*C*(*di*) is the NNdescriptorof *di* in class *C*).

ADVANTAGES:

- Avoid over fitting of parameter.
- Huge number of classes is handled easily.

DISADVANTAGES:

- Sometimes training required, which enhance the cost.
- Degrade the power of descriptive.

III. FUZZY DECISION TREE

Fuzzy Decision Tree approach is also a non parametric approach. It is basically based on hierarchical rule based method. It is morereliable, because of its fuzzy nature. FDT method uses the benefits of both the methods i.e. Fuzzy and decision tree. The Class grouping algorithm is used to determine the tree structure. It forms the groups of classes which have been separated at each internal node [6]. Within the tree building process effective feature selection is incorporated, selecting suitable feature subsets required for the node discriminations [6]. FDT has number of advantages like the classification accuracy is enhanced, interpretablehierarchy, and low model complexity. It also gives the hierarchical image segmentation and has reasonably low demands for computational and data storage. Obtained classifiers generalization capabilities depends strongly on the tree structure.

ADVANTAGES:

- Reliable because it uses stochastic approach.
- It provide more accurate results if compare with the other methods.

DISADVANTAGES:

- Calculation given by this method is very complicated.

- Prior knowledge about the desired area is required because of lake of training.

a. BMMA

Biased Maximum Margin Analysis is a good classification method. It overcomes all the disadvantages of RF-SVM method i.e. firstly it is not able to make any differences between positive and negative feedback. It is not suitable in the situation when two groups of training feedbacks have different properties. Second, most of the SVM-based RF techniques do not take into the unlabeled samples into account. But the BMMA and semi-BMMA easily remove these drawbacks. The BMMA able to make differences between positive feedbacks and negative ones based on local analysis; by introducing a Laplacianregulaizer to the BMMA semi-BMMA can easily integrate information of unlabeled samples. We generally feel this problem into general subspace learning and then create an approach which is automatically determining the dimensionality of the subspace for RF. Experimentally it is prove that if the this paper scheme combined with the SVM RF so it can gradually improve the performanceof CBIR systems [8].

ADVANTAGES:

- Easily deal with the small as well as large number of training samples.
- If BMMA combined with SVM so it performs better than the traditional SVM.

DISADVANTAGES:

- Suffers with global maximum problem.
- It is a linear method, so only gave satisfactory results in linear method.

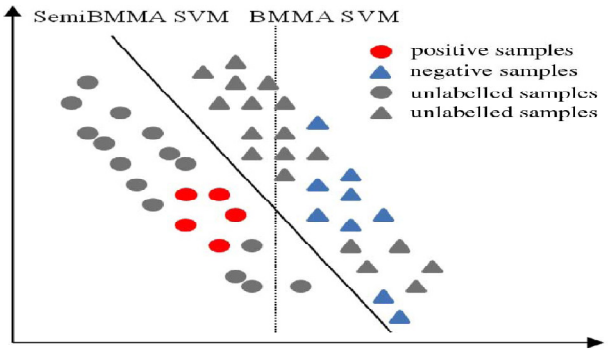

FIG.2 WORKING OF BMMA & SEMI-BMMA

III. LITERATURE REVIEW

In this chapter we discussed the previous research done by the different researchers, where:

In [1],this paperalgorithm which improves the classical fuzzy c-means algorithm (FCM) by the use of a gain field, which models and corrects intensityinhomogeneities caused by a microscope imaging system, flairs of targets (chromosomes), and uneven hybridization of DNA. Other than directly simulating the inhomogeneously distributed intensities over the image, the gain field regulates centres of each intensity cluster. The algorithm has been tested on an M-FISH database that we have established which demonstrates improved performance in both segmentation and classification [1].

In [5],this paper a new scheme of learning similarity measure is for content-based image retrieval (CBIR). It learns a boundary that separates the images in the database into two clusters. . Images inside the boundary are ranked by their Euclidean distances to the query. The scheme is called constrained similarity measure (CSM), which not only takes into consideration the perceptual similarity between images, but also significantly improves the retrieval performance of the Euclidean distance measure [5].

[7],this papera trivial NN based classifier – NBNN (Naive-Bayes Nearest-Neighbor), which employs NN distances in the space of the local image descriptors (and not in the space of images). NBNN computes direct 'Image to-Class' distances without descriptor quantization [7].

In [8],this paperthe FDT-support vector machine SVM classifier, where the node discriminations are implemented via binary SVMs. The tree structure is determined via a class grouping algorithm, which forms the groups of classes to be separated at each internal node, based on the degree of fuzzy confusion between the classes. In addition, effective feature selection is incorporated within the tree building process, selecting suitable feature subsets required for the node discriminations individually [8].

In [13],provide a brief overview image classification method and comparison between them. It has shown that Self Organizing Tree Algorithm, an unsupervised classification method classify the images to 81.5% even it contain blurry and noisy content. Henceproved that it is the best classification method [13].

In [19],this papera image retrieval method based on the semantic based image retrieval system using Gray-Level Co-occurrence Matrix (GLCM) for texture featureextraction. Based on the texture features, semantic interpretationsare given to the extracted textures. The images are retrieved according to user satisfaction and thereby reduce the semantic gap between low level features and high level features [19].

In [14],this paper algorithm for image retrieval based on shape and texture features only not on the basis of color information. Here input image is first decomposed into wavelet coefficients. These wavelet coefficients give mainly horizontal, vertical and diagonal features in the image. After wavelet transform, Edge Histogram Descriptor is then used on selected wavelet coefficients to gather the information of dominant edge orientations. The combination of DWT and EHD techniques increases the performance of image retrieval system for shape and texture based search [14].

[20],this paper a constrained linear discriminate analysis (CLDA) approach for classifying the remotely sensed hyper spectral images. Its basic idea is to design an optimal linear transformation operator which can maximize the ratio of inter-class to intra-class distance while satisfying the constraint that the different class centres after transformation are aligned along different directions. Its major advantage over the traditional Fisher's linear discriminate analysis is that the classification can be achieved simultaneously with the transformation. The CLDA is a supervised approach, i.e., the class spectral signatures need to be known a priori. But, in practice, these informations may be difficult or even impossible to obtain. So this paper will extend the CLDA algorithm into an unsupervised version, where the class spectral signatures are to be directly generated from an unknown image scene [20].

In [15],this paperCBIR system, Tamura texture features are extracted as imagecontent. To measure similarity of query image with images indatabase, a fuzzified distance measure, fuzzy hamming distance(FHD), is used. The database is sorted in the increasing order ofsimilarity measure, and made available to user [15].

In [18],focused on CBIR and basic conceptspertaining to it, as well as Relevance Feedback and its variousmechanisms. Relevance Feedback (RF) wasincorporated to CBIR systems. By allowing the user to assessiteratively the answers as relevant/irrelevant or even givinghim/her the opportunity to specify a degree of relevance (user's feedbacks), the system creates a new query that better captures the user's needs, hence raising the opportunity to get more relevant image results. An important contribution in this work is acomparative analysis of CBIR systems using reference feedback [18].

In [17],this paper a novel framework forcombining and weighting all of three i.e. color, shape and texture features to achieve higher retrieval efficiency. The color feature is extracted by quantifying the YUV color space and the color attributes like the mean value, the standard deviation, and the image bitmap of YUV color space is represented. The texture features are obtained by the entropy based on the gray level co occurrence matrix and the edge histogram descriptor of animage [17].

[11],attempts to study and provides a brief knowledge about the different image classification approaches and different classification methods. Most common approaches for image classification can be categories as supervised and unsupervised, or parametric and nonparametric or object-oriented, sub pixel, per-pixel and per field or spectral classifiers, contextual classifiers and spectral-contextual classifiers or hard and softclassification.This survey gives theoretical knowledge about different classification methods and provides the advantages and disadvantages of various classification methods [11].

IV. THIS PAPER SCHEME

The followings are the basic steps of a this paper system:

1. Read image database source.
2. Extract features of each read images and stored into a separate data file.
3. Then read query single image, and extract same feature for it.
4. For feature extraction to use colour based model and colour co-occurrence method.
5. Then filter and generated features with PSO and SVM, then classify it with SVM classify.
6. After successful classification, it'll process for the second layer as input.
7. Computer similarity matrix and apply standard distance formula to arrange images as order.
8. To get the KNN based classified images here after second process.
9. Then rearranged final classified images into separate classes or group, on the basic of similarity distance.
10. Finally display resultant classified images in a group.

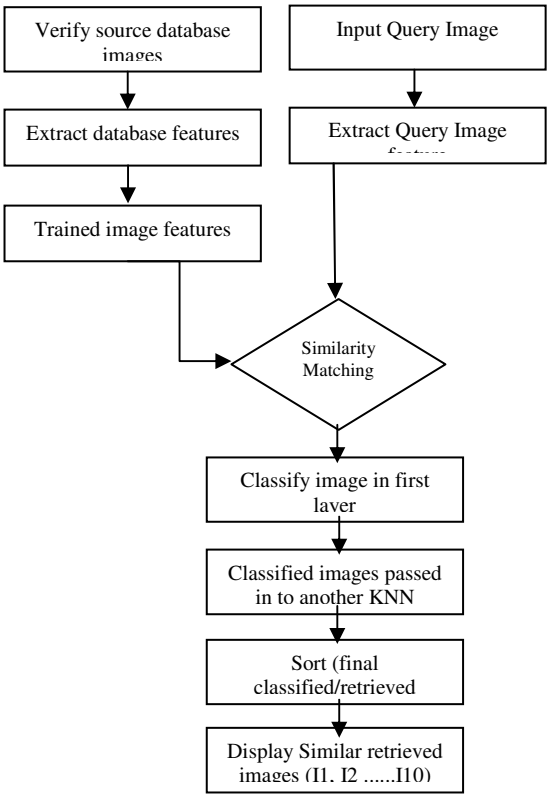

Figure 3: Block Diagram of this paper method

Figure 3, shows that the basic blocks of this paper methodology, where it starts from image database and query image and extraction of its features therefore similarity matrix measure the difference between features, then classified images.

V. CONCLUSION

We discuss about the four implemented methods of image retrival and classification and also discussed our this paper methodology along with the implemented method in this paper. In paper retrival methods are divided into four separate models RF-SVM, NBNN, FDT and BMMA. Each method has its own advantages and disadvantages. As we seen that RF-SVM provides good hyper plan, whereas it is unable to differentiate between positive and negative feedback. When we were studying about NBNN, we found that this method eliminate the over fitting but also degrade the performance of power descriptor. FDT method seems more advantages but it also suffers with a very severe drawback. The limitation of FDT is its calculation is very complicated, which is generally not understood by normal programmer. Now we come into our last but most effective technique Biased Maximum Margin Analysis (BMMA), it easily deals with the large and small parameters. Sometimes we use semi-BMMA, which gives the benefits of both supervised and unsupervised methods. So this paper concluded BMMA is a most effective retrieval method among the remaining methods, but we can't say it'll good globally because here we this paper a new methodology where I hope it'll produce more accurate result when it'll fully functional. So we can that our this paper method will be more and more accurate and fine as comparing to discuss existing method here.

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