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Efficient CBIR with Relevance Feedback for Remote Sensing Images

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ABSTRACT: With the development of satellite technology, large volume Remote sensing (RS) images become available. Accordingly, one of the most challenging and Emerging applications in RS is the efficient and precise retrieval of RS images from such archives according to the user's needs.In Content Based Image Retrieval (CBIR), there is semantic gap between the low level features and high level concepts. In content-based image retrieval, Relevance Feedback (RF) is an interactive process, which builds a bridge to connect users with a search engine. The semantic gap problem and the performance accuracy issues in a Content Based Image Retrieval System (CBIR) can be efficiently overcome by the Relevance Feedback mechanism. Based on this feedback the CBIR system modifies its retrieval mechanism in an attempt to return the desirable output. In designing a Relevance Feedback (RF) mechanism a number of design requirements have to be considered that helps the CBIR system to function efficiently.

KEYWORDS: Content Based Image Retrieval (CBIR), Remote sensing (RS), Relevance Feedback (RF)

I. INTRODUCTION

Conventional RS image retrieval systems often rely on keywords/tags in terms of sensor type, geographical location, and data acquisition time of images stored in the archives. Any CBIR system essentially consists of (at least) two modules:

1) A feature extraction module that derives a set of features for characterizing and describing images.
2) A retrieval module that searches and retrieves images similar to the query image.

Querying image contents from large RS data archives depends on the capability and effectiveness of the feature. Extraction techniques in describing and representing the images. With the rapid growth in digital media, necessity for large image database has raised. It comprises the major portion of the databases which makes the search engines to face difficulty in searching. Content based image retrieval is a method to retrieve the images from the large database based on the image content. CBIR takes an image as a query and identifies the matched images based on the visual similarity between the query image and gallery images. Various visual features, including color, texture, and shape.

Traditional RF methods in CBIR include the following two basic steps:1)When retrieved images are returned to the user, some relevant and irrelevant images are labelled as positive and negative samples respectively and, 2) the retrieval system refines the retrieved results based on these labelled feedback samples. These two steps are conducted iteratively until the user is satisfied with the presented result.

II. LITERATURE SURVEY

Various previous works related to **Content Based Image Retrieval** are as follows:

In literature [3], The author gives specified path to use these primitive features color, shape and geometry to retrieve the desired image. In CBIR first the HSV color space is quantified to obtain the color histogram and texture features. Using these components, a feature matrix is formed. This matrix is mapped with the characteristic of global color histogram and local color histogram, which are analyzed and compared. For the co-occurrence matrix between the local image and the images in the database to retrieve the image. For extracting shape feature gradient method is

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used here. Based on this principle, CBIR system uses color, texture and shape fused features to retrieve desired image from the large database and hence provides more efficiency or enhancement [3].

[5]The efficiency of the CBIR system with RF depends upon the choice of the feedback algorithm and the different parameters associated with the algorithm. Promising results in image retrieval is possible when the CBIR system takes a combination of techniques for its relevance feedback. Difficulties that arise when learning from small training sets were discussed and the two main drawbacks of CBIR system namely the "curse of dimensionality" and "semantic gap" can be successfully eliminated by the various RF techniques. Also this paper throws light on the various RF techniques recently used with their advantages and limitations discussed in detail. To conclude Relevance Feedback techniques used in a CBIR system helps in accurate image retrieval and improves the standard evaluation parameters like precision, convergence and execution time.[5]

Content-Based Image Retrieval (CBIR) uses the visual contents of an image such as color, shape, texture, and spatial layout to represent and index the image. Active research in CBIR is geared towards the development of methodologies for analyzing, interpreting cataloging and indexing image databases. In addition to their development, efforts are also being made to evaluate the performance of image retrieval systems. The quality of response is heavily dependent on the choice of the method used to generate feature vectors and similarity measure for comparison of features. In this paper we proposed an algorithm which incorporates the advantages of various other algorithms to improve the accuracy and performance of retrieval. The accuracy of color histogram based matching can be increased by using Color Coherence Vector (CCV) for successive refinement. The speed of shape based retrieval can be enhanced by considering approximate shape rather than the exact shape. In addition to this a combination of color and shape based retrieval is also included to improve the accuracy of the result.[4]

a novel AL method to drive

RF in CBIR for the identification of effective images to annotate and to include in the training set. The proposed AL method selects both informative and representative unlabeled images to be included in the training set at each RF round by the joint evaluation of the uncertainty, diversity, and density criteria. The uncertainty and diversity criteria aim to select the most informative images, whereas the density criterion aims to select the most representative images in terms of prior distribution. The proposed AL method overcomes the limitations of previously presented AL methods in CBIR problems, which are due to the following: 1) unbalanced training sets and 2) biased initial training sets. Note that the unlabeled images located in the high-density regions of the image feature space are highly important for CBIR problems particularly when an unbalanced and biased training set is available. This is due to the fact that they are statistically very representative of the underlying image distribution, and thus, the retrieval results on them affect much more the overall accuracy of the CBIR than those obtained on images within the low-density regions. Besides the overall system presented, the main novelties of the proposed AL method are the following: 1) the utilization of the prior term of the distributions based on the density of unlabeled images in the image feature space for driving the selection of images during RF rounds and 2) the strategy to jointly evaluate the three criteria. Moreover, we have introduced the use of HI kernel for CBIR problems (particularly in the context of the SVM classification and the proposed AL method) in RS.[1]

III. PROPOSED METHODOLOGY

The proposed system has been partitioned into following modules: User Module, Feature extraction Module, Image Retrieval Module, Relevance Feedback module.

In our proposed system, some steps are performed to make the system Perfect,

Step 1: Load database in the Matlab workspace.
Step 2: Load query image for getting feature of an image.
Step 3: Calculate the color histogram/texture feature/ color+texture feature of an image.
Step 4: Compute the above values and store in mat file for each image in the database.
Step 5: Show the results according to different features respectively.
Step 6: Apply SVM classification and do margin sampling while training.
Step 7: Show confusing matrix for given SVM output.
Step 8: Apply clustering and make clusters of relevant images.
Step 9: Take a relevance feedback from user for cluster selection.
Step 10: Determine the Euclidean distance of Query image with database.
Step 11: Sort the distance values to perform indexing.

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Step 12: Match the images.
Step 13: Display Results.

Figure 2 depicts the Architecture of Content Based Image Retrieval with Relevance Feedback .

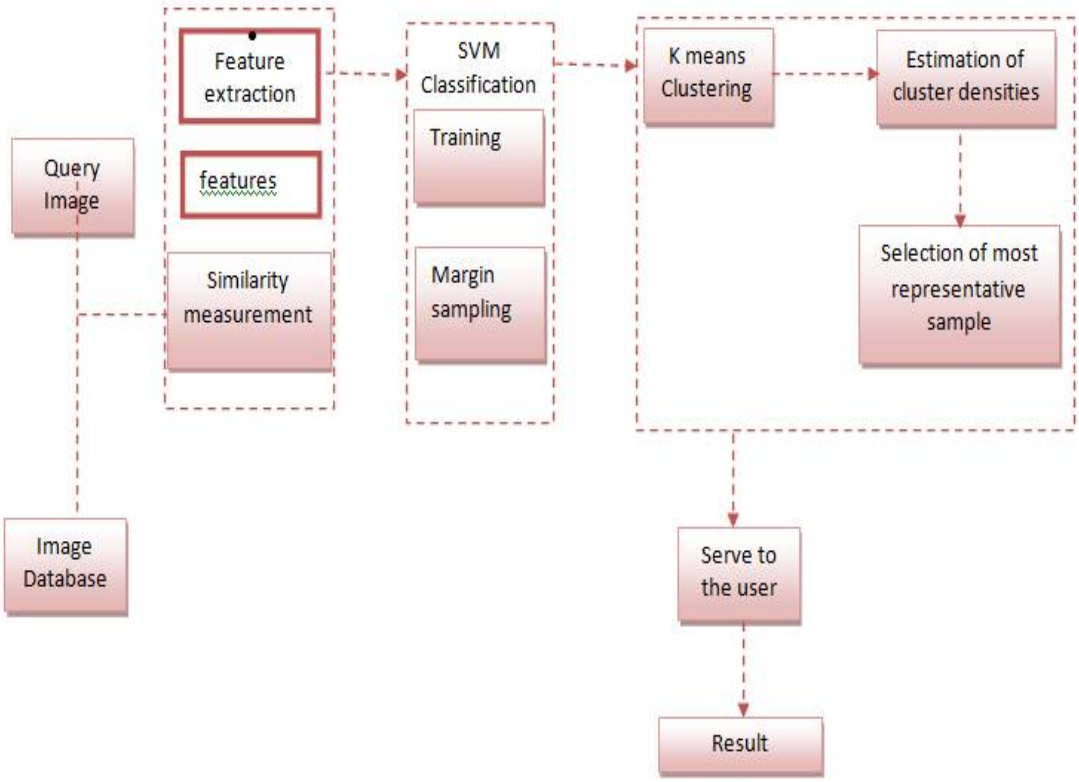

Fig. 1 Architecture of CBIR with Relevance Feedback

Modules in Proposed System

User Module:

At User module user provide a Query image to find the relevant and irrelevant images by extracting the features of Query image and Images in Data achieves and retrieve the images based on Relevance Feedback.

Feature Extraction Module:

Feature extraction is the most import issue of the first step. The features extracted from the images directly lead to the results. Some preprocessing is needed to avoid retrieval noise. Steps such as removing the background, highlights the objects. All the preprocessing steps help in feature extraction. a feature extraction module that derives a set of features for characterizing and describing images.Proposed system extract features of images based on color,texture and color+texture.

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Image Retrieval Module:

System comparing the features of query image and database image and retrieved similarity matching images to the user. Image retrieval module retrieve the images based on three similarity measurements are Color, Texture & Color+Texture. Number of Images to be retrieved is user specific.

Relevance Feedback Module:

In order to confine the semantic gap, relevance feedback (RF) schemes have been designed to iteratively improve the performance of CBIR by taking user's (i.e., an oracle who knows the correct labeling of all images) feedback into account. After each iteration, when a set of images are retrieved, the system must require a reasonable amount of feedback. If the user needs to labour over providing feedback for numerous images after each and every iteration, they will tire soon and not be satisfied with the process. The system must produce acceptable results after only a few iterations. Take a relevance feedback from user for cluster selection.

IV. EXPERIMENTAL RESULTS

By looking at the results provided by proposed algorithm and the results obtained by study different feature extraction system compared against various factors and following points are worth noted. The retrieval performance of proposed technique is shown in terms of Precision and Recall. These two measures are given by equations (1) and (2) respectively.

$$\text{Precision} = \frac{\text{No.of relevant images retrived}}{Total\ no.of\ images\ retrived} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (1)$$

Precision is the ratio of the number of relevant images you have retrieved to the total number of irrelevant and relevant images retrieved.

$$\text{Recall} = \frac{\text{No.of relevant images retrived}}{Total\ no.of\ relevant\ images} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (2)$$

Recall is slightly different. This evaluates how many of the relevant images you have retrieved so far out of a known total, which is the the total number of relevant images that exist.

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No. of images returned	Color	Texture	Color+Texture
1-3	YES	YES	YES
4-6	YES	YES	YES
7-9	NO	YES	YES
10-12	NO	NO	YES
13-15	NO	NO	YES

Table 1. Comparison between Color, Texture & Color+Texture based on Number of images return correctly.

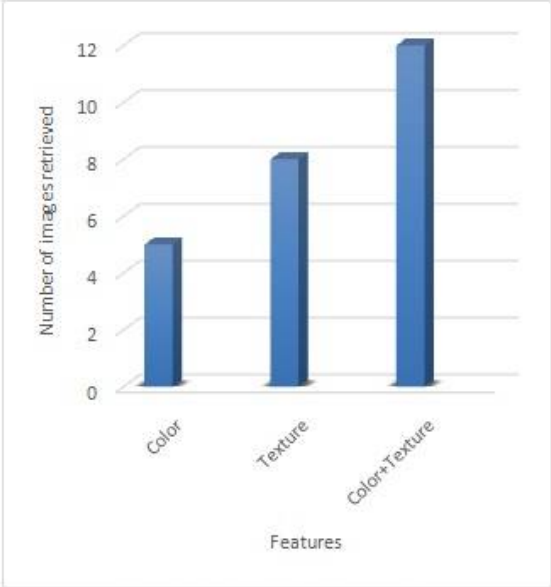

Fig 2. Color vs. Texture vs. Color+Texture

Table 1 shows the Comparison between Color, Texture & Color+Texture based on Number of images return correctly. Number of features increases the accuracy of the system. The requester has been provided requested images by our proposed system on the basis of different features.

Figure 2 shows difference between Color vs. Texture vs. Color+Texture with respect to Number of images retrieved.

Image Cluster	Color	Texture	Color+Texture
'Costal'	96%	98%	96%
'Desert'	96%	94%	100%
'Forest'	100%	90%	96%
'Metro'	76%	90%	92%
Accuracy	92%	93%	94%

Table2.Comparision between color, texture and color+texture using svm classifier

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Image Cluster	Color	Texture	Color+Texture
'Costal'	96%	98%	96%
'Desert'	96%	94%	100%
'Forest'	100%	90%	96%
'Metro'	78%	92%	94%
Accuracy after 10 iterations	92%	93%	94%
Accuracy after 50 iterations	92%	93%	95%
Accuracy after 100 iterations	93%	94%	96%

Table 3.Comparison between Color, Texture&Color+Textureusing k means clustering using relevance feedback after "n" iterations

From the Table 3, we show the comparison between Color, Texture & Color+Texture using k-means clustering using relevance feedback. First we consider the image clusters like 'Costal', 'Desert', 'Forest', 'Metro'. There are many feature extraction type which is covered in our proposed system. Table shows the overall summery. Here we consider the overall accuracy with respect to the number of iteration we perform with relevance feedback. As the feedback is given to the system more and more accuracy will be getting. We consider the scenario with different numbers of iterations like 10, 50 and 100 respectively getting the accuracy for color feature with clustering like 92%, 92% and 93% resp. The accuracy for texture feature with clustering like 93%, 93% and 94% resp. The accuracy for color+texture feature with clustering like 94%, 95% and 96% respectively.

IV. CONCLUSION

System Content Based Image Retrieval using color and texture,The system exactly do feature extraction in first step by using texture, color on images which gives features, which can be used to classify the image into different groups using distance formulas. But proposed algorithm helps to improve the results of the existing system with huge margin Also the system gives relevant images as well as irrelevant images. The relevance feedback of user which helps to improve the overall results. CBIR uses methods that analyze the actual bits and pieces i.e. color, texture features.The main objective of CBIR with RF is to retrieve the relevant images with minimum number of iteration and improve the performance and accuracy of system.

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BIOGRAPHY

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