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SVM Machine Learning Algorithm-Based Efficient Content-Based Image Retrieval System For Satellite Images

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Abstract: This research shows how to extract any data from a satellite image, such as colours, shapes, textures, and other features. SVM (Support Vector Machine) and texture filters are used to achieve this. Using this image processing technique, significant urban features such as buildings and gardens as well as rural traits such as native flora, water features, and fields may be recognized. Texel is used to represent the textures, which are then divided into several sets depending on how many textures are present in the image. We require satellite pictures in order to use SVM to extract the appropriate image. It is essential to have an image search and indexing tool since picture database sizes have grown significantly. For browsing, searching, and retrieving pictures in a variety of fields—including web-based searching, industry inspection, satellite images, medical diagnosis images, etc.—content-based image retrieval systems (CBIR) have gained a lot of popularity. The difficulty, however, is in creating a system that provides a group of photos that are relevant to the query; for example, if the query image is an image of a horse, the first images returned from a vast image dataset must be horse images. To close the gap between high-level semantic and low-level semantic information, we used Multiple Support Vector Machines Ensemble with CBIR [7], a CBIR that uses colour, texture, and points of interest. By minimizing the empirical classification error and maximizing the geometric margin classifiers, descriptors and improve retrieval performance. The experimental findings demonstrate that the suggested strategy achieves

***IndexTerms*: - Retrieval, Satellite Images, Colour and texture, CBIR, SVM (Support Vector Machine).**

1. INTRODUCTION

Digital pictures are widely used in a broad range of industries, including commerce, law enforcement, fingerprint identification, healthcare, surveillance, engineering, fashion, architecture, and graphic design, as well as in education, government, and historical research, among others. This would call for a decrease in retrieval time and an increase in retrieval precision. The previous methods did not include any visual features and exclusively relied on text-based searching. On several cases, a single phrase associated with a number of images also yields inaccurate results. Thus, Content Based Image Retrieval (CBIR) (Devyani Soni, 2015) circumvents the drawback of text-based retrieval. The earliest instances of content-based picture retrieval came in the early 1990s. A content-based image retrieval system's main objective is to find certain photos within a sizable database utilising the visual contents of those images, such as colour, shape, and texture, among other things. Mujtaba Amin Dar (2017) claims that the two key concepts behind content-based image retrieval systems are as follows:

• Feature extraction
• Matching

1.1 Support Vector Machine (SVM): THE SUPPORT a separating hyper plane is the formal description of the discriminative classifier known as the Vector Machine (SVM).

In other words, the algorithm creates a perfect hyper plane that labels training data and categorizes new samples. One class is on either side of the hyper plane, which splits a plane into two pieces in two-dimensional space. In this case, the structural risk minimization (SRM) approach is roughly used. It generates a classifier with a minimised Vapnik-Chervonenkis (VC) dimension. SVM is used to minimize an upper limit on the generalization error rate. Error The overall amount of training limits the rate. Consider the problem of classifying a set of training vectors into two groups. Image retrieval problem, where a positive example is denoted by a +1 and a negative example by a -1. Support vector machines (SVMs) are learning algorithms and supervised learning models that analyses data to find patterns for regression and classification. An SVM training approach uses a set of training samples that have been classified into one of two categories to produce a non-probabilistic binary linear classifier. An SVM model is a representation of the instances, which are points in space that are mapped in a way that clearly distinguishes examples of the different categories from one another. It is crucial to determine which side of the gap the new exam subjects are on before they are projected into the same area and categorised [Jagbir Singh, 2016; Tatta Sugamya, 2016].

2. LITERATURE REVIEW

The system that bases retrieval on the content and related data of the picture is referred to as query by image content and content-based visual information retrieval. For content-based image retrieval, the XYZ and HSV algorithms assess Euclidean distance. On the basis of colour, text, and logo, the findings show that the suggested algorithmic performs quite a bit better than XYZ for the dataset of trademark photos.

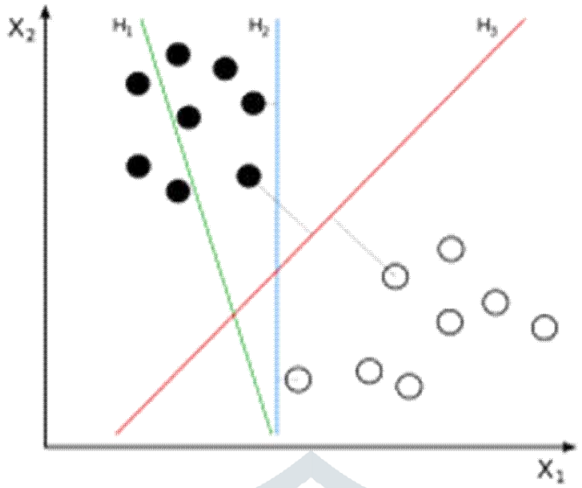


Figure2.1 H1 does not separate the classes. H2 does, but only with a small margin. H3 separates them with the maximum margin

Katta Sugamya et al. A novel two-stage technique, in which the first phase involves feature extraction utilising low level features (colour, shape, and texture), and the second step involves the use of an SVM classifier to handle the noisy positive samples. Thus, a useful image retrieval technique based on Gabor wavelet for texture feature extraction, wavelet transformation for shape feature extraction, and color-correlogram for colour feature extraction is presented. Nikita Upadhaya et al. The main emphasis is on extracting features from the picture that is being searched and from the photos that are stored in the database to detect similarities between these attributes and obtain images that are comparable aesthetically. Focusing on closing the linguistic or semantic gap between low level characteristics and high level semantics makes CBIR more difficult.

A.Komali and others. K-Means technique may be used to build CSIR by effectively retrieving results for related images. More iterations were made using the K-Means technique. We utilise the codebook approach to decrease the amount of rounds. This CSIR may be utilised in a variety of settings, including forensic labs and photo-sharing websites. CLARANS is a common technique for minimising flaws in already-in-use algorithms.

Sanjiv K. Bhatia and others. Correlating geographical coordinates to observation may help to simplify the work to some extent, but this might leave out situations that are comparable across areas. Work on a satellite image database-based image search engine that can quickly extract matched picture segments. This engine is based on a modification of RISE (Robust picture Search Engine), which has been successfully used to query big picture datasets.

Jisha. K. P, Thusnavis Bella Mary. I, Dr. A. Vasuki, presented the Grey Level Co-occurrence Matrix (GLCM) for texture attribute extraction in the semantic based image retrieval system. The extracted textures are given a semantic interpretation based on texture characteristics. The semantic gap between low level features and high level features is reduced as a result of the pictures being restored in accordance with user satisfaction.

Xiang-Yang Wang, Hong-Ying Yang, employing colour and texture information, a novel content-based picture retrieval method has been suggested that improves retrieval efficiency. A Zernike chromaticity distribution moment from the chromaticity space is used to imprison the uniqueness of the colour contents of an image after the picture has first been converted from RGB space to the opposing chromaticity space. Using a rotation- and scale-invariant picture descriptor in the contour-let domain, the texture properties are then retrieved, presenting a competent and adaptable assessment of early processing in the human visual system. Last but not least, the combination of texture and colour information yields a potent feature set for colour picture retrieval. The testing findings show that the suggested colour image retrieval is more precise and effective at locating photos that the user is interested in.

3. METHODOLOGY

The suggested task is to create a CBIR that is efficient for satellite images. As described in the result section, when the findings' precision, recall, and accuracy are evaluated, it is discovered that they have increased.

CBIR: Searching and retrieving digital pictures based on their content is called content-based image retrieval, or CBIR. A reaction to problems with text-based image retrieval has been the development of systems for retrieving pictures based on content rather than language. Finding semantically relevant images in an image database is accomplished through a series of techniques referred to as content-based image retrieval. Efficiency in image indexing and retrieval, which reduces the need for human interaction in the indexing process, is CBIR's main goal.

Creation of the Database: Some of the sample images are shown in figure 2

Fig.3.1. the above figure shows the satellite images from the dataset

3.1 Feature Extraction: The extraction of colour, texture, and form elements will serve as the foundation for the planned CBIR system for satellite pictures.

3.2 Color- One of the most significant and often utilised features in CBIR is colour. One aspect of the picture that cannot be altered in terms of orientation is the colour feature.

It is easy to analyse and extract because to the shape, size, and object. Colour descriptors are used to create similar output pictures by comparing database photographs with photos that have a high or similar percentage of colour to the amount of colour in the query image.

3.3 Texture- According to the definition of texture, it is when a visual pattern with characteristics of uniformity appears in a picture and does not result from the existence of a single hue or intensity. A certain area of an image or subimage is given a particular set of textural characteristics.

3.4 Shape- One of the main visual components used to communicate information about an image's content is shape. When studying shapes in an image, shape boundary and inner content are combined to depict an item or form. To properly retrieve pictures, form descriptors must effectively identify comparable shapes from a collection of photographs.

3.5 SVM:

The structural risk minimization (SRM) concept is approximated by the Support Vector Machines (SVM) method. It creates classifiers with Vapnik-Chervonenkis (VC) dimensions as little as feasible. SVM lowers the generalisation error rate's upper bound. The overall amount of training reduces mistake rates.

3.6 Performance Measures

- **PRECISION:** It is the ratio of discovered relevant records to all discovered relevant and irrelevant records. Most often, it is expressed as a percentage. PRECISION = Total Images Retrieved / Number of Relevant Images
- **RECALL:** It is the ratio of records that were successfully retrieved to all records that were relevant in the database. Most often, it is expressed as a percentage. Number of Images Retrievable/Number of Images Retrievable in the Database
- **ACCURACY: ACCURACY:** final_acc = 100*sum (diag (cmat))./sum(cmat(:));fprintf('SVM(1-against-1):\ naccuracy =%.2f%%\n',final_acc);

This code allows us to obtain the accuracy values from the picture retrieval.

4. RESULTS AND DISCUSSION

The description of the picture dataset can be seen in Fig. 3, which was collected from Google picture Search. The picture has a resolution of 384x256 and is a 12.9KB jpg file.

4.1 Working Methodology: The project's working steps will be covered in this part.

4.2 Performance Evaluation: The recall, precision, and accuracy of the retrieval system's performance are calculated in this section. While accuracy assesses the system's capacity to recover just relevant models, recall gauges its capacity to retrieve all relevant models. The value of accuracy indicates how well the query picture was retrieved.

Fig.4.1. Image in the dataset

STEP1- Initialization Phase

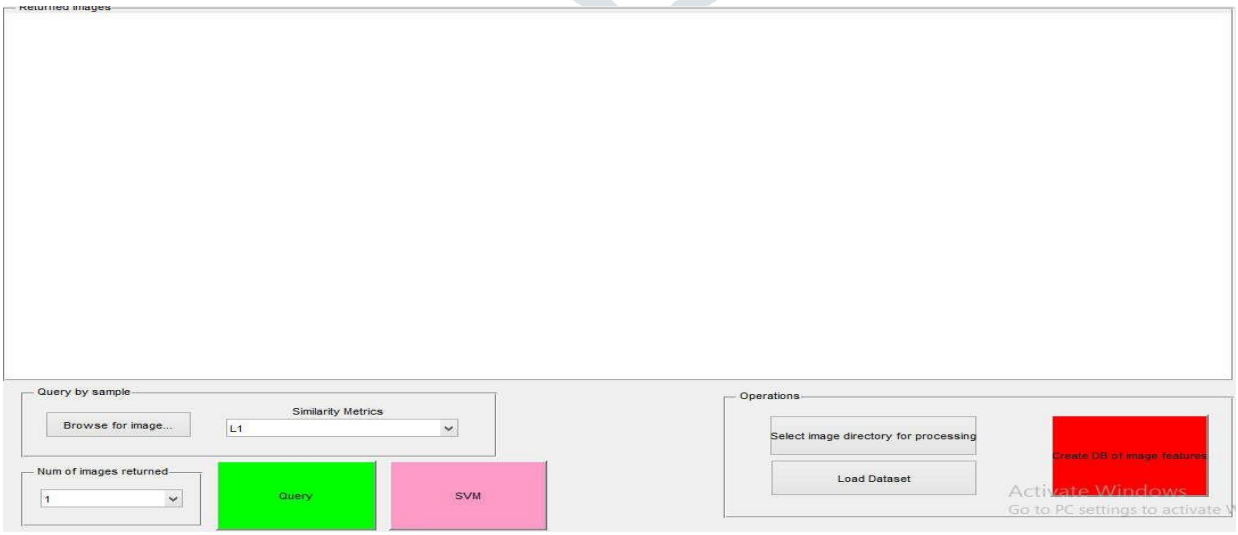


Fig4.2:- STEP1- Initialization Phase

STEP2: The datasets are loaded in this section

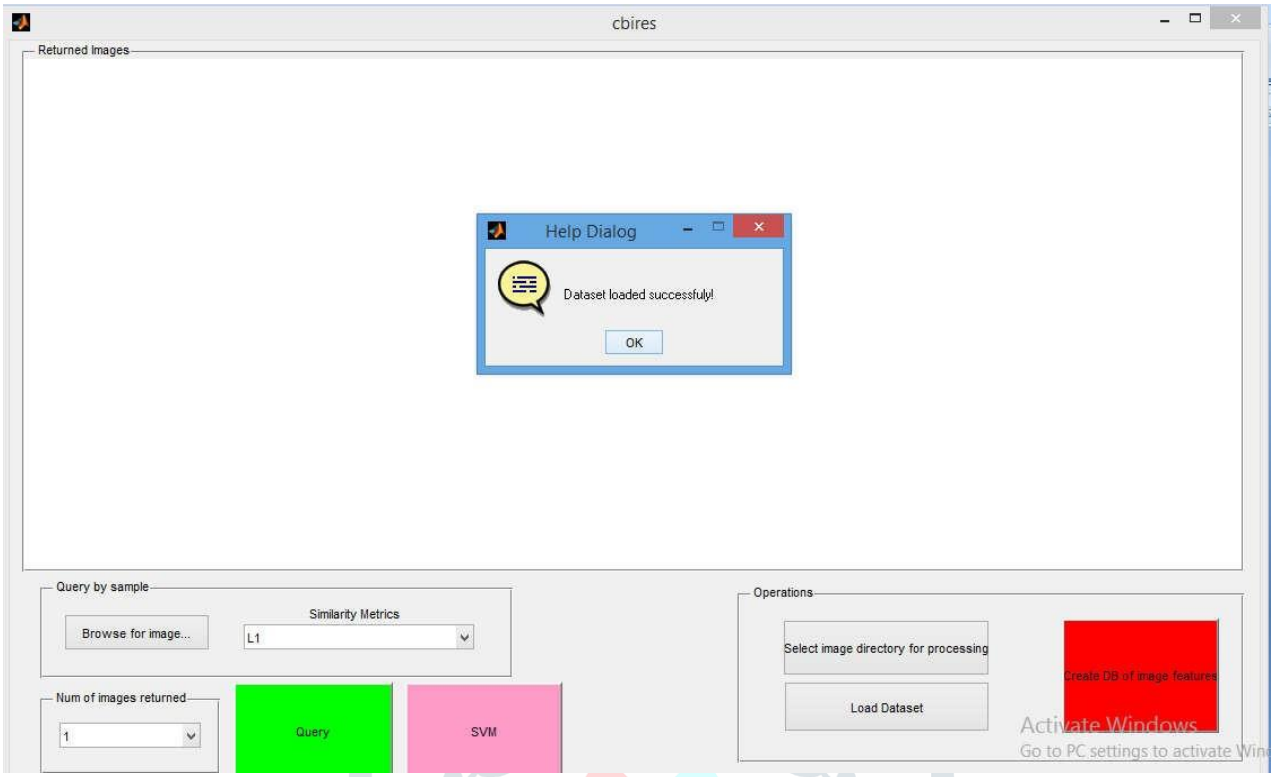


Fig4.3:- STEP2: The datasets are loaded in this section

STEP3: In this section we take an image from datasets and get the number of query images.

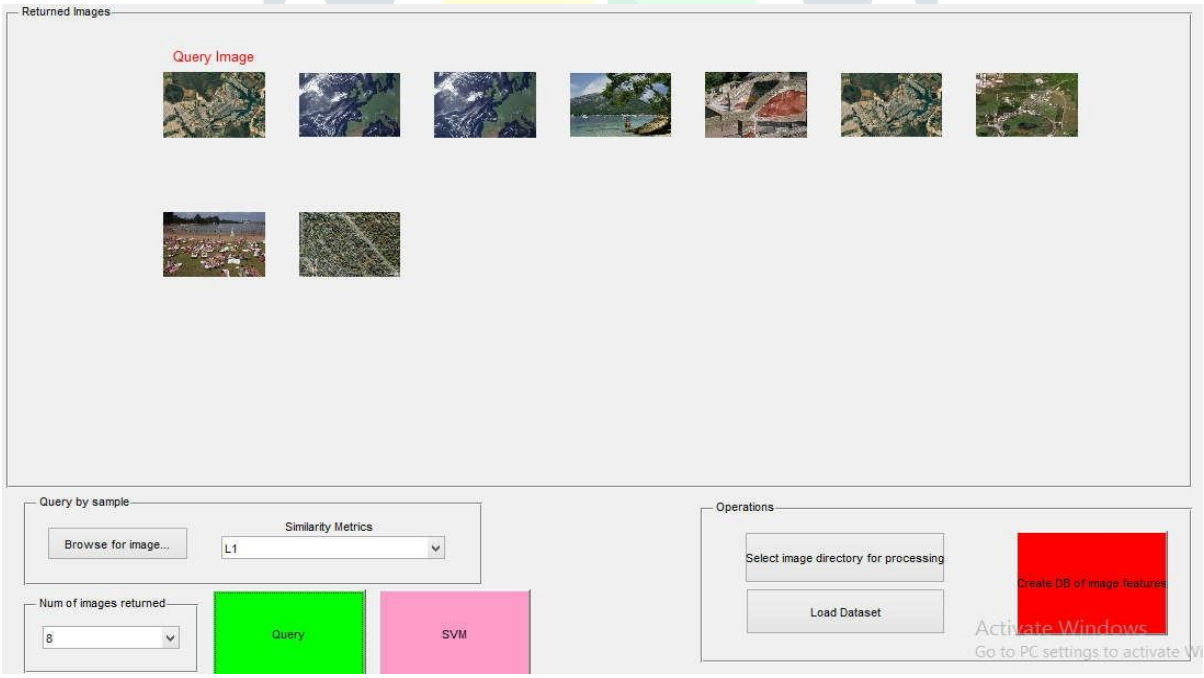


Fig4.4:- STEP3: In this section we take an image from datasets and get the number of query images

STEP4: After getting the query images we precede it to get SVM of it.

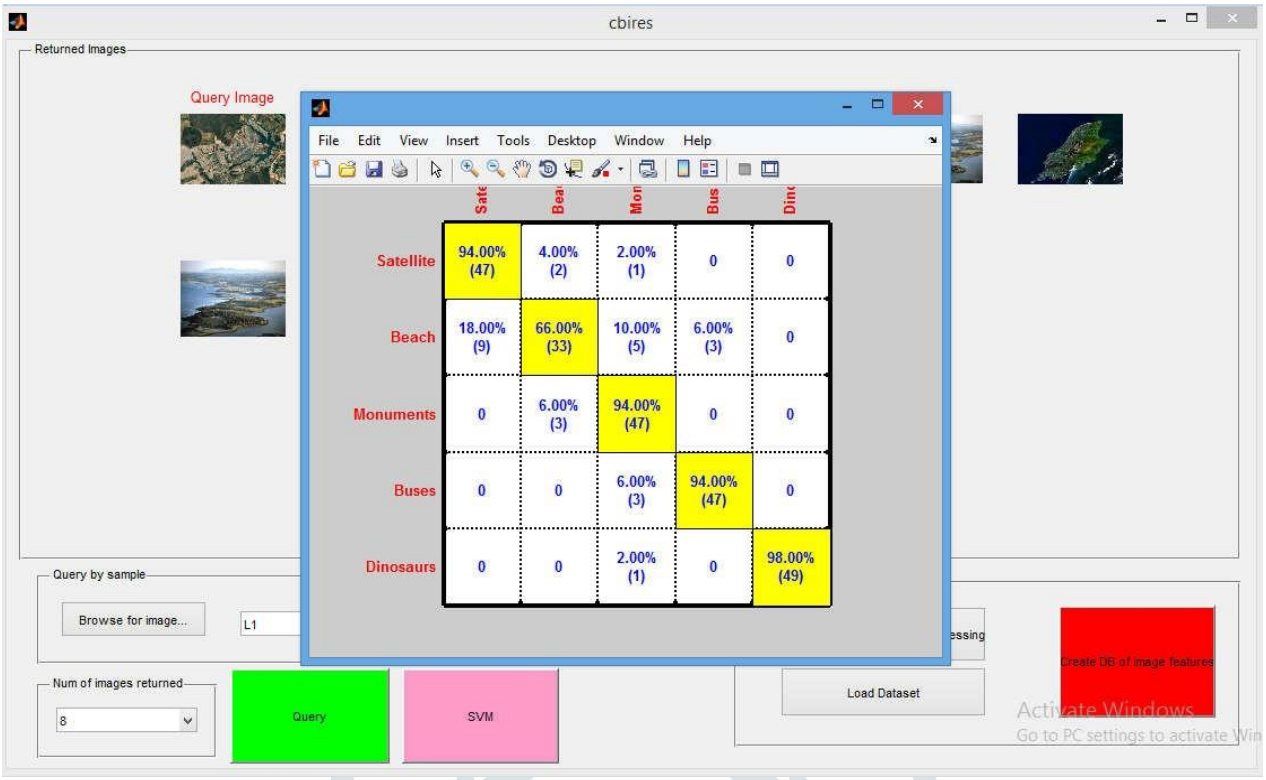


Fig4.5:- STEP4: After getting the query images we precede it to get SVM of it.

Table 4.1 shows the result of the different values

S.no.	Query image	Retrieved	Precision	Recall	Accuracy(%)
1.		10	0.1	0.02	85.20%
2.		15	0.15	0.03	85.20%
3.		5	0.05	0.01	86.40%

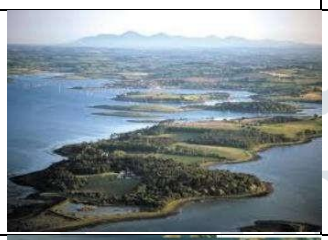
4.		8	0.08	0.16	89.00%
5.		10	0.1	0.02	84.60%
6.		12	0.12	0.24	89.20%
7.		10	0.1	0.02	87.60%
8.		15	0.10	0.01	89.20%
TOTAL			**0.8**	**0.7**	**87.05%**

Table 4.2.The comparative analysis

S.No	Precision	Recall	Accuracy
Simardeep Kaur and Dr.VijayKumar	0.6	0.5	67.75%
Banga et al. 2013 Proposed work	0.8	0.7	87.05%

4.3 Comparative analysis

The table above may be used to deduce the improved outcome and effective value of precision, recall, and accuracy. More than our labour is the outcome that was produced by the prior work.

5. CONCLUSION

In this paper, we represented a CBIR system that uses a query image and retrieves relevant images. The results show that SVM is the appropriate method to find color space for color feature extraction. It gives good results as compared to other Color spaces. As results shows, choice of color features has an impact on image retrieval. When all the three color features are used together, the results are more relevant. The expected designed system will be very efficient and accurate with improved retrieval results in terms of precision recall and accuracy.

Future work (Scope of work): The retrieval efficiency may be improved when use along with other texture features .The retrieval of the image based on shape features are also studied and suggested that the shape combined with other texture feature help in improving the efficiency of the image retrieval .The texture feature extraction techniques are also applied to the retrieval of nature images and for face recognition system. The texture features are collected from the whole image and significant portion of the image are used in the retrieval of natural images showing improved result.

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