SEMANTIC BASED IMAGE RETREIVAL

Amruta Laxman Mane
Information Technology, Savitribai Phule Pune University,
Vadgoan, Pune, Maharashtra, India
amruta.mane23@gmail.com

A.N. Bhute
Associate Professor, Vadgoan, Pune, Maharashtra, India
anbhute@gmail.com

Abstract - In Content-Based Image Retrieval (CBIR), images are retrieved depending upon the low-level feature of the images such as color feature, texture feature and shape feature. CBIR system analyses the image content for indexing, extraction and retrieval using low-level features. To retrieve images from the large image dataset, images should be indexed or labeled properly. In semantic features images are labeled and they are assigned to its appropriate class. Classes of different images are made and images are assigned to it. To retrieve images from dataset which searched for proper class and image is retrieved. To overcome such retrieval problem we are developing semantic based image retrieval system by classifying images into different categories and index the feature for fast retrieval.

Keywords: CBIR; Semantic Feature.

1. Introduction

There are two main frameworks used for image retrieval process: 1) text-based and2) content-based. Text-based methods are originated from the information retrieval community .In these systems retrieval is done by using the text information that is attached to the image. Content-based image retrieval (CBIR) systems use the visual features such as color, texture, and shape for image retrieval.

In Image processing images are retrieved from a large dataset. Primary it has two goals: first is to obtain the image that is more suitable for human observing and understanding and the second is to recognize the image automatically by the computer. Image processing is one kind of an efficient method to extract the images that are similar in context and content. Content-based picture recovery (CBIR), otherwise called query by image content (QBIC) and content-based visual information retrieval (CBVIR) is the utilization of PC vision strategy. This application is used in the image retrieval problem, that is, the problem of searching of images in the large database. “Content-based” means the contents of the image are searched rather than the metadata such as keywords, tags, or descriptors that are associated with the images. Here the term “content” refers to colors, shapes, and texture feature of the image. CBIR is a set of technique that is used to retrieve relevant images from an image dataset. CBIR goal is to retrieve the images efficiently.

CBIR system was initially developed to search database based on color feature, texture feature and shape feature. After there came the need for user-friendly interfaces, and then they were developed. This involves the query methods that allow descriptive semantics, queries that may involve user feedback, system that may include machine learning and the system that may understand the user satisfaction level. But there is some problem when querying the images for exact search. So when textual information is given to system it is difficult for the system to check for the images from the database. Example when we are searching for fruit “apple” it is possible that it can retrieve the images that are related to the company name “apple”. There lies a gap between the low-level features and high-level feature. So to overcome this gap, semantic feature is used. In this semantic feature technique large dataset are used. There are some dataset that are standardized. And some of the authors use that dataset. These dataset are different from the other database that is used in the CBIR system. This difference is that the images that are stored in that dataset have classification of the images. Example, under the “male” keyword there is a classification which consist of man, brother, father, etc. So there is a main class and from that class we have to search for the correct image. Due to classification, the images would be retrieved easily.

2. Literature Review

- Avinash N Bhute, B.B. Meshram,[Bhute and Meshram (2014)] ,present the content based image retrieval system which shows the color, texture and shape information of images that make the retrieval process easier. Paper presents the efficient content based image retrieval system. For an efficient feature extraction like color, texture and shape feature of images are extracted automatically using edge detection which are used in signal processing and image compression.
- Aman Chadha, Sushmit Mallik, Ravdeep Johar, [Chadha *et al.*(2012)] ,present the comparative study of the content based image retrieval system. The main aim of the Content-Based Image Retrieval system, which is also known as Query by Image Content which is used retrieve relevant images based on their contents. Using the trained images the system can find the relevant images from the large database. And for the trained images unique descriptors is assigned. An image consists of an image descriptors for texture feature, color feature and shape feature. So several feature extraction technique are used. However, these techniques when used individually then it result in poor performance. So, combination of these technique is been evaluated in this paper and the results of this combination is more efficient. These efficient combinations of technique have been presented and optimized for each class of image query. Paper presented an improvement in image retrieval performance by introducing the idea of query modification through image cropping. It enables the user to identify a region of interest and modify the initial query to refine the images retrieval results.
- Ye Lu, Hongjiang Zhang etl.[Lu *et al.* (2003)] , presents a relevance feedback framework. Relevance feedback is a power full technique for image retrieval and it has been an active research topic. Several techniques were used for relevance feedback. The most of the relevance feedback technique focuses on the low-level feature of the images. But this technique did not satisfy the need of the images of the semantic content. This paper presents a framework for the semantic features of the images. Relevance feedback framework is proposed, where semantic network is used and which has used the image semantic content for the retrieval purpose. Ranking technique is presents for the framework. The experimental results are shown which provide accuracy and effectiveness of the method.
- Xiang Sean Zhou, Thomas S Huang [Zhou and Huang (2000)], presents the hybrid image retrieval system. In content-based image retrieval system, the performance of the system is restricted to the feature that is used to represents the images in the database. Low-level features will not provide efficient result in many cases, and especially when the high-level concept is not easily expressible by the low-level features. So for the purpose the text based annotation should be used to improve the retrieval performance. This paper presents the hybrid image retrieval system which will provide the user with flexibility of using low-level features as well as high-level semantic which is used in the retrieval process. Statistical algorithm is used for semantic grouping in the concept space through the relevance feedback in the image space. System developed a framework in which learns the users search habit in terms of the semantic concept. And that information will be used to improve the performance of subsequent retrieval tasks.
- Thomas Deselaers, Daniel Keysers, and Hermann Ney,[Deselaers *et al.* (2008)] , presents a test examination of an expansive number of various picture descriptors for content based image retrieval. The majority of the papers depict new strategies and descriptors for content based image retrieval. Also, these systems depict their recently proposed strategies as most fitting one. Yet, these procedures don't give a top to bottom examination with all techniques that were proposed before. In this paper, a review of an extensive assortment of components for content based image retrieval and correlation of them is done on four unique assignments: stock photograph recovery, individual photograph gathering recovery, building recovery, and restorative picture recovery. For the investigations, five distinctive, freely accessible image databases are utilized and the recovery execution of the elements is broke down in subtle element. This takes into account an immediate examination of all elements considered in this work and besides will permit a correlation of recently proposed elements to these later on. The article concludes with recommendations which features perform well for what type of data. Color histogram performs well in the comparison and thus can be used as a simple baseline for many applications.

3. Proposed system

Semantic Based Image Retrieval has wide range of applications such as, quick browsing of image folders, remote instruction, digital museums, consumer domain applications, news event analysis, and educational applications. These applications motivate the research in text based image retrieval.

The framework consists of following steps as:

(1). Image tagging and annotation.
(2). Classification of the images depending upon the classes that are described.
(3). Semantic Classification of the images.
(4). Semantic Hierarchy to retrieve the images.

(5). User query.
(6). Retrieval of expected image i.e. the output.

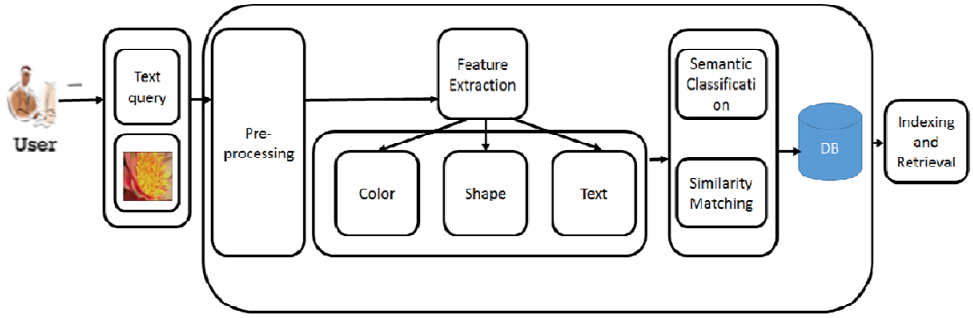

Fig .1. System Architecture

From the above figure .1.system architecture diagram, the images are being searched through a text based query and image based query. The semantic approach is used in which semantic feature are applied in the search process. The classification of the images is done and the feature extraction techniques are used. . Feature extraction process is used by image collection database where the properties of the image both visual such as color, texture and shape and semantic such as intentional, clicks, labels, keywords, annotation etc. are extracted from the feature database using convenient methods. In similarity measurement process, the query's feature is compared with the features vector of digital image. To highlight extraction process and question put away in highlight database the inquiry picture is subjected. The separation between the two components is computed and weights are resolved. The yield pictures are then sorted and ordered, so that most comparative pictures can be shown to the user. This system is based on the following functionalities and features:

(1). Extraction:

- *Visual feature*

  If the user enters the query as "shark", color feature would be considered as the essential identifier. For the query as "building" shape feature would be more relevant that the color feature. Whereas, if the user enter the query as "snow" and if the color feature and shape feature is considered then differentiation between "snow" and "cotton" would become hard for the system. So the texture feature will be considered as the essential identifier for query "snow".

- *Semantic feature*

  Semantics i.e. etymological is the genuine aim of the client behind the inquiry. This expectation can't be translated by the machine, bringing about the semantic gap. For instance, if the entered question is "apple", client may expect for a fruit or company named "Apple". Hence, to lessen the semantic gap, semantic component should be considered.

(2). Distance calculation and similarity measurement:

The image similarity is calculated between the images. The difference between the image features is calculated and the more similar images are considered. For example, if the user enters a query as "lake" and if the feature is color feature then the similarity between the images are plotted in feature space and distance between them is calculated. The images are considered as similar that will be laid near its space.

Given two feature vectors A and B such that:

A= (a1, a2, a3.....an)

B= (b1, b2, b3 ...bn)

Euclidean distance is given by Eq. (1):

$$E = \sqrt{(ai - bi)^2} \qquad (1)$$

3.1. *Semantic Approach*

The semantic approach is split into four parts:

I. Tagging and annotation of the images are done.
II. Semantic classification of the images depending upon the classes is done.
III. Build the semantic hierarchy.
IV. Retrieval of resultant image.

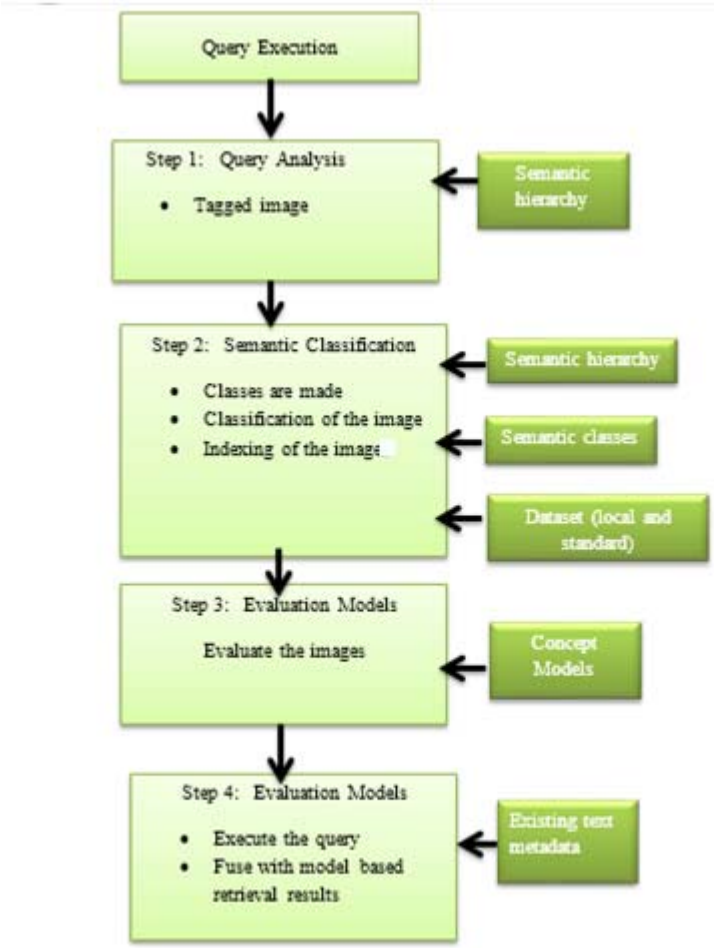

Fig .2. Overview of Semantic Based Image Retrieval

3.2. *Semantic Hierarchy*

As we know there are number of images in the dataset. Each and every image represents something. So to know what those images are representing the images are annotated either manually or automatically. In this thesis the images are annotated manually. The annotation of the images is done. The images are manually tagged. After the code is executed the image is display, so the content of the images are tagged that is what you can see in the image is tagged. After tagging each and every image the manual annotation is completed. The tagged images are then classified into the hierarchy. The hierarchy of the images is done depending upon the keywords that are used for tagging of the images. The hierarchy defines the indexing that is being provided by the tagged image. Fig .3. Semantic Classes which are classified shows how the images are tagged and classified into various semantic classes.

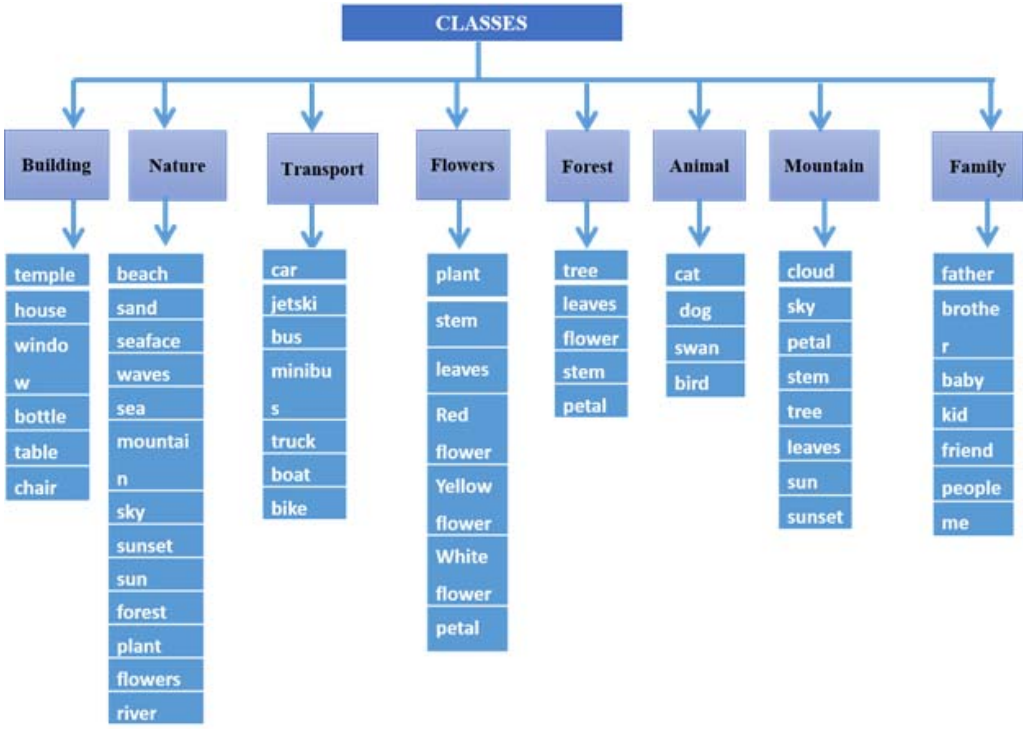

Fig .3. Semantic classes which are classified

The semantic hierarchy above mentioned describes the various semantic classes. As it mention the textual representation of the semantic classes.

3.3. *Database and Indexing*

Standard dataset are used such as WANG dataset and UW dataset. And a local dataset is used which consist of approx. of 400 images which include vacation images, beach image, forest images etc. The standard dataset are used basically for experimental comparison. To check the performance of various dataset the standard dataset are used. Images are partially annotated in some of the benchmark dataset. These tagged images are used by the semantic retrieval system.

I. WANG database:

The WANG database is a subset of 1,000 pictures of the Corel stock photograph database which are physically chosen and from which 10 classes of 100 pictures each are made. The WANG database are like normal stock photograph recovery with a few pictures from every classification and a client having a picture from a specific class and scanning for comparative pictures .The 10 classes are utilized for significance result: given a question picture, it is accepted that the client is looking for pictures from the same class, and in this manner the rest of the 99 pictures from the same class are viewed as important and the pictures from every different class are viewed as insignificant.

II. UW Database:

UW database is made at the University of Washington which comprises of classified accumulation of 1,109 pictures. A portion of the pictures are clarified utilizing watchwords. The rest of the pictures were clarified by a gathering to permit the comment to be utilized for significance estimation; comments are openly accessible. Pictures that are gathered incorporate excursion pictures from different area with various sizes. There are 18 classes, for instance spring owers, Barcelona, and Iran. The complete comment comprises of 6,383 words which has a vocabulary of 352 extraordinary words. On a normal, every picture has around 6 expressions of explanation. The greatest number of watchwords that is allotted per picture is 22 and the base is 1. The database is unreservedly accessible. The pertinence evaluation for the trials with this database was performed utilizing the comment: a picture is thought to be important w.r.t. a given inquiry picture if the two pictures have a typical watchword in the explanation. On the normal, 59.3 significant pictures relate to every picture. The watchwords are fairly broad; along these lines for instance pictures indicating sky are applicable w.r.t. each other, which makes it entirely simple to and important pictures (high accuracy is likely simple) however it can be amazingly dicult to acquire a high review since a few pictures demonstrating sky may have scarcely any visual similarity with a given inquiry. This assignment can be viewed as an individual photograph recovery undertaking, e.g. a client with a gathering of individual get-away pictures is searching for pictures from the same excursion, or demonstrating the same kind of building.

3.4. *Retrieval Image*

Query terms are searched in the hierarchy. And the same query term from that semantic hierarchy is searched and the image related to the keyword that is query term are retrieved. For each query term, similarity matching is done and the images are retrieved.

4. Result Analysis

Performance of the system is evaluated based on the Precision and Recall values. Table-1 shows the how much Precision and Recall is calculated for a given text query for local dataset**.**

Table 1. Precision and Recall of local dataset for SBIR

Input Query	Precision	Recall
sky	6	4
Me	7	3
Beach	9	3
Car	6	2
friend	2	3
Sunset	3	6
Baby	5	1
flower	2	1

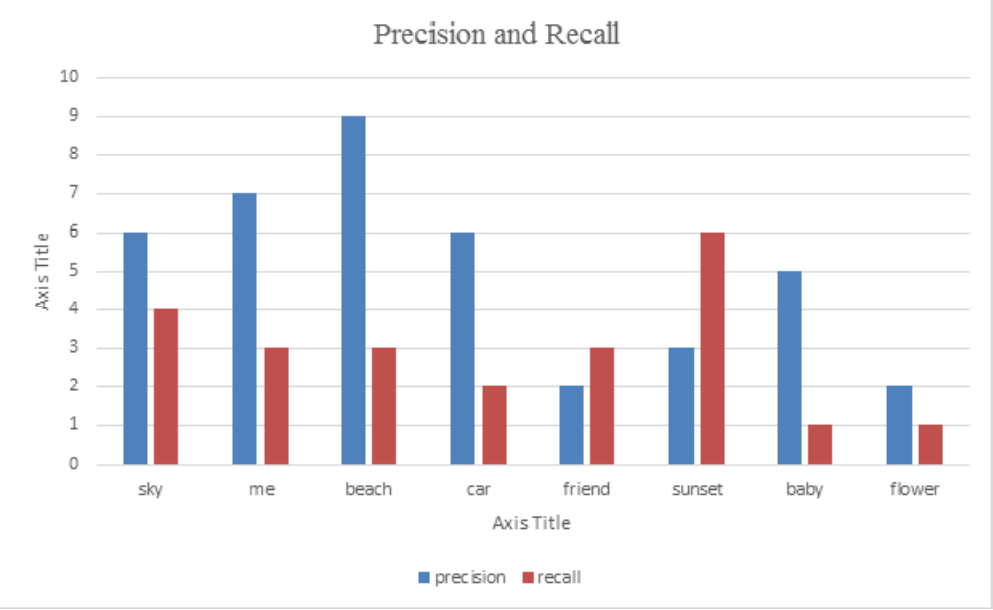

Fig .4. Precision and Recall graph of local dataset

Table.2. shows the precision and recall values of WANG dataset.

Table 2. Precision and Recall of WANG dataset for SBIR

Input Query	Precision	Recall
sky	5	1
beach	5	3
mountain	4	2
flower	3	2
tree	4	3
lake	6	2
river	6	2
cloud	2	1

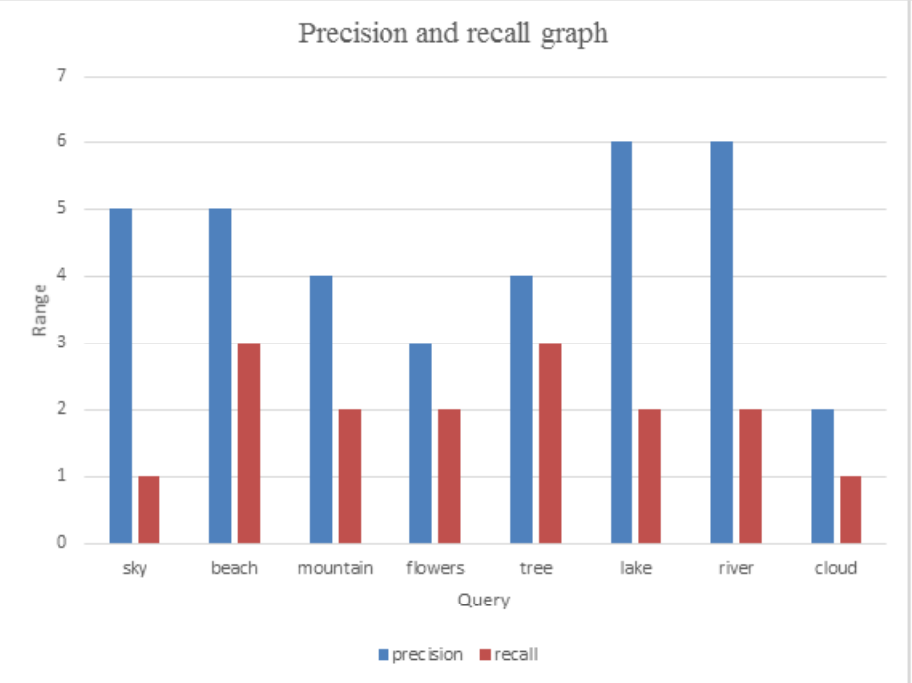

Fig .5. Precision and Recall graph of WANG dataset

Table.3. shows the precision and recall values of UW dataset.

Table 3. Precision and Recall of UW dataset for SBIR

Input Query	Precision	Recall
beach	5	1
people	6	2
car	7	1
animal	3	7
grass	3	1
mountain	5	3
sky	2	3
sunset	4	3

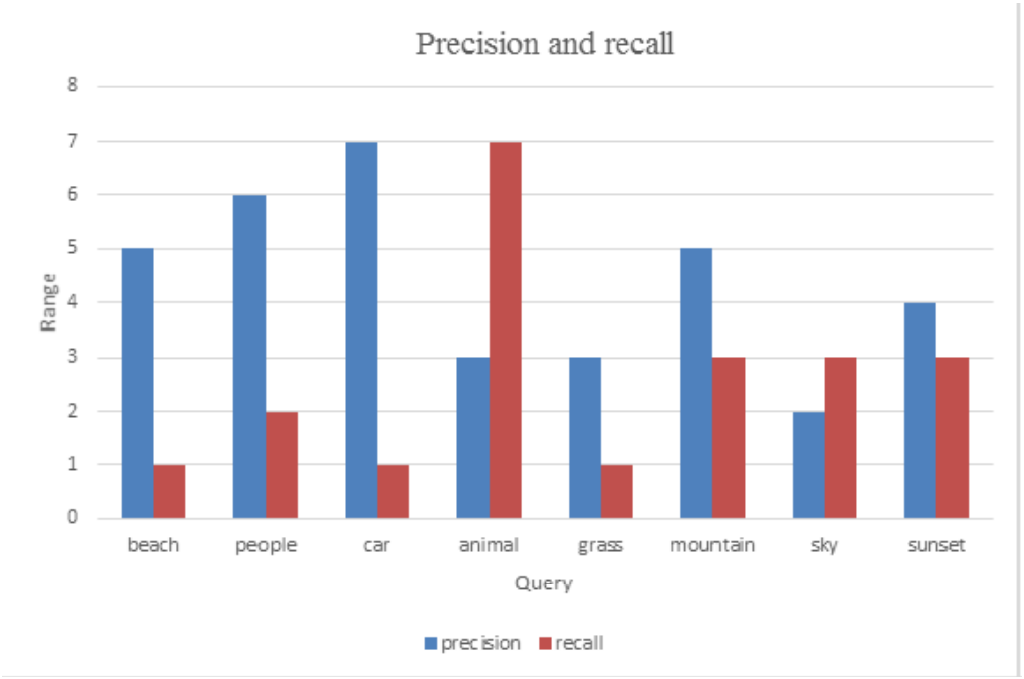

Fig .6. Precision and Recall graph of UW dataset

5. Conclusion

The proposed system does the semantic retrieval and feature extraction of the images. Feature technique such as color, shape and texture technique are used. Semantic feature are used which will provide some specified result. Comparative study of various standard databases is made with the user defined databases. Performance analysis of feature extraction technique and database is being made.

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