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Semantic based Image Retrieval

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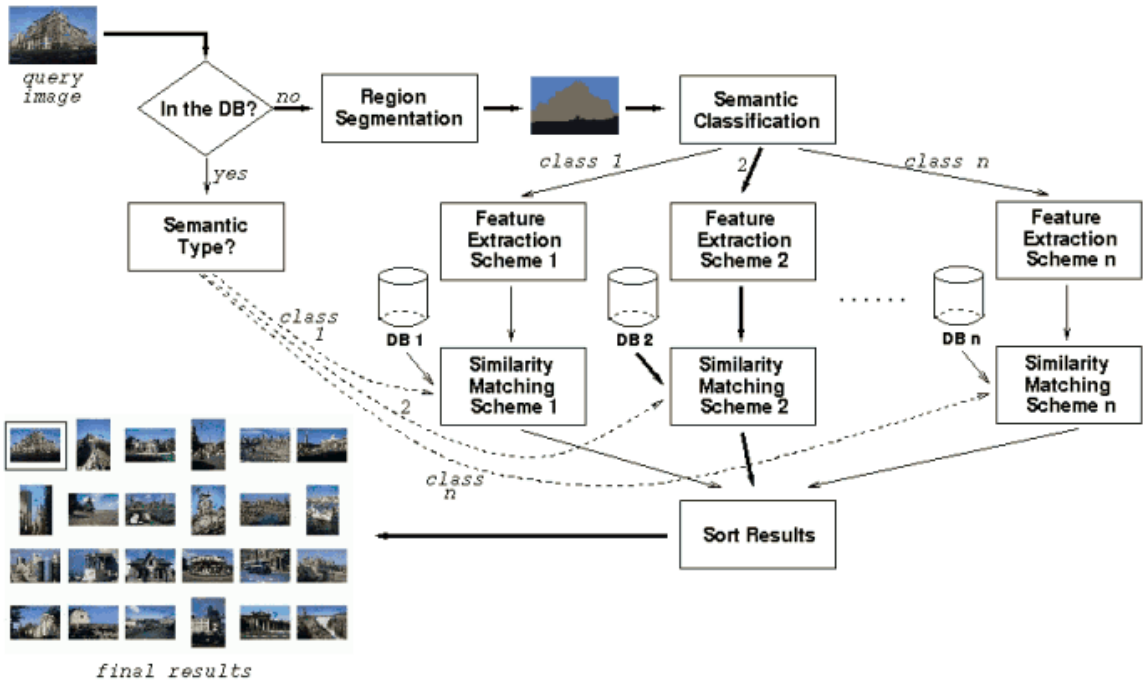
Abstract: Images / Videos are major source of content on the internet and the content is increasing rapidly due to the advancement in this area. Image analysis and retrieval is one of the active research field and researchers from the last decade have proposed many efficient approaches for the same. Semantic technologies offers promising approach to image retrieval as it tries to map the low level image features to high level ontology concepts. In this paper, we have proposed various Semantic Image Retrieval method for image retrieval relevant to the user query. Semantic Image Retrieval is based on hybrid approach and uses shape, color and texture based approaches for classification purpose.

Keywords: Image Retrieval, Ontology, Semantic Image, Semantic Retrieval, semantic gap.

INTRODUCTION

Image analysis involves investigation of the image data for a specific application. Normally, the raw data of a set of images is analyzed to gain insight into what is happening with the images and how they can be used to extract desired information. In image processing and pattern recognition, feature extraction is an important step, which is a special form of dimensionality reduction. When the input data is too large to be processed and suspected to be redundant then the data is transformed into a reduced set of feature representations. The process of transforming the input data into a set of features is called feature extraction. Features often contain information relative to colour, shape, texture or context.Considering that only color features cannot express the semantic information of an image sufficiently, capacity, entropy and relevance of an image are calculated by the grey-level co-occurrence matrix approach as the texture features.semantic image retrieval is a new and promising research direction in recent years. This paper attempts to introduce this emerging area to researchers, give them a brief overview of current research progress and framework[3].As shown in below figure 1 querying process, if the query image is not in the database as indicated by the user interface, it is first passed through the same feature extraction process as was used during indexing. For an image in the database, its semantic type is checked first and then its signature is extracted from the corresponding database. Once the signature of the query image is obtained, similarity scores between the query image and images in the database with the same semantic type are computed and sorted to provide the list of images that appear to have the closest semantics.



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SEMANTIC GAP IN IMAGE RETRIEVAL

The relationship between low level features (color, shape, texture, object detection) and high level user features (abstract, objects, event) categories defined by Wang. CBIR indexes the images by using the low-level features, then displays an interpretation opposition between image description and high-level semantics, this process call semantic gap[1]. The researchers tried to bridge the semantic gap by proposing many techniques Conventional information retrieval was based solely on text, and those ap- proaches to textual information retrieval have been transplanted into image retrieval in a variety of ways. However, "a picture is worth a thousand words".Image contents are much more versatile compared with texts, and the amount of visual data is already enormous and still expanding very rapidly. Hoping to cope with these special characteristics of visual data, content-based image retrieval methods have been introduced. It has been widely recognized that the family of image retrieval techniques should become an integration of both low-level visual features addressing the more detailed perceptual aspects and high-level seman- tic features underlying the more general conceptual aspects of visual data. Neither of these two types of features is sufficient to retrieve or manage visual data in an effective or efficient way[2]. Although efforts have been devoted to combining these two aspects of visual data, the gap between them is still a huge barrier in front of researchers. Intuitive and heuristic approaches do not provide us with satisfactory performance. Therefore, there is an urgent need of finding the latent correlation between low-level features and high-level concepts and merging them from a different perspective. How to find this new perspective and bridge the gap between visual features and semantic features has been a major challenge in this research field.

TECHNIQUE FOR IMAGE RETRIVAL

A. Object Metaphysics

Semantic used to define the image. This technique shows a difference of levels as an initial image feature[4]. Every level is considered as a middle level descriptor for image. That means the meaning of image features (vocabulary) watch called Object Metaphysics. The proposed Color Naming System (CNS) quantifies the shade of color , value into basic color sets to compare colors

Object metaphysics defines the image using semantic of the image. In this technique, different levels are assigned for primitive image features. Each level is considered as the intermediate level descriptor for an image. For example, sky can be defined as topmost blue region. Similarly, blue region can be defined as 'blue high', 'blue medium', 'blue low'. Such type of vocabulary is called Object metaphysics . Berk, Brownston and Kaufman proposed a color naming system 'CNS' which quantizes the hue values into set of basic colors such as red, orange, brown, yellow, green, blue and purple, black, grey and white. Compared to color, texture naming system is not yet available .

B. Machine Intelligence

This method predicts the value of output based on a set of inputs. In supervised machine intelligence a set of training images are collected and a binary classifier is trained to detect semantic category label based on a set of input measure [1]. Bayesian classifier is an important method in which database images are automatically classified into general types as indoor/outdoor, and the outdoor images are further classified into city/landscape, etc. Another method is by neural network, in which the user chooses 11 categories (concepts): brick, cloud, fur, grass, ice, road, rock, sand, skin, tree, and water[5].Then a large amount of input is fed into the neural network classifiers to establish the link between low-level features of an image and its high-level semantics . Decision tree is another technique to derive semantic features. Decision tree is built based on a set of images relevant to the query, and then used as a model to classify database images into two classes: relevant and irrelevant . In unsupervised machine intelligence method, there is no outcome measure; it only describes the organization of input data. In this technique, set of images similar to each other are assigned to clusters. Each cluster is assigned some name. It maximizes the possibility of getting similar image from that specific cluster.

C. Relevance Feedback

Relevance feedback technique involves the user interaction in the retrieval process but it is infeasible in some domains. Relevance feedback mechanism operates when the user enters the query in the form of a image, sketch or text. When the system retrieves the system, user checks the relevancey of returned image. Then machine learning algorithm is applied to get the user feedback. This process is repeated till the user is satisfied with the results.

D. Semantic Pattern

It is a set of general features that attends to images stored and in the database then this set of images will be calculated.Semantic Pattern is a set of general features which is calculated from the number of images stored in the database.It maps the high-level features to primitive features. Chang etal. introduced semantic visual template (SVT) to

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link low-level image feature to high-level. Semantic visual template (SVT) links low-level image feature to high-level concepts for video retrieval[5]. To generate SVTs, the user first defines the template for a specific concept by specifying the objects and their spatial and temporal Constraints, the weights assigned to each feature of each object This initial query scenario is provided to the system. Through the interaction with users, the system finally converges to a small set of exemplar queries that 'best' match (maximize the recall) the concept in the user'mind. The generation of SVT depends on the interaction with the user and requires the user's in-depth understanding of image features. This impedes its application to ordinary users .

E. Web Image Retrieval

Web Image Retrieval technique uses the web information to retrieve images such as URL of image, image title, ALT-tag, descriptive text of image, hyperlinks etc. But its performance is not accurate. To improve its performance, researches have begun the use of visual image contents with the web information

F.Synthetic Aperture Radar:

Synthetic Aperture Radar (SAR) images retrieval is close to human dialect and linguistic descriptors, reduce the semantic gap between the features of a Synthetic Aperture Radar (SAR) image being stored in a database and what is expected by the user and retrieve images based on the user query[6].

PERFORMANCE MEASURE

Many methods are available for measuring the performance of image retrieval systems[4]. The most common evaluation measures used in image retrieval system are precision and recall . These are usually presented as a precision vs. recall graph. The standard definitions of these two measures are given by following equations. Precision (P) is defined as the ratio of the number of relevant images retrieved to the number of total retrieved images.

Recall (R) is defined as the number of retrieved relevant images over the total number of relevant images available in the database[2].

precision = No. relevant documents retrieved/ Total No. documents retrieved ;

recall = No. relevant documents retrieved /Total No. relevant documents in the collection :

High precision means that less relevant images are returned or more relevant images are retrieved, while high recall means few relevant images are missed.

CONCLUSION

Retrieval systems based on low level features are considered as unsatisfactory and unpredictable because these low level features do not match human perception. This is referred to as semantic gap. For such systems, it is difficult to find the images based on the user query such as "Find images having rocks". Some researchers have attempted to bridge the semantic gap by proposing new techniques.

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