

A Proposed Method for Semantic Annotation on Social Media Images

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Abstract

Semantic annotation attaches to various concepts (e.g. people, things, places, organizations etc) in any other content. A semantically annotated document is easy to interpret, combine and reuse by computers. In human history Web plays as the greatest information source. Many researchers believe semantic annotations can be inserted in web-based documents for information extraction and knowledge mining. These annotations use terms defined in an ontology. This paper uses the annotation process based on textual patterns for improving annotation.

Introduction

Image databases are large and databases are used in public domain applications and domain-specific applications. Internet services such as social networks, photo sharing image and video monitoring are the specific examples. Specific-domain applications use medicine, aerial surveillance, audiovisual archiving and many more.

Many image semantic annotation approaches are the automatic association between low-level or mid-level visual features using machine learning techniques. Machine learning is insufficient to bridge the well-known semantic gap problem for achieving efficient systems for automatic image annotation. Structured knowledge models, such as semantic hierarchies and ontologies, will be a good way to improve such approaches. These semantic structures allow modeling many valuable semantic relations between concepts such as contextual and spatial relationships. These relationships are of prime importance for the understanding of image semantics. Structured knowledge models about high-level concepts can reduce the complexity of the large-scale image annotation problem.

The basic approach is prepare a methodology for building and using structured knowledge models for automatic image annotation. Initially it deals with the automatic building of explicit and structured knowledge

models, such as semantic hierarchies and multimedia ontologies, dedicated to image annotation. It helps for building semantic hierarchies faithful to image semantics. Image-semantic utilizes to find out the similarity measure between concepts and on a set of rules for building of the final hierarchy. It goes further in the modeling of image semantics through the building of explicit knowledge models to incorporate semantic relationships between image concepts. The proposed method creates automatically building multimedia ontologies consisting of subsumption relationships between image concepts, and also other semantic relationships such as contextual and spatial relations.

The problem of finding a desired image (or a subset of them) becomes critical as the digital images increases in social media. In a distributed medical database. Given the image of a patient, it can be find other images of the same modality, of the same anatomic region, and/or of the same disease that was already diagnosed and it can help on the clinical decision-making process. Multimedia image retrieval is still a big challenge.

The image retrieval field is carrying on the set of techniques/systems for browsing, searching and retrieving images from a large collection of digital images. Systems operate in two phases: i) image indexing: which could be defined as the process of extracting, modeling and storing the content of the image, the image data relationships,

or other patterns not explicitly stored, and ii) image search: which consists in executing a matching model to evaluate the relevance of previously indexed images with the user query. Figure 1 illustrates the image retrieval systems. It is common sense that image search in these system is based on the same features (or modalities) than the ones used for image indexing.

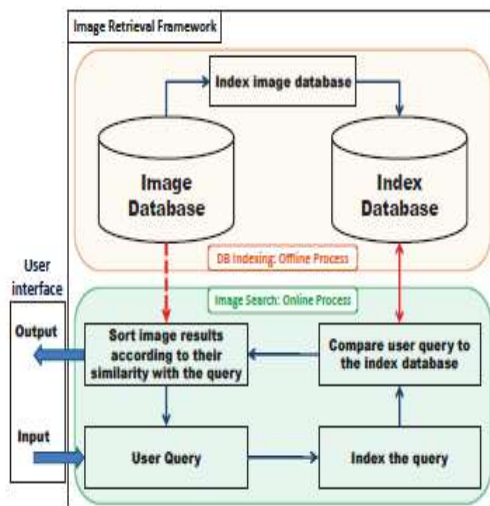


Figure 1 Workflow of image retrieval systems.

Automatic image annotation is a process of automatically assigning a text description (reduced to a set of semantic keywords) to a digital image through a computational model. Automatic image annotation means image retrieval systems in order to index and retrieve images of interest from a large database. This task is regarded as an image classification problem described by the following steps:

1. Training image dataset consisting of a set of images with their textual annotations is collected. These textual annotations consist of semantic concepts depicting image content. The set of all concepts composed the annotation vocabulary.
2. Computational model enabling to find a correspondence model between the low-level or mid-level representations of images is framed for the annotation vocabulary.
3. Test the system and adjusting the parameters of the computational model.

This paper deals with the problem of semantic image annotation. It focuses on how to

model in an effective way to find the image content. The approach is based on the building and the use of explicit and structured knowledge models in order to improve image annotation.

Review Works

Image annotation & retrieval is nowadays a research areas. Content based method via image content is feasible for image searching using keyword and it is one of the best ways for image searching. At the same time, creation of semantic metadata about photo content remains an elusive goal. The amount of annotation can greatly improve the usefulness of photo collections as they grow into the thousands. In addition to making the photo searchable by the contributing user, tags enable users to discover other user's photos. Similarly, the usual use for annotation, personal organization and retrieval, is improved by the skill for users to render their photos on-line to be viewed by other members of the society [1-2]. Annotations can include event, time, person, location etc [3]. In [4], the authors spotlight on collections of personal photos and make use of the contextual information by the associated GPS and time metadata. The photos are annotated based on collections or groups rather than individual human being. In [5], a background photo annotation approach on mobile device is introduced by author.

The popularity of digital imaging devices increases the growth of images on the worldwide web. Image retrieval has become challenging research issue. Most traditional techniques of image retrieval uses metadata such as keywords or captioning on the image to retrieve over the annotation words. The goal of Automatic image annotation is to assign keywords or "tags" to the images. It becomes an important research topic in the image retrieval & management systems. Image annotation is viewed as multi-label learning problem in which a set of labels are associated with the images containing multiple objects [6]. Since, annotate the images manually is the most time consuming task, which creates yet more challenging to image annotation problem. Several machine learning models have been build up, to overcome the challenging problems of image annotation, that linking to low level features and annotations. In the model-driven methods, the

algorithms can be divided into two main groups: Probability-based methods and Classification-based methods. The Probability-based methods guess the correlations among images and annotation keywords [7]. The Classification-based methods use a class label to characterize annotation keywords and formulate image annotation to a classification problem [8]. Content-based image retrieval scheme need the user to retrieve images based on their visual match to a query image. Although the multiple researches have been performed on image retrieval. However, recent studies have shown that there is a semantic gap between low-level visual feature for representing images in Content-based image retrieval and the high-level semantic tags for describing image content. The semantic gap is linking through the automatic image annotation that captures semantic features with machine learning techniques [9-10]. Many algorithms have been developed for tag based image retrieval to overcome the limitation of Content-based image retrieval. TBIR uses manually labeled keywords or tags to represent images and let a user to present required information in textual form. The relevant image is searched by similarities between the image tags and the textual query. However recent research shows that, retrieving the relevant images by TBIR is efficient than CBIR [10]. Tag ranking intends a ranking function that place relevant tags in front of the irrelevant ones. It is a scoring function which allocates greater values to the relevant tags than to those irrelevant ones [11-12].

Proposed Work

Many recent image annotation approaches were used to narrow the semantic gap between the low-level image descriptions using visual features and the richness of human semantics. Images get their semantic meaning as an act of image interpretation or understanding, and it is difficult for an image retrieval system to find the meaning of the image by a user to search for a particular image. If the notion of image semantics seems to be important for image retrieval related tasks, it is still vague and can vary according to the different approaches. Indeed, to our knowledge, only few work have tried to provide a precise definition of the notion of image semantics. Therefore, it is necessary to define the notion of image semantics according to basic objectives.

The following two approaches are used for attacking image annotation:

- i) Text-based approaches: which do not consider the image content during the indexing process, but rely on the only surrounding textual information (HTML tags, metadata, contextual text surrounding the image, etc.), and
- ii) Content-based approaches: which are basically based on the use of image content (Visual and semantic content) in order to index and retrieve images.

The scope of this paper is content-based image retrieval, and in particular content based-image annotation. The objective of automatic image annotation is to build a computational model that enables to associate a set of concepts $\{c_j \in C, 1 \leq j \leq N\}$ to any given image $i_i \in I$. The overall goal is to extend this computational model to previously unseen images (i.e. $\forall i_x \notin DB$) in order to provide them a textual description. Figure 2 illustrates the aim of automatic image annotation by an example.

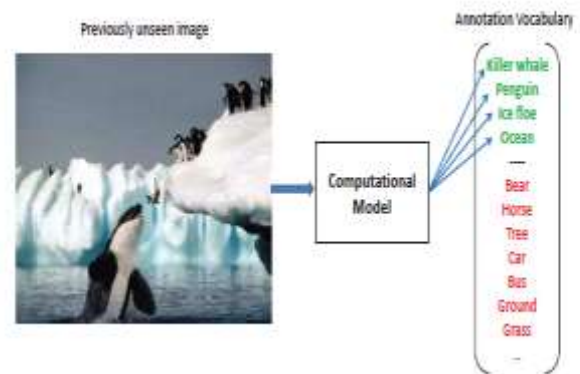


Figure 2 Example of automatic image annotation

Let us consider the following definition related to semantic image annotation and these are useful for proposing method for semantic annotation of images.

Concept is as a label (or a word) with a precise semantics (a given meaning) used for annotating images. For instance, in Figure 2 "Killer Whale" and "Penguin" are concepts.

- Annotation vocabulary indicates as the set of concepts used for annotating the images of a given database.

- Image features denotes as a set of low-level or mid-level descriptors used for representing the visual content of an image.
- The visual similarity is a measure reflecting the similarity between concepts with respect to their visual appearances.
- The conceptual similarity is a measure reflecting the semantic relatedness between two concepts from a linguistic and/or a taxonomic point of view. With respect to image retrieval field, this measure is usually computed using textual information sources.

With respect to the image retrieval field, image semantics can be defined as the meaning sought by the user in the image content.

Semantics is the study of meaning. In linguistics, it is also the study of the meaning or the interpretation of a word, sentence, or other language form. With respect to the image retrieval field, we can define it as the meaning sought by the user in the image content. Figure 3 illustrates some images and their associated semantic meaning.



Figure 3 A spectacular jump of a killer whale to eat penguins.

Image semantics can be defined as the meaning sought by the user in the image content within a particular context.

The context of searching is very important for understanding the image semantics thought and sought by a user. For instance, depending on the observer’s background knowledge, the image in Figure 4 can be interpreted as a statue. User can define it as statue or a statue of a particular person

or a statue of an important person or a statue situated in some place in a country.



Figure 4 A stue of a person

These examples enable us to put into perspective our two next views on image semantics: i) image semantics is a multi-level paradigm, and ii) image semantics is context-sensitive, i.e. it depends on the user’s objective and on his background knowledge. Consequently, one of the major challenges of image annotation and image retrieval systems is to be able to extract these different levels of image semantics and to adapt themselves to the user’s objective in order to be efficient and useful.

Semantic annotation on images based on predicting the presence/absence of a set of concepts in a given image. These approaches usually follow the scheme illustrated in Figure 5.

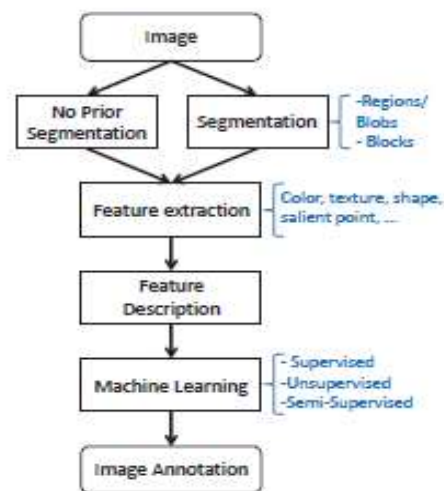


Figure 8 Proposed Method

It carries out the extraction of features. A feature is defined to capture a certain visual property of an image, either on the whole image or on a region of it. Most commonly used features for image classification are the ones reflecting: color, texture, shape, and salient points in images. Feature description is subsequently performed to assign a signature to the extracted features. Finally, a machine learning algorithm is trained to recognize/detect the concepts from the annotation vocabulary using the visual features of images.

Given a specific image annotation task, the criteria for choosing between these categories can be summarized as follows:

- i) Availability of a sufficient amount of images for training the classifiers.
- ii) The size of the annotation vocabulary (scalability).
- iii) The need for a natural ranking of keywords.
- iv) The required level of precision for the image annotation task.

Conclusions

The importance of contextual knowledge and explicit semantic structures for the image annotation problem. The use of explicit semantic structures, such as semantic hierarchies and ontologies, seems to be essential to improve the image annotation and in order to narrow the semantic gap. We are interested in semantic image annotation. The method aims at improving the image annotation by the use of images content and structured knowledge models about image semantics. This involves first to capture and to model suitable knowledge models about image context, and subsequently to build effective tools using these knowledge models in order to improve the image annotation process.

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