Automatic Tag Recommendation for Photos using Geo-location, User Information and Annotations

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***Abstract*—** Social tagging as become an important part in social websites, so to provide a good tag recommendation automatically to the photos uploaded to the website. Automatic tag recommendation is proposed by identifying the user profile information, geo-location specific and annotations of a photo. With the help of this information the tags that are semantically relevant can be recommended to the users. For this, we have to create a common subspace, where the textual, geo-location and annotated information of the photos are comparable. It is easy to get relevant tags based on user profile and geo-location information but it is hard to perform image annotation during information retrieval from the community contributed photos. So, we are going to create an intermediate subspace, where the digital images are annotated into keywords. Finally, the tags related to the keywords, geo-location and user profile information are recommended to the user automatically.

Keywords*—Annotation;geo-location;subspace;user profile*

I. Introduction

Social image tagging is the process of assigning tags to images by common users. The users will expect tag-based retrieval to be a natural and good starting point for search. Compared to content based image retrieval, tag-based retrieval is more easily and powerful with semantic queries. Moreover, its scalability has been verified by text retrieval research. However, due to the diversity of knowledge and cultural background of its users, social tagging is often subjective and inaccurate. We consider a tag objective and relevant with respect to an image if the tag accurately describes objective aspects of the visual content. In other words, users with common knowledge relate the tag to the visual content easily and consistently. As a consequence, objective tags reflect visual concepts such as objects, scenes, and events. In contrast to free text descriptions, wherein tag relevance might be reflected by tag statistics, individual tags are used once per image in the social tagging paradigm. Hence, a fundamental problem for social image retrieval is how to objectively learn the relevance of a tag with respect to the visual content it is describing. Thus explosive growth of personal photos with rich context like tags, geo-locations and visual attributes like colors and textures. Furthermore, many photo-sharing websites, such as Flickr, Corbis and Picasa, provides millions of users to upload and share their personal multimedia data by their smart phones or other internet access devices. As a consequence, the volume of community contributed photos increases extremely higher in the social websites. It is challenging and promising to exploit the overwhelming amount of context data for multimedia applications, such as retrieval, annotation and recommendation.

Among these process, it is very challenging for assigning proper tags to photos in the community contributed photos. As the manual tag assignment process is very time consuming and impractical due to the large collections of photos in the social websites. To make it easier, tag recommendation methods are proposed to suggest some relevant tags to a given photo uploaded and allow users to select the relevant tags, which will reduce the time for the users to upload and share their photos on social website. It also facilitates users to tag and manage their personal images as a complete album. However, several works were made to learn the association between tags and photos, while the user profile based information are ignored in the recommendation. User's profile based information for photos can be obtained by the following two aspects. Each and every users favor different types of photos. For example, some prefer the 'natural' photos, while others prefer the 'wild life' photos. Thus different users have different types of favorite tags that are tagged regularly. If very similar photos would be tagged by two users it is possible for the profile based tag recommendation to provide good tag recommendation results by considering user's profile information into account.

On the other hand, users organize their photo albums geographically by describing photos with tags related to locations where they were taken. Because the geographical information of photos should be used in tag recommendation. With the help of geo-location preference towards tags in the huge amount of context multimedia data will provide us useful information to recommend the most relevant tags to a given photo. Finally to make a perfect tag recommendation to the user we are going to use annotations. With the help of annotations, the photos which are uploaded without any geo-location information can also be taken into account for automatic tag recommendations. This is possible by

creating an intermediate subspace and with the help of that subspace the digital images are assigned to a keyword. Based on that keywords the relevant tags can be recommended to the users. Finally all the information collected based on user preference, geo-locations and annotations are combined in a common subspace. Based on that information the relevant tags for the photo uploaded is generated and those tags are recommended automatically to the user as it is given in Figure 1.

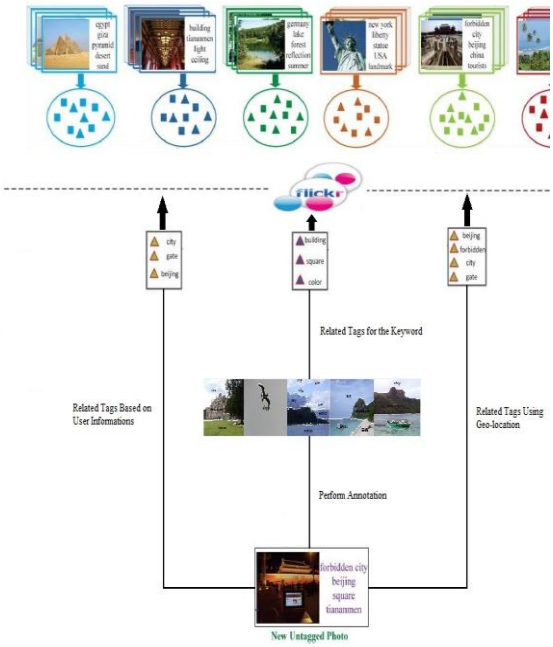

Figure 1. System Architecture

II. Related Works

Personalized geo-specific tag recommendation for photos on social website. Social tagging becomes very important to search the large number of community contributed photos on social websites. To provide a good social tags, we go for automatic tag recommendation by assigning relevant tags to photos. Here, we focus on the automatic tag recommendation by identifying user-profile based information, geo-location information as well as semantically relevant tags for a photo with the help of freely available community-contributed photos in photo sharing social websites. For users and geo-locations, the way of tag generation is different from each other, so we propose a subspace learning method to generate tags based on both types of preference. The main goal of our application is to learn a unified subspace shared by the visual and textual domains to make visual features and textual information of photos comparable. Since the visual feature is a lower level representation on semantics than the textual information, we go for an additional intermediate subspace for the visual domain to convert them in the local structure with the textual space. Therefore, the unified subspace is the combination of intermediate subspace and textual space respectively. We have created the above learning problems into a united form and generate the relevant tags for the photos. The user-profile based and the geo-location based tags are found by the nearest neighbor search in the unified spaces. By combine the tags that are obtained and the visual appearance of the photo. We can search the semantically and visually related photos, from which the most frequent used tags are recommended to the users.

A review on automatic image annotation techniques. Due to the explosive growth of digital technologies, ever increasing visual data are created and stored. Now a days, visual data are as common as textual data. There is an urgent need of effective and efficient tool to find visual information on demand. A large amount of research has been carried out on image retrieval (IR) in the last two decades. In general, IR research efforts can be divided into three types of approaches. The first approach is the traditional text based annotation. In this approach, images are annotated manually by humans and images are then retrieved in the same way as text documents. However, it is impractical to annotate a huge amount of images manually. Furthermore, human annotations are usually too subjective and ambiguous. These type of approach focuses on content based image retrieval (CBIR), where images are automatically indexed and retrieved with low level content features like color, shape and texture. However, recent research has shown that there is a significant gap between the low level content features and semantic concepts used by humans to interpret images. In addition, it is impractical for general users to use a CBIR system because users are required to provide query images. The third approach of image retrieval is the automatic image annotation (AIA) so that images can be retrieved in the same way as text documents. The main idea of AIA techniques is to automatically learn semantic concept models from large number of image samples, and use the concept models to label new images. Once images are annotated with semantic labels, images can be retrieved by keywords, which is similar to text document retrieval. The key characteristic of AIA is that it offers keyword searching based on image content and it employs the advantages of both the text based annotation and CBIR. There are several surveys on broad CBIR research in literature, and a survey on broad semantic IR techniques is given by Liuetal. However, one of them gives sufficient attention to AIA which is a new development in IR. In this paper, we focus our review on this emerging trend in IR, so as to complement existing surveys in literature. Specifically, we focus on the two major aspects of AIA, feature extraction and semantic learning/annotation.

With the help of this related works we are going to propose a new way of tag recommendation, by collecting the users profile based information, geographical location information and the annotation

information of the photo. By combining this three information in the common subspace, the tags that are related to this information are automatically recommended to the users.

III. Existing Methodology

Image annotation using artificial neural network for preforming annotation in the photos. An Artificial neural network (ANN) is a learning network which can learn from examples and it is capable of make decision for a new sample. ANN is completely different from common classifiers which usually learn one class at a time, because ANN can learn multiple classes at a time. An ANN consists of multiple layer and inter connected nodes, which are also known as neurons or perceptrons. Because of this, an ANN is also called multi-layer perceptron (MLP). The first layer is the input layer which has neuron sequel to the dimension of input sample. The number of neurons in the output layer is equal to the number of classes. This tells that, an ANN is capable of learning multiple classes at a time, although single class ANN is also available. The choice of the number of hidden layers and the number of neurons at each hidden layer are open issues in ANN approaches. These numbers are usually select empirically. The connecting edges between neurons of different layers areas associated with weights. Each neuron works as a processing element and is governed by an activation function which generates output based on the weights of the connecting edges and the outputs of the neurons at the previous layers. During the training, ANN learns the edge weights so that over all learning error is minimized. While classifying a new sample, each output neuron generates a confidence measure and the class corresponding to the maximum measure indicates the decision about the sample. An ANN can be used both for explicit classification of images, regions or pixels, or implicit assignment of fuzzy decisions on images.

Since the ANN is used for explicit classification of images and pixels, the image annotation can be easily done with the help of artificial neural network. With the help of this existing methodology, we can create an AIA in the intermediate subspace to generate the related keywords and based on that keywords the relevant tags are recommended to the users.

IV. Experiment

A. **Datasets Acquisition.** In this module, we create a database with several photos as a trained set of data. The database is build with the help of large amount of community contributed photos from photo sharing social websites like Flickr. The photos used in the database are loosely tagged images ie, in image level representation multiple object tagged photos are known as loosely tag images.

B. **Tag Generation.** Photo sharing is the process of posting the user's personal or general photos online in a photo sharing websites, so that other user's can view them publicly or privately. This is posible in all social photo sharing websites and applications that facilitate the upload and display of images. The photo sharing is also posible in the blogs that are managed by an individual user, thus by sharing photos online an individual user can maintain a online photo gallery. Sharing helps the other user's in the social network to view the photos and even to download it, thus the users can even select different copyright options for their photos while sharing the photos. Tagging is an important part while uploading a photo into a photo sharing social website, because tagging helps the other users in the social network to easily search a relevant photos based on their needs. So automatic tag gereration helps the user to minimise the time while uploading a photo. Here tag generation is done based on user profile based information, Geo-location information and annotations.

C. **Space Analysis.** This module addresses the automatic tag recommendation task with the help of community contributed information, such as history of tag that the user often use and geo-location information. Here the correlation between visual features and textual features of the photo are mapped together into a common subspace. The loosely tag photo taken from the photo sharing social websites help us to easily combine the semantic gap between visual and textual features.The common subspace space is generated inorder to create a common structure for automatic tag generation. By creating a common structure, visual contant can be coverted into keywords from which it is easy to generate tags related to that keywords.

D. **Tag Recommendation.** Recommending tags for a new photo is done with the help of user profile based information, annotation and geo-location information. Using the above proposed learning algorithm, For each new uploaded photo taken in geo-location by user, we first geather the users tag history and keywords generated in the intermediate subspace, based on this information the relevant tag for the photo is generated and recommended to the users. Finally visual image retrieval is implemented to identify the semantically and visually relevant photos, and top ranked tags are suggested based on the voting strategy.

E. **Evaluation criteria.**In this module, we can evaluate the performance of the system and provide semantic gap between visual features and textual features. To bridge the semantic gap, we

first geather the tag history of an individual user, geo-location information and annotated keyword into a common subspace and find relevant tags, to perform semantic and visual photo retrieval to find relevant photos. Finally, the most frequent tags in the relevant photos are suggested to users. Extensive experiments have been conducted to validate the effectiveness of our automatic tag recommendation method.

V. Conclusion

In this work, we propose to automatically generate the tags for newly updated photos with the help of users profile based information like their tagging histories, geographical location information like the latitude and longitude value and annotated information i.e. the keywords. This system is an automatic tag suggestion method which expands the tags of a photo by using textual, geo-location and annotation information. Our motivation is to provide a system that enhances upload capabilities of a photo-sharing website so that users will easily select meaningful tags for their photos. The significance of our work is the approach of including visual information to the Suggestion process. For improving our statistical results, a user study can be prepared where a photo and a list of initial tags are given, and the users choose the other relevant tags. Results of such a study can be used as the ground truth for evaluating annotation suggestion methods and would provide more reliable results.

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