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# Tag Based Image Search Using User Re-ranking

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***Abstract*—**From the last decades, social media websites are useful to user to upload their photos and videos with tags. The social tagging systems are useful to generate the image search engine. The tag based image search engine is used to find the images which are uploaded by different social users from the social websites like facebook, flickr. The tag based image search (TBIS) by inter and intra user re-ranking is sorting the images according to their view feature, semantic relevance measurement and visual feature. To overcome the tag mismatch and query ambiguity problem the tag based image search system can remove the duplicate images from the same user while sorting the image. To increase the searching speed inverted index structure is constructed. The co-occurrence word set is used in query matching process. The main aim of the system is improve the relevance and diversity of the images.

***Keywords*—**Tag based Image Search (TBIS), Image Search, Tag, View Feature, semantic Feature, Visual Feature.

## I. INTRODUCTION

Nowadays every person have smart device with high speed internet connectivity, everyone connected to social network. Every person in social network has access and shares the data to another social user on internet. Today there is large amount of data is available on internet, data such as images and videos. The tagging method is used to describe the images and videos. But the problem arises in data extraction because of tag mismatch and query ambiguity. The images, videos uploaded on internet with tags, sometimes these tags are similar or the same as user uploads same images with different tags.

Query ambiguity problems occur when user cannot give the information with related to tag. To overcome this problem concurrence word sets are used. The TBIS system is mainly used in searching images. This image search method is flexible than text based image search and content based image search. Inverted index structure increases the searching speed in keyword matching process. It removes the unrelated tags and duplicate images from same user. The TBIS system is based on feature extraction.

Feature extraction contains the view feature, semantic feature and visual feature to improve the diversity performance of search result. View feature is the view count of each image and calculate normalized view count and displayed in sorted order. Click count of the image means how many users see that image at how many times. The highest view count of the image has higher popularity and lowest have lower priority.

Semantic feature form the co-occurrences word set of given query as well as remove the noisy tag. Relevance score between query tags and its images used to find out the images are contained with tag set or not. For Example: The co-occurrence tag list like sky, sun and cloud; coast, sand, ocean and sea; airplane, airport and aircraft; and so on.

Visual features mainly used in image retrieval. It uses the scale invariant feature, similarity matrix introduced where visual distance between two images with their features is to be considered. This feature extraction value uses in re-ranking process. The inter user re-ranking and intra user re-ranking displays the related images in sorted order.

## II. RELATED WORK

X. Li *et al.* [1] proposed neighbour voting algorithm used to sort the tag list. The tag relevance score is learned by collecting votes from visually similar neighbour. Counting neighbour votes on tag is reduced by estimating the tag relevance. The relevant set query and irrelevant set query are distinguished by learned tag relevance, if visual neighbour search is better than random sampling.

Liu *et al.* [2] proposed tag ranking method used to rank the tags of a given image. Initial relevance score is calculated by probability density method. To refinement of these relevance score over a tag similarity graph random walk method is proposed.

 

Wang *et al*.[3] proposed a diverse relevance ranking algorithm. This approach is used to take diversity and relevance score into consideration by expressing the content of images and their associated tags. If two images are similar then their tag sets are identical. Therefore, Semantic similarities of social images are based on their visual feature as well as tags. Semantic similarities of social images are mined for optimization framework. The greedy ordering algorithm generated ranking list which is based on similarities and the relevance score.

G. Agrawal *et al*.[4] proposed relevance tag ranking algorithm. It is used to automatically rank the tags of an image according to their image content in order to overcome the problem of unrelated tags. They proposed modified probabilistic relevance method. This method included the size factor of objects with random walk based refinement.

L. Chen *et al*.[5] developed tag based image retrieval framework. It is used to search their personal photo from group of photos captured by same user. The proposed system used inverted file method to determine relevant and irrelevant images which related to query tags or not. They developed classification method named Support Vector Machine (SVM) with Augmented Feature (AFSVM).This method is applied on each photo to obtain its decision values. Based on decision values photos are ranked. They proposed group based tag relevance refinement method to investigate photos of each group. The Laplacian Regularized Least Squares (LapRLS) method was used to improve the retrieval performance. The Content Based Image Retrieval (CBIR) system makes use of input query as image. But CBIR system doesn't use input query as tag. This limitation is overcome by Tag Based Image Retrieval (TBIR) system.

L.Wu *et al*. [6] represented the image-tag relation by tag matrix. The performance of TBIR is based on availability and quality of tags. But sometimes tags are unreliable to describe the visual content of image. This problem is overcome by automatically fillings the tags as well as corrects the noisy tags. It automatically completes the tag matrix with real numbers by using binary image tag matrix. This method shows the probability of assigning the tags to the related images. Optimal matrix is used to find accurate image to related query. It relates to both observed tag matrix and visual similarity between images.

L. Chen *et al*. [7] proposed relevance-quality ranking method. This method not only based on visual information and semantic information but also based on image quality. The problem of ambiguous or poor quality of image is overcome by relevance-quality ranking method. Firstly they rank the images according to the relevance to the query tag. Based on relevance score visual similarity of images is checked along with semantic information of related tags. Relevance quality based ranking achieved when quality score added in the candidate ranking list.

Qian *et al*. [8] proposed a retagging approach. It is used to cover a wide range of semantics. The final tag list of the given image is determined, based on relevance of a tag to image as well as its semantic information.

Xueming *et al*. [9] proposed image location estimation to investigate the location of input image using image content. Firstly, they determined location of input image using global features clustering. To increasing speed up select some candidate location. Secondly, they described spatial information based on visual words by using mean shift clustering to improve the image location estimation performance.

X. Qian *et al*. [10] proposed tag based image retrieval by user oriented ranking. Inter and intra user re-ranking used to sort the images. Image database is used for feature extraction. To represent image dataset both semantic and visual features are used.

Qian *et al*.[11] proposed tag based image search by social re-ranking. It is based on inverted index structure, social views of user, semantic relevance feature and visual feature for better result than above approaches. Semantic relevance score between query tags and its images used to find out the images are contained with tag set or not. User oriented images are sorted with query tag by using Inter and Intra re-ranking method

## III. METHODOLOGY

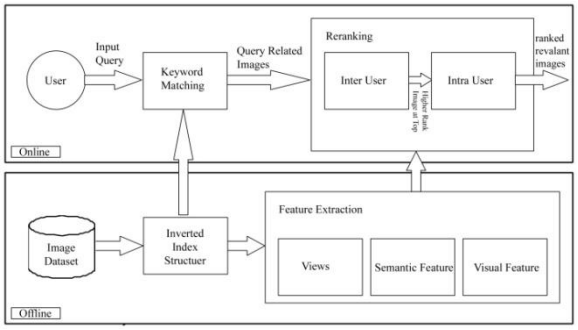


*Figure 1. System architecture of tag based image Search system[11]*

The figure 1.shows the system architecture of the tag based image retrieval with social re-ranking. The system consists of two sections online and offline. The offline section contains two parts: 1) Inverted Index Structure construction for image dataset. It is useful in improving image retrieval speed.2) Feature extraction: To extract visual feature, semantic feature and views for the images dataset. Semantic feature is related to the co-occurrence word set of query tags and tags of the images. For views feature check the click count of images.

 

The online section contains three parts: 1) keyword matching: To obtain corresponding images these are tagged with given query. 2) Inter User Re-ranking: Used to find out higher contribution of user to related query, these user's images comes first.3) Intra user re-ranking process used to retrieve the images which is based on feature extraction. Also check the same images of different user.

**1. Inverted Index Structure**

Inverted index structure is based on tag and each tag corresponds to the images uploaded by different users. Let G is used denote the total no. of tags in image dataset and the corresponding tag set is denoted by Γ={Γ1,Γ2,….,ΓG}. Γi denotes the ith tag that users have used to comment their shared photos in social websites. The inverted index structure of image dataset is ID={ID1,ID2,…..,IDG}.IDi is the image collection of tag Γi .i.e. all images in IDi is tagged with Γi.

**2. View Feature and Semantic Relevance Measurement**

View feature is used to click count of images. It used to indicate image popularity. The highest views are more popular. The $view_i$ represents the view times of image i and its normalized form $vt_i$ shows in given formula**.**

$$vt_i = \frac{view_{i-} view_{min}}{view_{max-} view_{min}}$$

Where $view_{max}$ and $view_{min}$ are the maximum and minimum views of the images which share by same user with image i.

*3. Semantic Relevance Measurement:-*

Co-occurrence word set related to query q is S(q)={$s_1$,$s_2$,…..,$s_l$},where *l* is number of co-occurrence word with respect to given query q. Then tag set is ranked in descending order with respect to query q. Co-occurrence word set useful for improve the retrieval performance for query q. For example, cloud and blue are co-occurrence words of sky, but cloud is more valuable word related to sky. For each co-occurrence word assign $s_i$ and weight $M_i$

where N is the number of images in image dataset, R(q, $s_i$) is the number of images tagged with q and $s_i$in image dataset. Semantic relevance matrix C uses to calculate semantic relevance between query tagged image and query.

$$\mathbf{C_i}=\frac{1}{\sum_{m=1}^{l} sign(s_m)} \sum_{m=1}^{l} sign(s_m) * M_m$$

where sign($s_m$) used to denote the image i related with tag $s_m$or not. If sign($s_m$) = 1 then image i tagged with $s_m$ ,else if sign ($s_m$) = 0 then image not tagged with $s_m$.

**3. Visual Feature Extraction and Similarity Matrix Construction**

For Color feature the image is divided into 4 equal blocks and each block computed 9D color moment. Color distribution in an image contains mean, standard deviation, and skewness of each channel in HSV space. Texture feature extraction by Scale Invariant Feature Transform (SIFT).

*Similarity Matrix Construction:*

A similarity matrix W whose element $w_{ij}$ used to calculate the distance between two image si and j. Visual features of image i and j is $v_i$ and $v_j$.

$$w_{ij}=\exp\left(-\frac{\|v_i-v_j\|^2}{2\sigma^2}\right)$$

where $\|.\|^2$stands for $l_2$- norm of the vector, $\sigma$ used to represent the radius parameter, which is set to mean value of all pair wise Euclidean distance between images.

**4. Keyword matching and Re-ranking**

For query q is belonging to the tag set Γ, from the inverted file index ID={$ID_1$,$ID_2$,….,$ID_G$},corresponding images tagged were obtained with query q is denoted by X.

$$\mathbf{X=\{X(u_1),….,X(u_z)\} = \{x_1,….,x_z\} =}$$
$$\mathbf{X=\{\{x_{11},x_{12},….x_{1N1}\},…\{x_{z1},x_{z2},…,x_{zNz}\}}}$$

Where U={$u_1, u_2, \dots, u_Z$} is the user set, the number of user in X is Z. $X_i$ or X($u_i$) represents the images uploaded by the user $u_i$.where$x_{11}$up to $x_{zNz}$ in the form of $x_{ij}$, where $x_{ij}$ define $j^{th}$ image in $X_i$ dataset; $N_i$ used to define the number of images in $X_i$.

**Inter User Re-ranking:**

For each user the number of images in X which is tagged with words in S(q). $u_h$ ,h ∈ (1,…,Z) user set. Query related contribution of each user calculated by this formula

$$\mathbf{E_h}=\sum_{j=1}^{k} sign(x_{hj})$$

where k is used to define the total number of images in $X_h$ ,sign ($X_{hj}$)=1 means that the image tagged with word in s(q) ,while sign($X_{hj}$) = 0 means the image is not tagged with word in s(q).Then rank $E_h$, h∈(1,2,…Z) in descending order, higher contribution of user $E_h$ which is related to query on the top.

**Intra User Re-ranking:**

Select image which has highest score among each users image set. $X_{h,}$ h ∈ (1,2,…Z).For k number of images in $X_h$={$X_{h1}$,$X_{h2}$,…$X_{hz}$} relevance score of query q denoted by r, Set of r for selected image is r=[$r_1$,$r_2$,…,$r_k$].Use regularization framework for visual, semantic, and views information for intra user re-ranking.

## IV. RESULTS AND DISCUSSION

The system experimented on Flickr image dataset. Sky, building, bird, sea, and garden these query tags are used to evaluation. Performance evaluation is done on relevance score and diversity score of images which is assigned by volunteers. The diversity and relevance calculated for top n

 

images. The diversity and relevance score of images are based on values in between 0 to 3. For each image the score values are calculated using average diversity formula. The correlation between the query and the searched result is measured by averaged relevance score. The averaged diversity score has shown the diversity level of searched results.

Table 1. Shows the diversity value for top n images

| N | ADP@N |
|---|---|
| 2 | 2.8 |
| 4 | 2.69 |
| 6 | 2.44 |
| 8 | 2.23 |

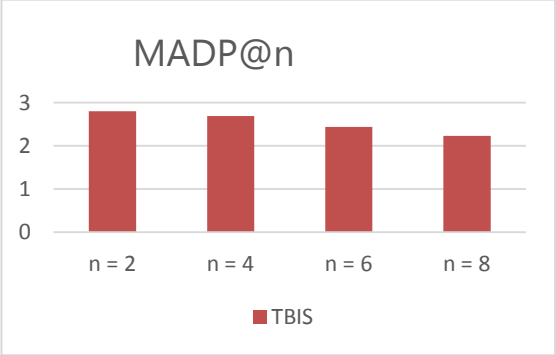


*Figure 2.shows the MADP@n of TBIS system*

## I. CONCLUSION AND FUTURE SCOPE

The user re-ranking method usedfor tag based image search. In this user re-ranking method feature extraction is used to sorts the images. View feature of image is used to improve the relevance performance of search results. In order to increase the quality of diversity performance user information is used. The scale invariant feature transformation algorithm used for visual feature extraction method. The tag based image search system gives satisfactory result on diversity score. In this system, timestamp information of flickr dataset is still ignored.

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