Combining Collaborative Tagging and Ontologies in Image Retrieval Systems

Jose Emilio Labra Gayo[1], Patricia Ordóñez de Pablos[2],
Juan Manuel Cueva Lovelle[1]

[1] Department of Computer Science, University of Oviedo, C/Calvo Sotelo S/N,
33007 Oviedo, Asturias
[2] Department of Business Administration, University of Oviedo, Avda. El Cristo S/N,
33071 Oviedo, Asturias
{labra, patriop, cueva}@uniovi.es

Abstract. In this paper we propose a combination between collaborative tagging and semantic web technologies for the development of an image repository system. The proposed system will be part of the WESONET project which will also handle other types of resources like video and audio. Our approach combines low level features extracted by automatic means, high level descriptions provided by the content creators and sets of tags dynamically added by end-users.

Keywords: semantic web, information retrieval, collaborative tagging, image retrieval

1   Introduction

One of the most important successes in the World Wide Web has been the publication of different media types, like images, audio and video with hypertext features. However, searching and locating this type of resources is not an easy task given that they are mostly treated as black boxes, whose content can not be accessible by automatic means. Current state-of-the-art techniques are mainly able to extract low level features like resolution, date, time, etc. which are very far the conceptual level in which the users are thinking. This semantic gap has already been acknowledged in [4]. Although most of the file formats have some mean to add meta-data to their content, it has usually been considered unfeasible that end-users would participate in the process of adding semantic descriptions to content.

Nevertheless, in the last years, a lot of web sites have appeared which enable end-users to add tags in a collaborative way. This kind of social software allows the users to tag a given resource with some text. Some examples of sites with collaborative tagging are Flickr, del.icio.us, Technorati, CiteULike, Buzznet, etc. They enable sharing photos, URLs, blogs, article references and music titles. A tag is a free text string chosen by the user. Usually, these tools offer some recommendations about similar tags given to the same resource so the tags tend to be similar.

2   Combining Collaborative tagging and Ontologies

Although collaborative tagging is different to ontology based approaches, we consider that both approaches are complementary and that their combination will improve the information retrieval process. Our approach is based on the combination between three levels of descriptions (see image. The first one is the low level descriptions which are automatically extracted from the resource. In the case of images they could be the dominant color, resolution, date of creation, etc. These features can be related to core ontologies, which contain low level concepts.

The second level consists of high level descriptions which are provided by the creator of the resource in production time. These descriptions are higher level and can even be linked to domain specific ontology concepts. The problem of this information is that it only captures the knowledge of the producer or creator which can be more specialized than the knowledge of the end-users.

Our approach adds a third level which contains the sets of tags dynamically assigned by the users.
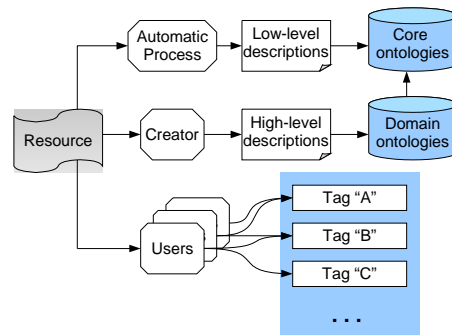
Fig 1. Description levels of a resource

In this paper we will present how we have adapted the algorithm proposed in [3] to image retrieval systems. The algorithm has also been applied to improve the search of legal documents in text based systems in [1]. The main steps are the following:

- Let α be the initial query formed by a set of words $\{w_1, w_2, \dots w_n\}$. The first step is to obtain a normalized set of terms $\tau = \{ t_1, t_1 \dots t_n \}$ by removing plurals, death words, verb forms, etc.
- The next step is to obtain the ontology concepts Ω whose synset match with the terms in τ
- Next, we apply spreading activation (Crestani (1997)) to Ω to obtain a new set Ω' of ontology concepts related with the initial ones. Each concept c_i contains a weight w_i which indicates the strength of its relationship with the concepts from Ω.

- We create a new syntactic query formed by the synsets of the concepts in Ω' with their associated weights. We also include the terms t_j for which there was no related concept in order to take into account the information in the collaborative tags that has not been included in the ontologies.

The new semantically enriched query is executed over the collaborative tags and the synsets that appear in the metadata of each resource. For efficiency reasons, in this phase of the search we are not taking into account the relationship between the user who makes the query and the users who tagged the resources. The above algorithm could be extended to accomodate a similarity measure between the profiles of the different users giving more weight to tags declared by more similar users.

3 Conclusions

The increase of publication of image and photo libraries in the Web in the recent years has been enormous. At the same time, image retrieval systems has been a difficult challenge which a long history. We consider that it the development of hybrid approaches combining collective tagging with ontologies will offer a better integration and user experience.

At this moment we are implementing a prototype of a system using our algorithm. One problem we are facing is how to obtain a reliable testing framework given that the collaborative tags can change dynamically and that there can even be badly tagged resources. We are also planning to combine the system with e-learning technologies which could facilitate the retrieval of multimedia learning objects.

References

1. Berrueta, D., Labra, J. E., Polo, L., 2006. Searching over public administration legal documents using ontologies. In: Tyugu, E., Yamaguchi, T. (Eds.), Joint Conference on Knowledge Based Software Engineering. IOS Press, pp. 167–175.
2 Cattuto, C., 2006. Semiotic dynamics in online social communities. The European Physical Journal C 46, 33–37.
3 Labra, J. E., Ordóñez , P., Cueva, J. M., WESONET: Applying Semantic Web Technologies and Collaborative Tagging to Multimedia Web Information Systems, Computers in Human Behavior, In press.
4 Mich, O., Brunelli, R., Modena, C. M., 1999. A survey on video indexing. Journal of Visual Communications and Image Representation (10), 78–112.