# Group Profile and Ontology-based Semantic Annotation of Multimedia Data for Efficient Retrieval

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**Abstract.** Efficient retrieval of multimedia data has gained importance in recent years. There are many techniques for efficient retrieval of textual data; however, not all of them are applicable to multimedia data. The problem of efficiency in the retrieval of multimedia data could be over come by getting the semantics of multimedia data. In this regard, the researchers have adapted the approaches from the domain of image processing and computer vision. Until today, these approaches are not very much matured; therefore, the results which most of the researches wanted could not be achieved. We try to tackle this problem, from our domain of computer science by incorporating group profile and merging the domain and multimedia ontology to annotate the multimedia data semantically. Hence, by semantic annotation, we would able to retrieve the multimedia data efficiently.

## 1 Introduction

The multimedia data retrieval is very different from textual data retrieval. In textual data, the retrieval is based on keyword/exact matching, whereas in multimedia the retrieval, also known as content-based retrieval (CBR), is mainly dependant on the actual contents of the multimedia data. Various multimedia data items may share the same contents with very minute difference and this difference could only be identified by understanding the semantics of each multimedia data item such as an image. This semantic difference is also called *semantic gap* [1], between the actual multimedia data and human perception about it.

In the past, multimedia retrieval is mainly achieved through low-level features such as color, shape, texture, orientation [2], [3] etc. These features do not provide much help in extracting the semantics of multimedia data. For example, it is very difficult to find *picture of a drawing room* with only low-level features. But, low-level features along with high-level features/annotation can some what achieve it [4], [5] etc. High-level features/annotation can be achieved manually as well as automatically. Manual annotation can provide rich semantics, but it is time consuming and labor extensive. Therefore, it is not feasible to apply it on a large multimedia data set. On the other hand, automatic annotation can overcome these problems, but it may not be able to achieve annotation with affluent semantics.

In our proposed approach, we analyze the multimedia data (image for the time being) though its components. For example if in an image we find *tiger*, *deer* and *tree* or *grassy area* then it means that image is representing the abstract *a tiger is chasing a deer in the jungle*. To tag or name the components we utilize the combination of domain and multimedia ontology, domain ontology for representing high-level features and multimedia ontology for low-level features. And to extract the abstract automatically, we apply the understanding of a specialized group in a community of like minded people.

Use of domain ontology for annotating the multimedia data at the time of storage and later maps the users' query on the same ontology for better results is being proposed by [6] etc. Lux et al. [7] emphasize on applying the standards such as, MPEG-7 for representing the low-level features. Combined approaches of using domain ontology along with multimedia standards/ontology are used by [8] etc. In addition to use a combined ontology Chebotko et al. [9] further added the concept of language profile for making the annotation process personalized and selecting a subset of domain ontology terms for linguistic annotation. The idea of community based profile is being proposed by [10], [11] etc. for sharing and reusing the knowledge within a community of like minded people.

## 2 Proposed Approach

Our approach is a hybrid approach, which uses the combination of domain and multimedia ontology, almost in the same fashion as used by [8], [9] etc. In addition to the combined ontology, it also uses a group based learning or group profile based approach which is a subset of community based learning used by [10], [11] etc. One of the advantages of group based learning: is the specialized nature of a group as compared with a community of same interests. For example, if we compare the *researcher community* with a specialized research group such as *Database group*, then it is very obvious that the knowledge which we can share or reuse of a specific group will be more precise and accurate to the one from the specific community.

A significant principle behind our proposed approach is to consider the user's context through group profile and annotate the multimedia data automatically by using domain and multimedia ontology along with already stored annotations in the related groups' repository in order to extract the semantics. Our approach consists of six main components: (1) Feature Extractor, (2) Repository, (3) Group profile, (4) Abstract generator (5) Domain ontology, and (6) Multimedia ontology.

Feature extractor extracts the low-level features and fills in the tags of the multimedia part of the ontology. Repository acts like a coordinator between group level stored annotations, abstract generator and group profile. Group profiles contain the information about the group behaviors, restrictions, preferences, history, future events, links to the repository, etc. A number of group profiles are created initially, based on the nature of the users' of the system. On the first use, the user provides his/her profile, which is then analyzed, and the user is associated to a set of related group(s). The group profiles are regularly updated based on the annotations, added by

the users of the same group. Group profile will interact with other components at the time of annotation. This is due to the fact that when group profile(s) are included at the time of storage; this can limit the abstract generator to consider only those semantics, which are related to the specific user group at that time. While it is possible that abstract generator finds more than one abstract for the submitted media. If that is possible then image will be annotated with multiple semantics. Group profile along with the annotations already stored in the groups' repository will help towards filling in the tags of the domain part of the ontology. Fig. 1 shows the conceptual level diagram of the approach.

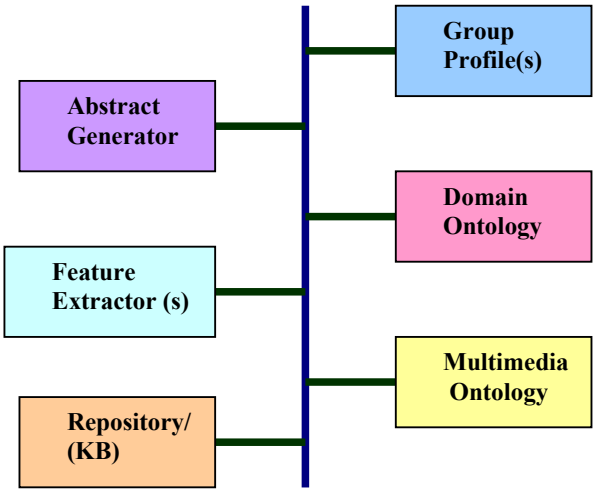


**Fig. 1.** Main components of the proposed approach

## 3 Conclusion

Semantic based retrieval of multimedia data depends upon accurate extraction of semantics. It is not feasible to manually write the abstract of ever growing billions of multimedia data available on the *WWW*. Most of the automatic abstract extraction techniques based upon different image processing algorithms use low level features (color, texture, shapes etc), have not come up to the mark yet. We have proposed a novel approach, which is based on combined ontology and group profile. In our approach, automatic abstract generation starts with the extraction of low-level features and then by using group based learning the system narrows down the scope and moves towards the high-level features.

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