

Context Ontology Construction For Cricket Video

Dr. Sunitha Abburu

Professor& Director, Department of Computer Applications
Adhiyamaan College of Engineering,
Hosur, pin-635109, Tamilnadu, India

Abstract— Content based video retrieval systems are not complete in semantic sense. To improve the efficiency and the effectiveness of the retrieval system the content based retrieval systems must be equipped with the semantic based retrieval. In view of end users retrieval demands, content based or concept based retrieval systems will not be complete without context details. A video object that is separated from its context is not complete. The retrieval system is absolute only when the semantic concepts are enforced with the context details like context independent and context dependent information. To provide a complete video semantic concept or information retrieval solution, concept and context based video annotation, indexing and retrieval system should be built. This raises the need for concept based video retrieval systems and Context based information retrieval. To build the concept and context based video annotation the knowledge of the domain should be extracted, represented and stored. Complete knowledge can be represented with the help of Ontology. Ontological systems have more powerful reasoning abilities compared to the common keyword-based systems. Effectiveness and the efficiency of the retrieval system improve with the support of the domain ontology. Domain ontology helps to represent complete knowledge about the domain. The cricket domain has been selected as the primary application. This paper proposes a methodology for construction of cricket context ontology, to support Context based information retrieval. The cricket context ontology is constructed using the Protégé tool. Future work has been discussed at the end.

Keywords - Ontology, Context, Concepts Semantics, Domain knowledge.

I. INTRODUCTION

To sustain an ongoing rapid growth of video information, there is an emerging demand for a sophisticated semantic-based video annotation, indexing and retrieval systems. However, current video indexing and retrieval solutions are still immature and lack of any standard [1]. End users are becoming more demanding in terms of information needs, quality, quantity, the ability to present the context information and efficient ways to retrieve the video scenes intelligently. Survey on user requirements pertaining to videos reflects that most of the queries are based on the context based information or concept based video scene. And conveys the need for video scenes pertaining to the events, actions, celebrities based on the

semantic concepts or information about the celebrities, events, actions, locations etc.

As user requirements and their information demands are changing continuously. Content-based video retrieval system using color-texture-shape based image, video analysis techniques are generally inefficient when users need to search for semantic concepts. Content based video retrieval systems are not complete in semantic sense. To improve the efficiency and the effectiveness of the retrieval system the content based retrieval systems must be equipped with the semantic based retrieval. This gives raise to the semantic based retrieval systems. The major attributes in semantic based retrieval system are semantic concepts. In view of end users retrieval demands, content based or concept based retrieval systems will not be complete without context details. A video object that is separated from its context is not complete. These systems must be enforced with the context information. The retrieval system is absolute only when the semantic concepts are enforced with the context details like context independent and context dependent information. People want to search and find the video segments or information according to its semantic content or context. They want to quickly get the right information or right spot in the right video by only describing what they want, preferable in natural language. In order to achieve this there should be knowledge about the semantic concepts and context. To increase the effectiveness and efficient of retrieval system, concept and context based video annotation, indexing and retrieval system should be built. To build the concept and context based video annotation the knowledge of the domain should be extracted, represented and stored. Complete knowledge can be represented with the help of Ontology. Domain ontology helps the effective and efficient methods to represent complete knowledge about the domain. This raises the need for concept based video retrieval systems and Context based information retrieval. These demands in turn raises the need for construction of concept based ontology and Context information ontology. The Video retrieval system would be complete, with multiple ontologies. Concept based ontology and the Context based ontology.

Sports video has been chosen as a main source. Cricket video has been selected as the primary application, because they attract viewer worldwide and the complexity of the game is high. There are many reasons why sports domain is important and necessary. The sport domain is

receiving a growing attention due to the interest of broadcasters and producers, sponsors and audience. Sports domain is widely spread over various multimedia repositories and appeal to large global audiences. Hence sports video analysis, semantic segmentation, automatic detection of events, efficient indexing and context information retrieval techniques are highly adored.

The paper is organized as follows: Section 2 presents related research work. Section 3 describes cricket context ontology construction. Section 4 contains a practical implementation. Finally conclusions and future works are drawn in section 5.

II. RELATED RESEARCH WORK

Ontology is an explicit specification of a conceptualization [2][3]. It is defined as a set of definitions of formal vocabulary. Practically, an ontological commitment is an agreement to use a defined vocabulary by a group of people agreed upon in a coherent and consistent manner. Ontologies are most widely used in artificial intelligence, semantic web, software engineering, information retrieval, knowledge representation, knowledge sharing, knowledge integration, knowledge reuse, and so on. Hence the development of ontology is seriously impeded. Ontologies describe individuals (instances) - the basic objects, classes (concepts) - collections of objects, attributes - parameters that objects can have, and relations - ways the concepts are associated. N. F. Noy, and D. L. McGuinness in [4] describe the need for ontology as:

- To share common understanding of the structure of information among people or software agents.
- To enable reuse of domain knowledge.
- To make domain assumptions explicit.
- To separate domain knowledge from the operational knowledge.
- To analyze domain knowledge.

Ontology development process is an iterative process that will continue in the entire life cycle of the Ontology. The basic steps for building Ontology are:

- Determine the domain and scope of the ontology.
- Consider reusing existing ontology.
- Enumerate important terms in the ontology.
- Define the classes and the class hierarchy.
- Define the properties of classes—slots.
- Define the facets of the slots.
- Create instances.

III. CRICKET CONTEXT ONTOLOGY

To represent the complete semantics of video, content information must be associated with context information. Moreover the index considering only semantics ignores the context information regarding that video. Unfortunately a single video object which is separated from its context has less capability of conveying semantics. For example, diagnostic medical images are retrieved not only in terms of image content but also in terms of other information associated with the images (like physician's diagnosis, physician details, treatment plan, photograph

taken on. ...etc.,). Hence, from the physician's viewpoint the text associated with diagnostic medical image is as central as the content of the image itself. This includes context information regarding the video, such as date, time, and place of video taken. In the sports video context details abstracts complete information of that context i.e., the match, team, tournament, stadium, umpire and player personal details, etc see fig 1. End user's information requirement is very important and extensive input during database design. The retrieval needs are changing continuously even after accumulation there is no guaranty that the information requirements are complete and correct. This motivates the design of a cricket domain ontology which is flexible and easy to enhance, as and when the requirements changes. Survey on user requirements pertaining to videos reflects that most

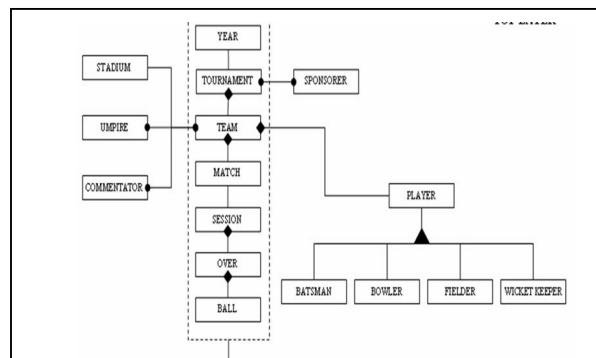


Figure 1 context concepts of cricket

of the queries are based on the context based information or concept based video scene. This conveys the need for video scenes pertaining to the events, actions, celebrities based on the semantic concepts or information about the celebrities, events, actions, locations etc. This raises the need for concept based video retrieval systems and Context based information retrieval. These demands in turn raises the need for construction of concept based ontology and Context information ontology. The Video retrieval system would be complete, with multiple ontologies. In our previous work [5] we have constructed the concept ontology which supports the concept based video object search. In this paper we construct the context ontology, to support Context based information retrieval.

The context information associated to the video can be classified in to context independent information and context dependent information. Context information is the information associated to the video. In cricket domain the information associated to the video can be of two types, One, specific information associated to the occasion, event, game, concepts for which the video has been taken, known as Context dependent information. Second, the general information associated to the occasion, event, game, concepts, ie the general information not pertaining to a specific game is known as Context independent information. Cricket concepts are players, stadium, umpire, match, sponsors, score, records, commentators etc. Cricket domain ontology contains these concepts, relations between concepts, concepts attributes. The concept attributes share

object oriented structure. In order to build a complete retrieval system for cricket which meets the end user requirements domain knowledge is essential. Cricket fans, sponsors, players, umpires would like to watch information about players like date of birth, hobbies, list of world records, ranking...etc, and also would like to view metadata such as who captured the video, where, when...etc, motivated by these demands efforts have been made to build a semantic cricket ontology, exploring more efficient context management and information retrieval system. Context information like players, stadium, umpire, match, sponsors, score, records, and commentators' etc information can be the general information or information pertaining to specific game. This kind of information or data is not related to the content or semantics. To build complete retrieval system semantic information must be associated with context information along with the scenes. Moreover the index considering only semantics ignores the context information regarding the video. Unfortunately multimedia objects which are separated from its context have less capability of conveying semantics. The context information associated to the cricket domain can be classified in to context independent information and context dependent information as shown in Fig.2

Context Dependent Information: Specific information associated to the occasion, event, game, concepts for which the video has been taken is known as context dependent information. The information associated with a particular

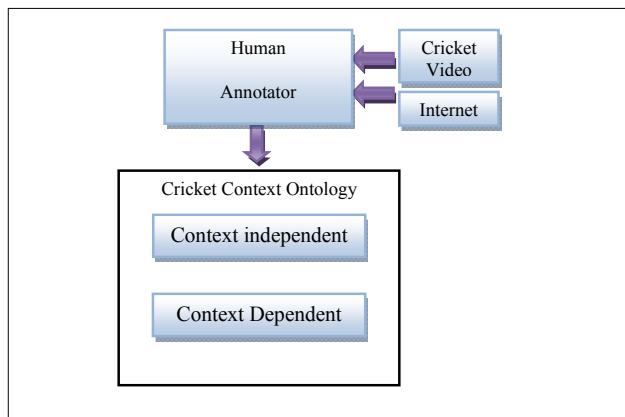


Figure.2 Context Information Classification

game, like players performance in a specific game, team members in a match, umpire, and sponsors details of specific match i.e. all information associated to a particular match.

Context Independent Information: The general information associated to the occasion, event, game, concepts. General information like details about players, stadium, umpire, match, sponsors, score, records, commentators etc not pertaining to a specific cricket match is known as Context independent information.

Domain ontology improves the efficiency of the storage and retrieval systems. Guo [6] describes how to utilize domain knowledge of Ontology to realize query

based on concept during the process of information retrieval. Domain knowledge should be extracted represented and stored to get more efficient retrieval system. Effective structure of the knowledge improves the efficiency of the retrieval system. Context information is purely text data which can be dealt as information extraction, storage and retrieval. To support these activities and to improve the efficiency of the retrieval system information is stored and retrieved based on the cricket context ontology. Ontological systems have more powerful reasoning abilities compared to the common keyword-based systems.

IV. A PRACTICAL APPROACH

This section discusses the methodology for construction of cricket context ontology. Reference [4] provides a nice guide for creating ontology. Although there may be some subtle differences between knowledge-engineering methodology proposed by Noy .N. F and our understanding of the overall process for ontology construction, they share a lot of things in common. The proposed methodology is slightly different from the methodology to construct concept based cricket ontology [5].The annotation generator should support the context based video information retrieval. Context search and retrieval based on various concepts details like player, umpire, stadium, commentator, match, events, action etc. Context dependent and context independent details are extracted and stored using object oriented concepts. Our understanding of the overall process for cricket context ontology construction is summarized below. The general steps involved in the practical approach of context ontology construction are:

Step1: Multiple Cricket videos are taken as the source of the semantic data.

Step2: Manual approach is adopted to identify the semantic concepts pertaining to context for cricket videos.

Step3: Identify the context concepts, concept hierarchy. Identify the abstract, concrete concept classes in cricket context.

Step4: Concepts are classified into disjoint concepts, overlapping concepts, range concepts ...etc.

Step5: Build the ontology using ontology construction tool - protégé and the ontology graph to visualize and evaluate the ontology.

Step6: Post-construction analysis by domain expert.

Multiple videos are taken as a source, and based on which, core concepts, abstract concept class, concrete concept classes, concept instances and the concept hierarchy between them are identified. The beauty of the methodology is its flexibility. Context concepts can be identified and added at any time which increases the flexibility of the proposed model. User can browse cricket information regarding matches, players, umpire, sponsors, and stadium etc information. Duineveld [7] gives a comparative study of ontological engineering tools. A Survey of Editing Tools is presented in [8]. The construction of cricket context ontology is been done using Protégé as an Ontology developing tool. Protégé was developed by Mark Musen's group (<http://protoge.stanford.edu>) at Stanford University [9]. Context ontology graphical notation is shown in fig

3.Context concept hierarchy is shown in fig 4. We selected OWL, as the ontology language, which is standard ontology language recommended by W3C. OWL/XML format for context ontology is shown in fig 5.

V. CONCLUSION AND FUTURE WORK

Content based, concept based video retrieval techniques will not serve the purpose of the user demands. The content based search must be supported with the semantic based search. And the retrieval system would be complete only if the context details are extracted and stored. As most of the user queries are pertaining to the video scenes and the context information, there is a need for concept based video ontology as well as context based cricket ontology. In our previous work we have constructed the concept ontology for the cricket video and in this paper we construct the cricket context ontology in order to make the cricket domain retrieval system complete. Further research could be conducted on capturing the emotions of the people in the video scenes. And a retrieval system which supports, retrieval of video objects based on the emotions of the people captured in the video.

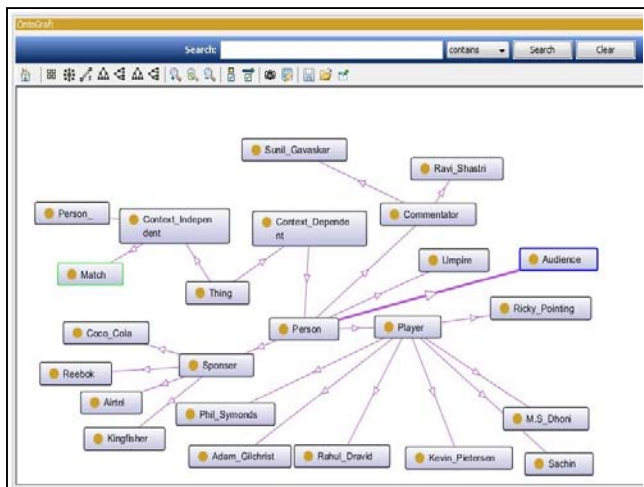


Figure 3. Onto Graph picture of context ontology

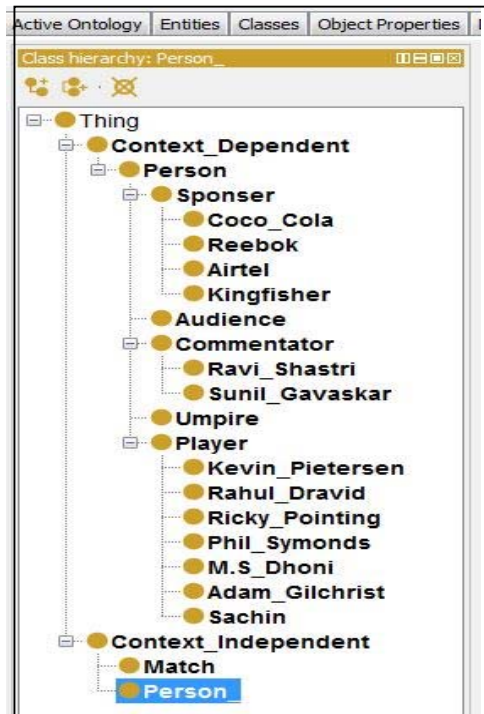


Figure 4. Concepts in cricket context

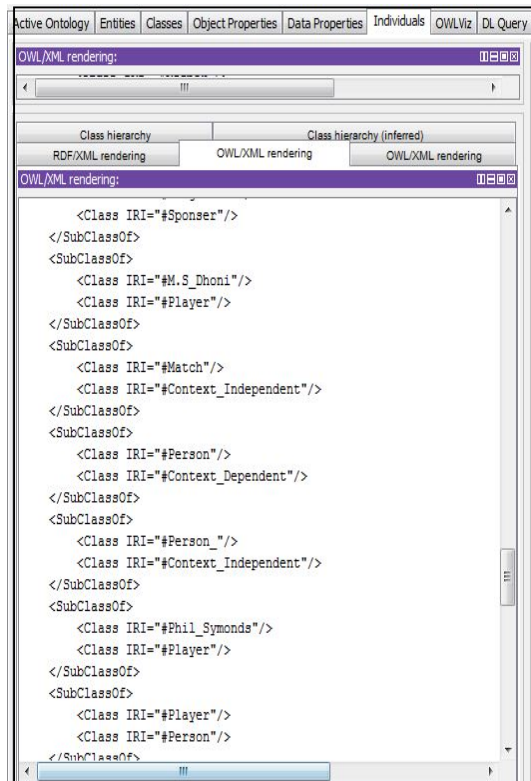


Figure 5. OWL/XML rendering for context ontology

ACKNOWLEDGEMENT

This work has been partly done in the labs of Adhiyamaan College of Engineering where the author is currently working as a Professor & Director in the department of Master of Computer applications. The author would like to express her sincere thanks to Adhiyamaan College of Engineering for their support rendered during the implementation of this module.

REFERENCES

- [1] D. Tjondronegoro, Y. Chen, and B. Pham, "Content-based video indexing for sports applications using multi-modal approach," Proc. of ACM MultiMedia'05, Doctoral Symposium, pp. 1035-1036, 2005.
- [2] Gruber T.R: Towards principles for the design of ontologies used for knowledge sharing. International Journal of Human-Computer Studies, Volume 43, Issue 5-6, pp. 907- 928, 1993.
- [3] Gruber, T. (1993). A translation approach to portable ontologies. Knowledge Acquisition, 5(2), pp. 199-220.
- [4] Noy .N. F., McGuinness D. L, —Ontology Development 101: A Guide to Creating Your First Ontology, Stanford Knowledge Systems Laboratory Technical Report KSL01- 05, 2001.
- [5] Sunitha Abburu, et al , "Concept ontology construction for sports video" Proceedings of the 1st Amrita ACM-W Celebration on Women in Computing in India 2010, Coimbatore, India September 16 - 17, 2010.
- [6] Guo Chengxia Huang Dongmei, "Research on Domain Ontology Based Information Retrieval Model", 2009 International Symposium on Intelligent Ubiquitous Computing and Education, 15-16 May 2009.
- [7] Duineveld A. et al. —Wonder Tools? A Comparative Study of Ontological Engineering Tools. *Intl. Journal of Human-Computer Studies*. Vol. 52 No. 6, pp. 11 11-1 133. 2000.

- [8] Michael Denny, Ontology Building, —A Survey of Editing Tools, <http://www.xml.com/pub/a/2002/11/06/ontologies.html>.
- [9] Matthew Horridge, Simon Jupp, Georgina Moulton, Alan Rector, Robert Stevens, Chris Wroe. OWL Ontologies using protégé 4 and CO-ODE Tools Edition 1.1. The University of Manchester , October 16, 2007.

AUTHORS PROFILE

Sunitha Abburu: Working as a Professor and Director, in the Department of Computer Applications, Adiyamaan College of Engineering, Tamilnadu, India. She received BSc and MCA from Osmania University, A.P, India. M.phil and Ph.D from Sri Venkateswara University, A.P, India. She is having 13 years of teaching experience and 3 years of industrial experience.