Multilayer Semantic Data Model for Sports Video

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ABSTRACT
Content-based video management system has become an active research topic for many researchers, which can fully abstract the content of video and index the video objects. A hierarchical semantic abstraction for sports video is proposed in the paper. We have represented the semantics of sports video at three levels of abstraction (using cricket video as an example). The top layer describes the content independent features, where they are described as context independent and context dependent features. The middle layer abstracts the key concepts of sports video. In the bottom layer, concept_measures of the concepts are described by using fuzzy approach to find the semantic similarity. For storing, concepts and concept_measures we have used XML databases. The proposed system can easily be applied to any sports video.
Index Terms*:*
Concept based Video Indexing, XML Database, Semantic Video data model, Concept Measure, Context

1. INTRODUCTION

The volume of digital video has grown tremendously in recent years, due to low cost digital cameras, scanners, and storage and transmission devices. Multimedia objects are now employed in different areas such as entertainment, advertising, distance learning, tourism, distributed CAD/CAM, GIS, sports etc. This trend has resulted in the emergence of numerous multimedia repositories that require efficient storage. The stored multimedia data poses a number of challenges in the management of multimedia information, including data and knowledge representation, indexing and retrieval, intelligent searching techniques, information browsing and query processing.

The common indexing and retrieval process is as follows, multimedia objects in the database are preprocessed to extract features and they are indexed based on these features. During retrieval, queries are processed and main features are extracted. Then the semantic similarity between the query and the multimedia object features are computed and the retrieval technique is based on ranking video objects. Current approaches to content based video retrieval differ in terms of which video features are extracted.

There are two major categories of features: low level features and high level semantics

2. VIDEO SEMANTICS

Video data is rapidly growing and becoming very important in our life. Despite the vast growth of video, the effectiveness of its usage is very limited due to the lack of complete technology for the organization and retrieval of video data [11][16]. We have proposed a video data model which summarizes the semantic content. Semantics of video are extracted by examining the features of a video such as audio, video, superimposed text of the video [18]. The feature extraction process may be automatic, semiautomatic or manual.

Context of an image depends on individual perception. Moreover, there is no limit on the number of attributes to be used to identify the piece of video object.

VDMS (video data management system) imposes various challenges on feature extraction,

Identification of features.

Extracting metadata

Structure metadata (Video data model)

Video clustering and classification

Finding similarity matching

Information retrieval

The effectiveness and efficiency of the VDMS depends upon the above factors. To improve the effectiveness and efficiency one must concentrate on user community and their requirements in different aspects. Domain Knowledge is required to capture the metadata in different aspects, as well as to interpret the query. Multimedia objects are required for variety of reasons in different contexts including

the presence of a specific type of object (eg: Trains, cars, player)

the depiction of a particular type of event (eg: dismissal or score in a cricket match)

the presence of named individuals, locations or events (eg: Sachin Tendulkar, India)

subjective emotions (eg: Happiness, violence)

reference to actions before the photo was taken

meta data such as who captured the video, where, when…etc.

Motivated by these demands efforts have been made to build a semantic video data model, exploring more efficient content management and information retrieval system.

3. RELATED WORK

OVID [Oomoto, Tanaka 1993] First object oriented video data model, which inherits the video object properties and considers interval inclusion.

AVIS [Adali et al., 1996] (Advanced Video Information System) proposed two kinds of entities in videos objects and events. In this studies objects are physical entities appearing in the video-people, weapon, ball etc. Events are more abstract entities, describing what is happening in the video. AVIS emphasizes on events and objects involved in that event.AVS (Algebraic Video System) [weiss et al 1995] represented video as tree structure with row video segments as leaves and algebraic operators like concatenation, union, intersection etc as internal nodes. The model permits arbitrary description to be associated with the nodes, which is implemented as property-value pairs with textual values.

Video STAR(Video Storage Retrieval) [Hjclsvold and Midstraum 1994], [Hjelsvold et al 1995], [Hjelsvold 1995] is a database system developed at the Norweigian Institute of Technology. It proposes a comprehensive conceptual model designed to handle media files, virtual video documents, video structure and content-based annotations and parts of it have been implemented. Video STAR model creates structural annotations and content annotations. The structural components enable a hierarchical segmentation of the video. The content annotation class has several subclasses corresponding to different kinds of concepts used to describe the video. Video STAR provides four such classes. Person, location, key-word and object.

Vane, [carrer et al., 1997] is a video annotation engine developed at Boston university. It is a tool for semi-automatic production of metadata in the form of SGML documents. In this model the annotations are generated based on the appearance of the object in the video or audio. It is claimed that all the annotation belonging to a particular object can be grouped together to form a stratum.

Veggie, [Hunter and Newmarch 1999] is a video data model in which video is segmented into scenes and the video as whole as well as each scene is described with appropriate properties. The properties are specified in an RDF Schema.

CARAAT, [Hjelsvold et al., 1999] in which each object or item or media item belongs to an object type (ex. Baseball Video) which again belongs to a media type (ex. Video). Object have attribute defined by log structures, each of which is associated with an object type and a user domain.

BilVideo, [Donderler 2002], [Donderler et al., 2003], is a video database system developed at Bilkent university in Ankara Turkey. It provides rule-based, spatio-temporal modeling and querying functionality. The spatio temporal annotations are based on minimum bounding rectangle. According to bilvideo video consists of events placed in time. Activities are abstractions of events. An activity may have a number of roles. Events may have sub events.

Ekin [Ekin 2003] proposed a video data model which is an extension to ER model with the object-oriented concepts. The main entities in the model are events, objects that participate for these events and actor entities that describe object attributes which are specific to events.

This video content models provides solutions to the task out lined. However, the challenge of developing, a flexible and semantic expressive schema that can reveal common structures for various video remains under investigated. Though, such a video model could not exist with some limitations. Our research is aimed towards designing techniques such that they can globally applied to any video types. The sports video indexing and retrieval schema proposed till date fail to meet the action_based, player_action based, player_action_context based query like all square cuts, inswinger by akram, sixers of sachin in world cup 2003, etc.

To store such problems, video semantics must be abstracted and processed at differ aspects. Video object classified should be action based, event based, player based etc. that is the video object should be classfied on different aspects. We proposed a video data model and classification approach which meets these requirements.

While these are applicable to any video, we apply and implement to the popular game of cricket. Moreover it is interesting to note that the complexity in the game of cricket is more when compared with other sports and hence this example of the game of cricket is chosen.

Our studies on user requirements concluded that most of the queries are based on the three different aspects of the media objects viz Context, Concept and Concept measures.

Context: Along with the content information, context information must be attached to the video to represent the complete information about the video.

Concept: Concept may represent terms, topics, persons, places, events… anything that it is desirable to mark the presence in the media object. eg: Player, event, player action.

Concept Measures: All adverbs like good, bad, high, low are concept_measures. To describe the events and actions more effectively, concept_measures are attached to the concept/concept_value like good shot, low catch.

To facilitate video storage and retrieval, a lexicon is built specifically to the game of cricket. A lexicon is a repository of words. The lexicon would consists of an explicit list of every word of the application domain, which gives complete information about different aspects of the multi media object. See fig.1.

Class Type	Class Name	Value
Concept	Score	dot, one, two, three, four, five, six, …
	Dismissal	runout, lbw, catch, stumped, bowled, …
	Player	sachin, dravid, akram, bretlee…
	Shot	glance, cover drive, square cut, straight drive, …
	Extras	wide, no ball, byes, leg byes
	Misfielding	missed runout, missed catch, missed four, …
Concept Measure	d1	good, bad, worst, excellent, …
	d2	high, low, ground level, …
Context	stadium	Chinnaswamy stadium, LB stadium
	year	2006, 2005, 2004, 2003, …
	tournament	world cup, reliance cup, LG cup, …
	match	Ind Vs Aus, Ind Vs Pak, …
VP_Word	verbs	give, play, hit, made, take, face, held, deliver, …
	prepositions	of, by, in, to
	stastical	total, minimum, maximum, average, …
Conjuction		and, or, before, after, between

Fig.1. A Sample Cricket Lexicon

4. PROPOSED MULTILAYER VIDEO SEMANTIC DATA MODEL

Multi layer semantic video data model is proposed in this paper see Fig.2, which is an abstraction of sports video semantics at three different layers viz., context, concept and concept_measure layers.

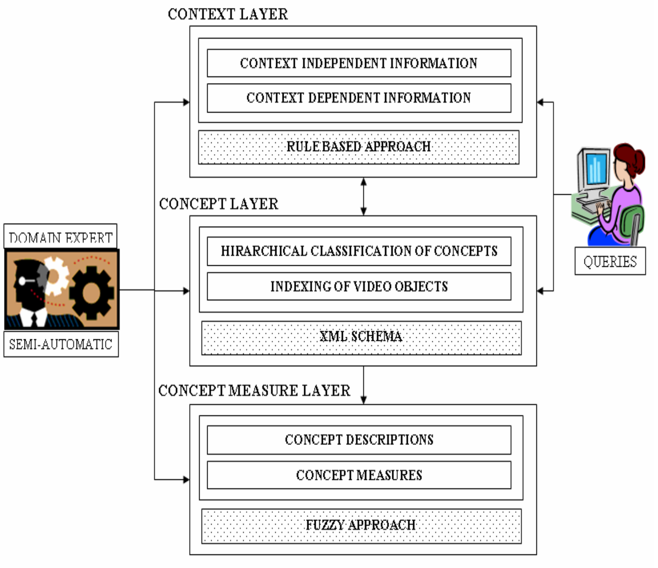

Fig.2. Multilayer Semantic

4.1 Context Layer

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 this layer abstracts complete information of that context i.e., the match, team, tournament, stadium, umpire and player personal details, etc.

The context information associated to the video can be classified in to context independent information and context dependent information. Context dependent information depends upon that context, like player performance, team details in that match see Fig.3. Rule based approach is adopted to maintain the context dependent information, which is extracted from video objects. Context independent information gives the general details like player personal details, stadium…etc.

The video object identity is generated from context dependent information, which establishes the relation from middle layer to top layer. This identity inherits the details of tournament, match, year…etc

Video Object Identity = {Y, C, T_1T_2, M, S, O, B}

Y = year of the match

C = tournament identity

T_1T_2 = match identity

M = match type

S = session identity

O = over identity, which ranges from {1, 2, ……..49, 50}

B = ball identity, in a particular over {1, 2,....5, 6}

By analyzing the video object identity we can get the information like tournament, match, year etc., to which the video object belongs.

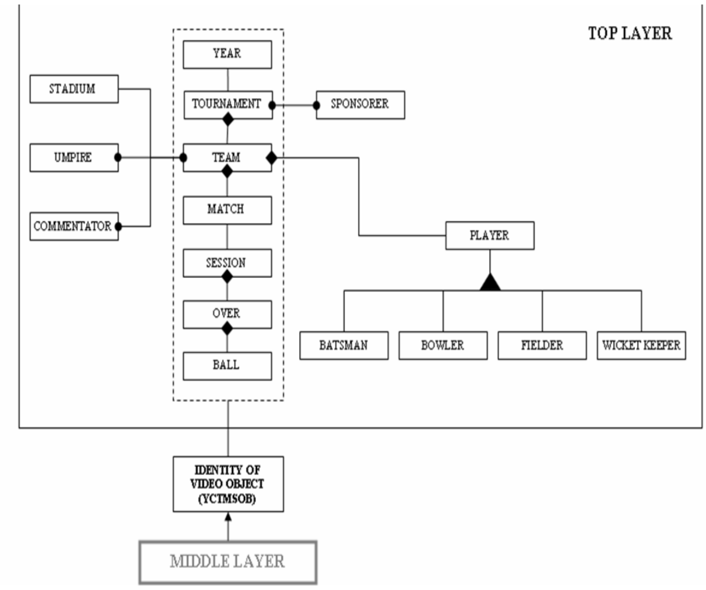

Fig.3. Context Dependent Historical Information

4.2 Concept layer

Concept may represent terms, topics, persons, places, events... any thing that is desirable to mark the presence in the media object. We have identified that most of the queries in CBVR systems are concept/concept_value oriented. The queries in CBVR may be related to specific player, event or action. Since CBVR system are around concepts there is a need to develop concept based video indexing and retrieval systems to meet the user requirements. Our emphasis is on concepts. Efficient retrieval of video information systems requires concept based video indexing and filtering techniques. The advantage of high-level concept based video indexing is the support for more natural, powerful and flexible way of querying. Concept may be thought of as organized into hierarchies [13]. See Fig.4 Concepts are classified into different concept classes, where each concept class is having its own concept_values. Multimedia objects are described by a set of concepts $C_1, C_2, C_3 ....C_N$ where n is the number of concepts associated to video object, each concept C_k can have m concept_values. ie.,

$$VO_i=\{C_1(CV_1),C_2(CV_2)......C_n(CV_m)\}.$$

Eg: VO_i = { dismissal (run out),
batsman (sachin), shot (square cut)}.

Concepts can be identified and added at any time which increases the flexibility of the proposed model. eg in cricket video player, score, dismissal, ball goes to , shot ext are concepts. run out, square drive, sixer are concept_values. User can browse a video based on the semantic hierarchy concepts like all dismissals and they can search specific type of dismissal like catch, run out etc.

Event-based indexing [14] is considered to be more suitable indexing technique for sports videos. But user query may be related to the concepts of the video like display all sixers of Sachin Tendulkar or display all in-swingers of player Srinath. These demands raised the need of concept based video indexing, which supports concept based querying system. This paper examines the issues of concept based video indexing, which includes different kinds of semantics. Effective classification and indexing mandates the use of domain knowledge.

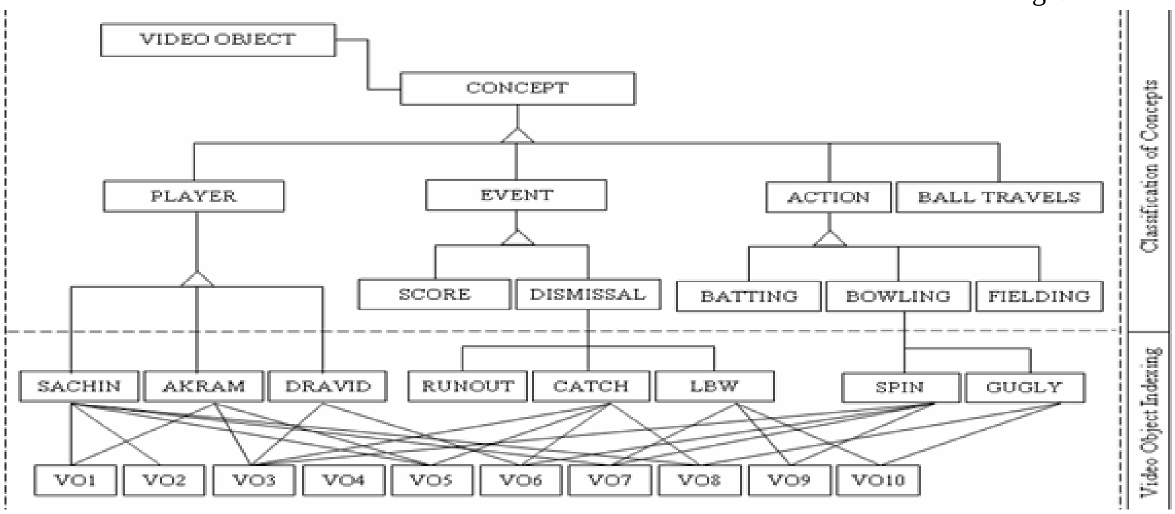

Fig.4. Video Indexing and Classification of Concepts

Efficient and effective handling of video documents depends on the availability of indexes [11][5][4]. The emphasis of this layer is on Concept based video indexing. Concept based video indexing mandates the use of prior knowledge about the domain of the video data in the indexing process. Domain knowledge is required to identify and classify the concepts. Once concepts are identified, video objects are grouped based on these concepts. Given a video object database D = { VO_1, VO_2, ...VO_N } of video objects and a set of concept classes C = {C_1, C_2,...C_K} the classification problem is to define a mapping f: D--->C where each VO_i is assigned to m(where m>1)concept classes. This grouping gives a more general view of video semantics. The number of classes depends upon concepts.

A given video object may be classified on different concepts. The video object classification algorithm is given below.

Algorithms: Preparation of Video Object List in XML Document using Concepts and Concept_Values

Input: V ← { VO_1, VO_2, VO_3, …, VO_n }
/ Video with list of Video Objects */*
VO_S ← { S_1, S_2, S_3, S_4, …….., S_n }
*/*Video object Semantics after adding the tags */*

Output: Updated XML Document (VideoObjects.xml) with Video Objects indexing.

Library: Lexicon (in hash tables)
/ Prepared for the domain 'Cricket' for our approach */*

Process:

for each $VO_i \in$ V do
  for each $S_i \in Q_S$ do
    C: concept ← {}
    CV: concept_value ← {}
    if $S_{i\ (class\_type)}$ = Concept then
      C ← $S_{i\ (class\_name)}$
      L_{CV} = getConceptValueList(C)
      / get list of Concept_Values for the 'concept' from Lexicon*
      *L_{CV} = { CV_1, CV_2, CV_3, …, CV_n } */*
      for each CV $\in L_{CV}$ do
        addVideoObject(identity of VO_i,
          in document ("VideoObjects.xml"),
          child :: C, child :: CV)
      end for
    else if $S_{i\ (class\_type)}$ = Concept_Value then
    C ← $S_{i\ (class\_name)}$
      CV ← $S_{i\ (value)}$
      addVideoObject(identity of VO_i,
        in document ("VideoObjects.xml"),
        child :: C, child :: CV)
    end if
  end for
end for

Examining the domain like cricket game reveals that it incorporates different kinds of concepts suggesting the use of multiple representations of the video clips. The concept based classification produces overlapping classes see fig.5.

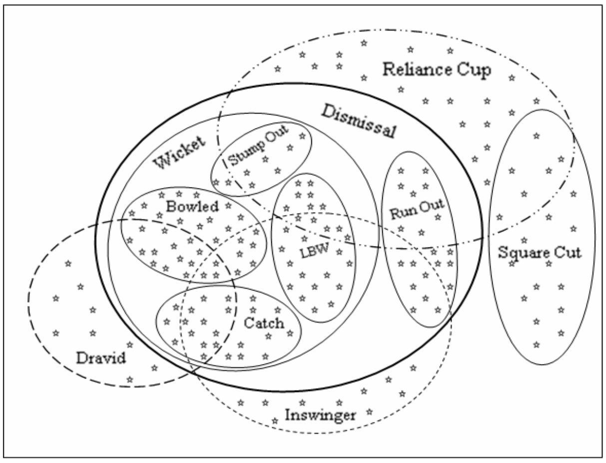

Fig.5. Video Object Classification based on

```
<cricket>
    <dismissal>
        <runout>
                <video_object video_id=0001 start=2001 end=2006>y3c1pt3t41482</video_object>
                <video_object video_id=0001 start=2010 end=2260>y3c1pt3t41484</video_object>
        </runout>
        <wicket>
            <bowled>
                <video_object video_id=0001 start=2093 end=2124>y3c1pt4t91275</video_object>
                <video_object video_id=0001 start=2126 end= 2157>y3c1pt4t92421</video_object>
            </bowled>
            <catch>
                <video_object video_id=0001 start=2201 end=2253>y3c1pt4t91164</video_object>
                <video_object video_id=0001 start=2061 end=2100>y3c1pt4t91463</video_object>
                <video_object video_id=0001 start=3061 end=3101>y3c1pt3t42171</video_object>
            </catch>
            <stump>
                <video_object video_id=0001 start=2265 end=2300>y3c1pt1t42173</video_object>
            </stump>
            <lbw>
                <video_object video_id=0001 start=2158 end=2199>y3c1pt1t41146</video_object>
                <video_object video_id=0001 start=1161 end=2000>y3c1pt1t41273</video_object>
            </lbw>
            <hitwicket></hitwicket>
            <handlingtheball></handlingtheball>
        </wicket>
    </dismissal>
    <shot>
        <coverdrive>
                <video_object video_id=0001 start=0250 end=1160>y3c1pt4t91111</video_object>
                <video_object video_id=0001 start=1068 end=1100>y3c1pt4t91182</video_object>
                <video_object video_id=0001 start=1036 end=1057>y3c1pt3t41312</video_object>
        </coverdrive>
        <squaredrive>
                <video_object video_id=0001 start=0975 end=1032>y3c1pt4t92013</video_object>
        </squaredrive>
        <squarecut>
                <video_object video_id=0001 start=0900 end=0963>y3c1pt1t41062</video_object>
        </squarecut>
        <straightdrive>
                <video_object video_id=0001 start=0470 end=0520>y3c1pt3t41122</video_object>
                <video_object video_id=0001 start=0530 end=0570>y3c1pt1t41063</video_object>
                <video_object video_id=0001 start=0620 end=0680>y3c1pt1t42202</video_object>
        </straightdrive>
        <loftedshot>
                <video_object video_id=0001 start=0720 end=0760>y3c1pt4t91364</video_object>
                <video_object video_id=0001 start=0800 end=0852>y3c1pt1t42134</video_object>
        </loftedshot>
        <glance></glance>
        <pull></pull>
        <sweep></sweep>
        <hook></hook>
    </shot>
</cricket>
```


Fig:7. Sample Structure of The Middle Layer

4.3 Concept_Measure Layer

Exact-matching may not be the appropriate method to answer the query like, display all easy catches, difficult catches, low catches, good shots, excellent shots etc. So, Similarity plays a very important role for approximate match queries. To adopt the similarity matching, concept_measures are introduced in bottom layer. These are associated to the concept class, conceptvalues. A concept is described using concept_measures. Concept measures are degree adverbs. The degree adverbs are attached to the concept to describe the video concept more effectively. See Fig.7.

Set membership function is Boolean for concepts. But in case of concept_measures the membership function is not Boolean, and thus the results are fuzzy. Concept measures like easy, good, bad, worst, high, low etc are purely human judgement. and allways thereis a chance that two individuals may judge it differently. The judgement of the degree varies from one individual to other.

Fig.7(a). Crisp Sets

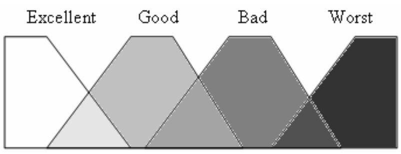

Fig.7(b). Fuzzy Sets

Figure shows difference between traditional and fuzzy set membership. Fig:7(a) shows crisp sets and fig.7(b) shows the gradual increase/decrease in the set membership value So query processor must consider the fuzziness. Set membership function is not Boolean and thus the results are fuzzy. We rank the concept_measures on a scale of 0 to 1.

Multimedia objects are described by a set of concept C_1, C_2, …………….., C_n, where n is the number of concepts associated to video. A concept can have k number of descriptions (d1, d2,…….d_k). Concept measures (c_m) are associated to the descriptions ranges between [0…1].

The video object can be described mathematically as See Fig.8.

Video Object = {C_1[(d_1:c_m),…(d_k:c_m)], C_2[(d_1:-c_m),…(d_k:c_m)],….C_n[(d_1:c_m),… (d_k:c_m)]}.

The descriptions (d) can be described using concept_measure (c_m) as:

d_1 = {(excellent, 1), (good, 0.75), (average, 0.5), (bad, 0.25), (worst, 0.0)}.

d_2 = {(very high, 1), (high, 0.8), (medium, 0.6), (low, 0.4), (very low, 0.2), (groundlevel, 0.0)}.

Eg: Good and low catch is represented by
VO_i = {catch[(d1:0.75), (d2:0.8)], …..}

Ranking of video object is done based on the similarity between the query and video objects. Once the appropriate video objects are identified from the concept layer and the query contains concept_measures then the similarity between the query and video object is calculated using distance function:

$$\text{distance}\,(qm_{ih}, dm_{jh}) = \sum_{i=1}^{h} \left| dm_{jh} - qm_{ih} \right|$$

where qm = query concept_measure

dm = video object concept_measure

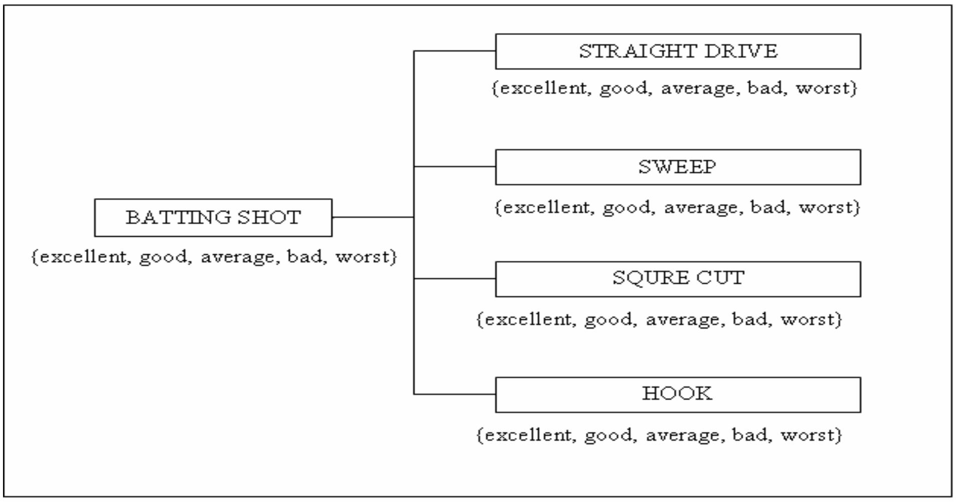

Fig.8. Concept Measures

5. VIDEO RETRIEVAL

With the help of this model we could able to represent complex semantics of video which supports various queries. The preeminence of this model is that the appropriate video objects are identified based on the concepts first, before finding out the semantic similarity between the video objects and the query. Thus filtering the unrelated video objects from the database which in turn increase the performance. The advantage is that the filtering process filters all video objects in the database which are unrelated to the given query and identifies the video objects based on the concepts specified in the query, instead of finding out the similarity between the given query and video object in the database which are not related to the query.

The abstraction supports the generation of the sports video summary. The match summary, highlights are displayed and links are provided to the user to watch all other related video objects. This structure supports both highlights of a particular match or specific events, action of the match or actions of specific player. ie., combination of any concepts or a specific concept. Another feature of the proposed model is that it not only show the video objects of specific match but also shows the video object of a particular concept in various matches and combination of different concepts in different matches.

In order to process the query the level of semantic abstraction that the query word represents must be identified [12]. The natural language query is first tokenized and then using the lexicon all affix morphemes are deleted to get the basic morphemes. Each and every morpheme of the query must be provided with an identify. The identity of the morpheme is represent as :

$$T = \{T_{position}, T_{classtype}, T_{classname}, T_{value}\}$$

This is done using the lexicon, which is build specifically to cricket game. see fig 1

The user query may contain single or multiple concepts and concept_values of the query is composed of concept and concept_value then the list of concept and concept_values of the query are identified and for each concept and concept_values, corresponding list of video objects are extracted, then conjunction operation is performed on the lists to eliminate video objects, which are irrelevant to the user query.

Algorithms: List out Video Object List at First Level

a. Extract List of Video Object lists by using Concepts and Concept_Values

Input: $Q_T \leftarrow \{ T_1, T_2, T_3, T_4, \ldots\ldots, T_n \}$
/ Query word set after adding tags */*

Output: $L_{VOL} \leftarrow \{ VOL_1, VOL_2, VOL_3, \ldots, VOL_m \}$
/ List of extracted Video Objects Lists */*

$VOL_i \leftarrow \{ VO_1, VO_2, VO_3, VO_4, \ldots, VO_n \}$
/ List of Video Objects */*

Library: Video Objects Lists (in document ('VideoObjects.xml'))

/ prepared and indexed for the domain 'Cricket', based on Concept and Concept_Values */*

Process:

L_{VOL} : List of extracted Video Objects Lists ← {}
for each $T_i \in Q_T$ do
C: concept ← {}
CV: concept_value ← {}
if $T_{i\ (class\_type)}$ = Concept then
C ← $T_{i\ (class\_name)}$
L_{CV} = getList (C)
/ get list of Concept_Values for the* concept 'C' from Lexicon */
for each CV ∈ L_{CV} do
VOL ← getList(
in document ("VideoObjects.xml"),
child :: C, child :: CV)
$L_{VOL} \leftarrow L_{VOL} \cup$ { VOL }
end for
else if $T_{i\ (class\_type)}$ = Concept_Value then C
← $T_{i\ (class\_name)}$
CV ← $T_{i\ (value)}$
VOL ← getList(
in document ("VideoObjects.xml"),
child :: C, child :: CV)
$L_{VOL} \leftarrow L_{VOL} \cup$ { VOL }
end if
end for

b. Applying Intersection between Extracted Video Object lists to eliminate Video Objects which are irrelevant to the user Query

Input: L_{VOL} ← { VOL_1, VOL_2, VOL_3,…, VOL_m }
/ List of extracted Video Objects Lists */*

Output: IL_{VO} ← { VO_1, VO_2, VO_3, …….., VO_n }
/ List of Video Objects after applying Intersection */*

Process:

IL_{VO} ← VOL_1
for each $VOL_i \in L_{VOL}$ do
if VOL_{i+1} <> null then
for $VO_j \in VOL_i$ do
if $VO_j \notin VOL_{i+1}$ then
$IL_{VO} \leftarrow IL_{VO}$ – { VO_j }
end if
end for
end if
end for

If the user query consists of concept_measures, then semantic similarity between concept_measures is calculated using the following algorithm.

Algorithm: Filter out Video Object List at Next Third Level using Concept Measures

Input: IL_{VO} ← { VO_1, VO_2, VO_3, …….., VO_n }
/ List of Video Objects after applying Intersection */*
Q_T ← { T_1, T_2, T_3, T_4, …….., T_m }
*/*Query wordset after adding the all tags for tokens */*

Output: FL_{VO} ← { VO_1, VO_2, VO_3, …….., VO_n }
*/*List of video objects after measuring and filtering */*

Library: Video Objects Data (in document ('VideoData.xml'))
/ Prepared and indexed for the domain 'Cricket' based on Concept Measures */*
Lexicon (in hash tables)
/ Prepared for the domain 'Cricket' for our approach */*

Process:

qm ← { } /* query measures set */
dm ← { } /* data measures set */
a : Query Measure Value
d : Data Measure Value
C: Concept
CM: Concept Measure
T: Threshold Value
D ← { } */* distances set */*
h: total number of Concept Measures
for each $Vo_i \in IL_{VO}$ do
for each $T_i \in Q_T$ do
if $T_{i\ (class\_type)}$ = Concept Measure then
CM ← $T_{i\ (value)}$
if T_{i+1} <> null and
$T_{i+1\ (class\_type)}$ = Concept then
C ← $T_{i+1\ (class\_name)}$
else if T_{i+1} <> null and
$T_{i+1\ (class\_type)}$ = Concept_Value then

```
            C ← T_{i + 1 (value)}
        end if
    end if
    a ← getQueryMeasure( CM )
    qm ← qm ∪ { a }
    b ← getDataMeasure( C )
    dm ← dm ∪ { b }
  end for
  h ← { length of a }
```

$$distance\,(qm_{ih}, dm_{jh}) = \sum_{i=1}^{h} \left| dm_{jh} - qm_{ih} \right|$$

```
  D ← D ∪ { distance( qm_i, dm_j ) }
end for
for each Vo_i ∈ IL_VO do
  if D_i >= T then
    FL_VO ← FL_VO ∪ { VO_i }
  end if
end for
```

The similarity between the query and video object is calculated and those video objects are selected as a final list whose distance is greater than a given threshold.

6. SUMMARY

In this paper, we have presented a multilayer sports video data model. We have used three layers to represent sports video semantics. At the top layer we have considered context information. which maintains complete information regarding the context depend and context independent information like stadium, umpire, match, tournament, player personal details etc., The middle layer deals with concepts and classifies the concepts in to various concept classes. Video indexing is created based on concepts. Finally in the bottom layer we have consider the measures of the concepts and attached different description to the concepts, which enables to find semantic similarity bearing in mind fuzziness.

The proposed model is constructive to any sports video. Since the cricket is a complex game, we have espoused the cricket video as an example. Further research could be conducted on semantic segmentation of sports video , OCR(optical character recognition)process to detect text from video, which is a direct source of semantic information where most of the semantics can be identified using the superimposed text and audio processing to extract concept measures.

7. REFERENCES

1. Adali, S., Candan, K.S., Chen, S., Erol, K . and Subrahmanian , V.S., “ The advanced Video information system: Data structures and Query processing,” Multimedia systems, 4(4) August 1996, p. 172-186.
2. Carrer, M., Ligresti, L., Ahanger, G. and Little, T. D. C., "An Annotation Engine for Supporting Video Database Population," Multimedia Tools and Applications, 5 (3) 1997, p.233-258.
3. Dönderler, M. E., "Data Modeling and Querying for Video Databases", Department of Computer Engineering, Bilkent University, July 2002.
4. Dönderler, M. E., Saykol, E., Ulusoy, Ö. And Güdükbay, U., "BilVideo: A Video Database Management System," IEEE MultiMedia, 10 (1) 2003, p.66-70.
5. Ekin Ahmet, Automatic Soccer Video Analysis and Summarization, published in IEEE Trans. On Image Processing, 12(7), 2003.P.784-795.
6. Hjelsvold, R. and Midtstraum, R., "Databases for Video Information Sharing," Storage and Retrieval forImage and Video Databases (SPIE), 1995, p.268-279.
7. Hjelsvold, R. and Midtstraum, R., "Modelling and Querying Video Data," in J. B. Bocca, M. Jarke and C.Zaniolo (Ed.), VLDB'94, Proceedings of 20th International Conference

   on Very Large Data Bases, 1994, p.686-694.
8. Hjelsvold, R., "VideoSTAR - A Database for Video Information Sharing", Department of Computer Science and Telematics, Norwegian Institute of Technology, 1995.
9. Hjelsvold, R., Liou, S. and Depommier, R., "Multimedia Archiving, Logging and Retrieval," in B. Fuhrt (Ed.), Handbook of Multimedia Computing, 1999, p.379-402.

10. Hunter, J. and Newmarch, J., "An Indexing, Browsing, Search and Retrieval System for Audiovisual Libraries," in S. Abiteboul and A. Vercoustre (Ed.), Research and Advanced Technology for Digital Libraries (ECDL), 1999, p.76-91.
11. Jurgen Assfalg, Marco Bertini, “Semantic Annotation of Sports Videos”, IEEE MultiMedia 9(2): 52-60 (2002) ... 2002
12. Krishna Murthy Ilango, Raman. S (1996) Natural Language query interface to multimedia database syste. Computer science and Informatics, Journal of CSI, March 1996, 43 – 50.
13. Margaret H.Dunham ,Data mining introduction and advanced topics, Southern Methodist University,Pearson Education
14. Noboru Babaguchi, Yoshihiko Kawai and Tadahiro Kitahashi, “Event Based Indexing Of Broadcasted Sports Video By Intermodal Collaboration”, IEEE, Transaction on Multimedia, vol 4, no.1, pp 68-75, Mar 2002.
15. Oomoto. E. and Tanaka. K, OVID: Design and Implementation of a Video-Object Database System, IEEE Transactions on Knowledge an Data Engineering Vol5, No.4 August, 1993.
16. Sridharan, P.N. and S. Raman (1996) Video handling in Multimedia: A Review, pp. 182 – 186. In P.S. Nagendra and Ravi Mittal (eds) Trends in advance computing, Proceeding of fourth International Conference on Advance Computing, ADCOMP’ 96, Bangalore, India, Tata McGraw-Hill Publishing Company Limited, New Delhi.
17. Weiss, R., Duda, A. and Gifford, D. K., Composition andSearch with a Video Algebra IEEE MultiMedia, 2 (1) 1995, p.12-25.
18. Xingquan Zhu, Xindong Wu,” Video Data Mining: `Semantic Indexing and Event Detection from the Association Perspective”,IEEE Transactions on knowledge and data engineering vol 17 (5) May 2005, p. 665-677

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