Automatic Semantic Content Extraction in Videos Using a Fuzzy .Ontology and Rule-Based Model

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Abstract - Recent increase in the use of video-based applications has revealed the need for extracting the content in videos. Raw data and low-level features alone are not sufficient to fulfill the user's needs; that is, a deeper understanding of the content at the semantic level is required. Currently, manual techniques, which are inefficient, subjective and costly in time and limit the querying capabilities, are being used to bridge the gap between low-level representative features and high-level semantic content. Here, we propose a semantic content extraction system that allows the user to query and retrieve objects, events, and concepts that are extracted automatically. We introduce an ontology-based fuzzy video semantic content model that uses spatial/temporal relations in event and concept definitions. This metaontology definition provides a wide-domain applicable rule construction standard that allows the user to construct ontology for a given domain. In addition to domain ontologies, we use additional rule definitions (without using ontology) to lower spatial relation computation cost and to be able to define some complex situations more effectively. The proposed framework has been fully implemented and tested on three different domains. We have obtained satisfactory precision and recall rates for object, event and concept extraction.

Keywords - Semantic content extraction, video content modeling, fuzziness, ontology

I. Introduction

The rapid increase in the available amount of video data has caused an urgent need to develop intelligent methods to model and extract the video content. Typical applications in which modeling and extracting video content are crucial include surveillance, video-on-demand systems, intrusion detection, border monitoring, sport events, criminal investigation systems, and many others. The ultimate goal is to enable users to retrieve some desired content from massive amounts of video data in an efficient and semantically meaningful manner. There are basically three levels of video content which are raw video data, low-level features and semantic content. First, raw video data consist of elementary physical video units together with some general video attributes such as format, length, and frame rate. Second, low-level features are characterized by audio, text, and visual features such as texture, color distribution, shape, motion, etc. Third, semantic content contains high-level concepts such as objects and events. The first two levels on which content modeling and extraction approaches are based use automatically extracted data, which represent the low level content of a video, but they hardly provide semantics which is much more appropriate for users. Users are mostly interested in querying and retrieving the video in terms of what the video contains.

Therefore, raw video data and low-level features alone are not sufficient to fulfill the user's need; that is, a deeper understanding of the information at the semantic level is required in many video-based applications. Besides generic ontology models make available solutions for multimedia formation representations. In this study, offer a wide-domain applicable video content model in command to model the semantic content in videos. Therefore, using semantic entities in the explanation helps us as an upgrading for the data model. "Objects" and "Events" are the primitives used to construction the explanation for semantics. Objects are the entities recounting the concepts while measures are used to model the relations between the concepts and relating the performance in the video segments. Therefore, the querying performance thorough the videos are processed using the analysis actions working on the ontology instances of each video represented by SWRL. In previous language, the answers for the queries on the video contents are extracted by analysis on the logical illustration. The infrastructure proposed in this thesis uses a video data model based on explanation layering. But, an object-based move towards is also used in the explanation in order to hybridize this data model with the object-based models for structuring the video explanation.

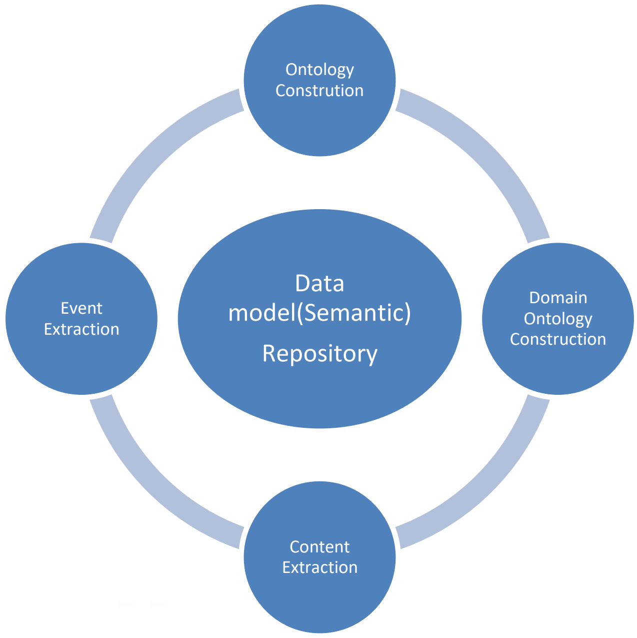

Fig: Architecture

II. LITERATURE REVIEW:

Current solutions are silent far from success the vital objective, namely to facilitate users to retrieve the required video clip among enormous amounts of visual data in a semantically important manner. Objects and/or events use all these information to make events and concepts. In [5], the organization has a consistent video data model, which gives the client the aptitude to create ontology-supported fuzzy querying. RDF is used to characterize metadata. OWL is used to correspond to ontology and RDQL is used for querying. Queries contain items, events, spatial-temporal clauses; concepts and low-level character are handled. A database model for video (DAMVO) provides automatic object, event and concept extraction. With using instruction sets and authority opinions, low-level attribute values for objects and associations between items are determined. The genetic algorithm-based classifier is old to formulate organization of segments to objects. At the apex level ontology of objects, events and concepts are worn. Multimedia databases have gained attractiveness due to quickly growing quantities of multimedia data and they have to achieve efficient indexing, retrieval and investigation of this data. One consequence of multimedia databases is the requirement to development the data for feature extraction and labeling earlier to storage and querying. Huge quantity of data makes it unfeasible to entire this task yourself. Aims to decrease the effort for physical collection and group of objects appreciably by detecting and tracking the most important objects, and hence, requiring to come in the label for every object only formerly within each shot as a substitute of specifying the labels for every object in each frame they show. This is also necessary as a first step in a fully-automatic video database management system in which the labeling should also be completed automatically. Planned framework covers a scalable construction. Multi-modal structure for semantic event extraction from basketball games based on webcasting text and broadcast video. Event recognition in sports video which relies heavily on low- level features nonstop extracted from video itself, our move towards aims to suspension bridge the semantic gap between low-level features and high- level events and facilitates personalization of the sports video. Promising grades in [3] are reported on real-world video clips by using text analysis, video analysis and text/video configuration. An unsupervised clustering based system as a substitute of predefined keywords to automatically detect event from webcasting text; get better the game time recognition algorithm to identify the break time in basketball games; a numerical approach as a substitute of finite state machine as in to detect event boundary in the video.

III. System Model

III.1. Overview

VISCOM is a well-defined meta ontology for construct area ontology's and acts as a substitute to the rule-based and domain-dependent removal methods. It contains classes and associations between these modules. Several of the modules characterize semantic content types such as item and incident though others are used in the automatic semantic content extraction method. Associations defined in VISCOM provide ability to model actions and concepts associated with other items and actions. Ontology provides many advantages and capabilities for content modeling. until now, a great mass of the ontology based video content modeling studies propose domain specific ontology models limiting its use to a specific domain. Besides, generic ontology models provide solutions for multimedia structure representations. A wide-domain applicable video content model in order to model the semantic content in videos. In addition to the complexity of handling such difference, each rule structure can have weaknesses. Besides, VISCOM provides standardized rule construction ability with the help of its metaontology. It eases the rule construction process and makes its use on larger video data possible. The rules that can be constructed via VISCOM ontology can cover most of the event definitions for a wide variety of domains. However, there can be some exceptional situations that the ontology definitions cannot cover. To handle such cases, VISCOM provides an additional rule based modeling capability without using ontology. Hence, VISCOM provides a solution that is applicable on a wide variety of domain videos. Objects, events, concepts, spatial and temporal relations are components of this generic ontology-based model. Fig 1. Architecture

III.2 Ontology-Based Modeling

VISCOM contains module and associations among this module. A number of the modules characterizes semantic content types such as item and occasion while others are worn in the automatic semantic pleased extraction process. VISCOM module, VISCOM facts Properties correlate module with constants and VISCOM Object Properties are worn to describe associations. The linguistic part of VISCOM contains classes and relations between these classes. Some of the classes represent semantic content types such as Object and Event while others are used in the automatic semantic content extraction process. associations defined in VISCOM give ability to model events and concepts related with other objects and events. VISCOM is developed on an ontology-based structure where semantic content types and relations between these types are collected under VISCOM Classes, VISCOM Data properties which associate classes with constants and VISCOM Object Properties which are used to define relations between classes.

III.3 Domain Automatic Semantic Content Extraction Framework

First to get on attributes with organized tree design behind that there are two main steps follow in the automatic semantic content extraction process. The following step is to take out and classify object instances beginning delegate frame of shots of the video instances. The third step is to extract measures and concepts by with area ontology and law definitions. A set of actions is executed to extract semantically important mechanism in the automatic event and concept extraction method. The first semantically important components are spatial relation instances among object instances. Then, the temporal associations are extracted by with changes in spatial relations. Finally, actions and concepts are extracted by resources of the spatial and temporal relations.

III.4 Event Extraction

Event instances are extracted behind a series of automatic extraction processes. Every extraction method outputs instances of a semantic content form definite as an character in the domain ontology. Through the extraction process, the semantic substance is extracted among a confidence degree between 0 and 1. An extracted event instance is represent among a type, a frame set instead of the event's gap, a connection value and the roles of the items enchanting part in the event. outline Set is used to represent the frame interval of instances.

III.5 Concept Extraction

In the model extraction process, Concept Component persons and extracted object, event, and concept instances are worn. Concept Component persons recount objects, events, and concepts with concepts. When an object or event that is worn in the meaning of a conception is extracted, the linked concept instance is automatically extracted with the significance degree given in its definition. In addition, connection individuals are utilized in classify to extract added concepts from the extracted apparatus. The last step in the concept extraction process is executing model rule definition.

III.6 Object Extraction

Object extraction techniques use instruction data to study object definitions, which are regularly figure, shade, and texture features. These definitions are commonly the similar across dissimilar domains. Through the object extraction procedure, for each commissioner key structure in the video, abovementioned object extraction method is performed and a position of objects is extracted and confidential. The extracted item instances are stored with their kind, frame digit, association value, and least Bounding quadrilateral data.

Algorithm: Object Extraction
Input: Segmented and feature extracted key frames

Output: Object

1. Extracting current frames
2. evaluate feature information available on all segmentation
3. evaluate segmentation into key frames (pixel wise, color wise, shape/area)
4. Check for key frame annotation
5. Create segmentation for annotation
6. Specify annotation type
7. Compare new segmentation to current segmentation
8. Store in to database

K-Means – Clustering

Where, *'(ui – vj)'* is the Euclidean distance between *ui* and *vj*.
'cn' is the number of data points in *nth* cluster. *'c'* is the number of cluster centers.

Algorithmic steps for k-means clustering

Let U = {u1,u2,u3,…….. ,un} be the set of data points and V = {v1,v2,…….,vn} be the set of centres.

1. Randomly select *'c'* cluster centres.

2. Calculate the distance between each data point and cluster centres.

3. Assign the data point to the cluster centre whose distance from the cluster centre is minimum of all the cluster centres..

4. Recalculate the new cluster centre using: where, *'cn'* represents the number of data points in *nth* cluster.

5. Recalculate the distance between each data point and new obtained cluster centers.
6. If no data point was reassigned then stop, otherwise repeat from step 3.

II.7 VISCOM

7.

VISCOM is built-up on an ontology-based construction where semantic content types and dealings between these types are together below VISCOM module, VISCOM information Properties which associate classes with constants and VISCOM article Properties which are used to describe dealings between module.

8.

In Accumulation, there are numerous domain autonomous class persons. The VISCOM properties consist of four extra relative like temporal relation, item relation, association persons and spatial relative. These relations are opening out by group, since these relative are distinct by classes itself where the predicate persons is used to denote "an entity is distinct as an personality of a class" in the formal demonstration of classes. It is sub- classed to the dissimilar types of domain concepts that must to be supported by the examination.

CONCLUSION

The semantic content extraction procedure is completed mechanically. In adding, a general ontology-based semantic meta ontology representation for videos (VISCOM) is projected. in addition, the semantic content symbol potential and extraction achievement are enhanced by accumulation fuzziness in class, relative, and rule definitions. . An automatic k-means based object extraction method is integrated to the proposed system to extract more relevant objects from video. K-means clustering algorithm for object extraction is proposed for semantic content. In every module of the structure, ontology-based modeling and extraction capability are used. Object or event that be used in the explanation of a thought is extracted; the associated concept instance is repeatedly extracted with the application degree specified in its designation. Lastly use the proposed VISCOM meta-model effectively and construct well and correctly defined domain ontology.

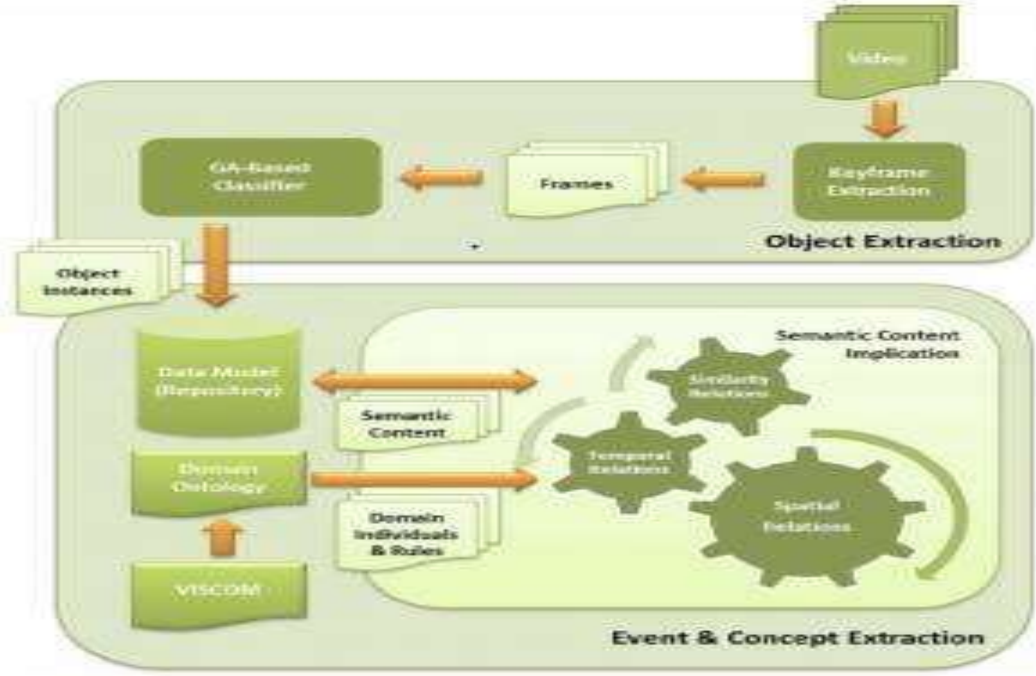

Fig 2. Automatic semantic content extraction framework.

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