

Requirements for a common Multimedia Ontology Framework by JOANNEUM RESEARCH

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Purpose

This document provides a short overview of relevant projects which use or will use multimedia ontologies, especially for annotation and retrieval tasks.

Brief descriptions of related projects co-ordinated by JOANNEUM RESEARCH, Institute of Information Systems & Information Management

Salero [1]

SALERO's overall vision is to define and develop 'intelligent content' for media production, consisting of multimedia objects with context-aware behaviour for self-adaptive use and delivery across different platforms. 'Intelligent Content' should enable the creation and re-use of complex, compelling media by artists who need to know little of the technical aspects of how the tools that they use actually work.

A goal is to obtain a better understanding of the relations between media types, genres, workflows and styles as a pre-requisite to the adaptation and transfer of content elements across productions and platforms. To this end, metadata, media semantics and ontologies need to be analysed, researched and developed that define the parameters necessary for the creation and manipulation of semantically aware media objects of various types. Practical methods of context-based information retrieval will be researched that simplify the location and retrieval of images, sounds, videos, characters, movements or behaviours from very large datasets and media storage systems. Improved methods and tools for language processing and speech synthesis, as a means of supporting the generation of multilingual media content, need to be developed.

- MPEG-7 will be used to describe low-level features and physical features. Such metadata representation techniques will be the starting point for the development of domain specific multimedia ontologies for the description of multimedia objects and their context.
- Knowledgebase for Multimedia Objects: Following the development of an appropriate ontology language, this task will yield fully-fledged tool support for this ontology language, including
 - a) A uniform API for managing the storage and retrieval of media object annotations, based on work on ontology APIs.
 - b) A suite of tools, especially an ontology workbench (editor, versioning, alignment, etc.) and an ontology management system (including a scalable repository for ontology data) adapted to the needs of media objects.

NM2 [2]

NM2 is developing compelling new media forms which take advantage of the unique characteristics of broadband networks. To achieve this goal NM2 will create tools for the cost efficient production of non-linear interactive narratives that are integrated with emerging end-to-end digital production environments. Using a practice-based research methodology, NM2 will deliver seven example productions.

As the NM2 system will be able to create personalised versions of narratives on an individual basis, it has to understand the content and the structure of the narrative. To make the NM2 system to 'understand' the production the project will create a language for the representation of narratives and allow to describe the content with metadata on different semantic levels. To describe the essence itself MPEG-7 will be used as a metadata format. The tools will allow automatic and manual annotation of this metadata. In addition multimedia ontologies (using OWL) will be utilised to describe the story, the plot, and the single media objects on a higher semantic level. For this a core ontology that contains the core concepts and relationships that are necessary to describe these productions will be created. This core domain will be extended by production-specific ontologies that contain more specific concepts and relationships that are relevant for single productions and/or genres.

Within the project JOANNEUM RESEARCH focuses on the semantic description of the media content: a description tool will be created that allows end-users to manage and structure productions, to assign and manipulate the metadata, and to explore the content by searching and browsing. The relevant ontologies will be developed within the project and to manage them an OWL data store will be created. In addition to this content analysis modules will be developed that extract metadata automatically from the content.

MediaCampaign [3]

Ontology to be developed: MEPCO (Media Presence and Campaign Ontology)

Objective / requirements: The main goal of MEPCO is the cross-relation of media campaigns over the media TV, press and Internet and furthermore the ambitious goal to cross link media campaigns also over different countries. What makes a media campaign unique from others is not completely straight forward; however, there are rules how a human can determine whether a media campaign is new. These heuristic rules will be formally encoded as to describe media campaigns in a generic way.

MEPCO will be based on the PROTON upper-level ontology (<http://proton.semanticweb.org/>), which is developed for the purposes of semantic annotation and, more generally, knowledge management within the SEKT project. It provides consistent formal definitions of about 300 general concepts and 100 relations and attributes. MEPCO will also be aligned with existing standards for media-related metadata, such as NewsML and News Codes from IPTC.

Requirements

0. Link to existing metadata standards:

For example, MPEG-7, formally named Multimedia Content Description Interface, is a standard for describing multimedia content, independent of the encoding of the content, and allows different levels of granularity of the description. MPEG-7 has been designed to support a broad range of applications. MPEG-7 descriptors are a good starting point for the creation of a multimedia ontology [4].

Appropriate structures to cross-reference between metadata standards and ontologies should be defined.

1. Annotation

A "Smart media asset" will contain the description of the object (in form of metadata, ontologies, rules) and the data itself. If this additional information is stored in the media itself in a standardized way, it can easily be extracted and used for applications which allow "pack-and-go scenarios". This approach enhances certainly the chances

of better integration of multimedia content. Organizations, companies etc. are encouraged to develop operational procedures that institutionalize this process.

However, requirements for the creation of “smart media asset” are

- User support for processing of metadata and ontology creation within the annotation client. Inference mechanisms for the deduction of new information are one of the main benefits of ontology-supported systems. Ontology axioms and rules are important in the verification of a described media object. Consistency checking and refinement of the description are some of these reasoning activities.
- Software toolkits, plug-ins and interfaces should enable the description of ontologies and rules within already existing industry programs in the field of media production and post-production.

2. Analysis process (especially in concept labelling)

In audio-visual content analysis – concept labelling of segments can be done on different levels of granularity, from single shots to whole programmes. The approaches deal with classifying shots or scenes by sites or objects, e.g. indoor/outdoor, natural/man-made environment or the presence of certain objects. These concepts can be part of a multimedia ontology. By using the underlying knowledge base and inference mechanisms contradictions, confirmations and relations will be identified. This improves the analysis process.

3. Multimedia retrieval

Semantic annotated content enables indexing all the content/multimedia objects of the repositories and perform requests, which combine structured queries, reasoning, and IR. Ontologies are used both to present the result and in the retrieval process.

- For example (from Salero proposal): “Intelligent content” should be open for context-sensitive retrieval (“given the sound of a galloping horse, find an image of a galloping horse”). The associated contextual information should be clearer and more useful, helping the production company to find examples of ‘horse’ and ‘horse with rider’ from other productions with similar actions. From the context of the scenario, it should be possible to infer the underlying need and look for ‘rider objects’ created before, which could be adapted for re-use.
- A concept browser - it provides the user with a high-level way to explore a collection. The visual view of concepts (e.g. labelled video segments) and relationships can be useful to find similar objects. The concept browser can be designed around a tree (hierarchical structure) or graph based visualisation, where users could navigate to concepts of interests.

References

- [1] Salero (EC-project), URL <http://www.salero.info/>. Last access: 25/01/2006
- [2] NM2 (EC-project), URL <http://www.ist-nm2.org/>. Last access: 25/01/2006
- [3] MediaCampaign (EC-project).
- [4] AceMedia (EC-project), URL: <http://www.acemedia.org/aceMedia>. Last access: 26/1/2006.