

The INVENIO Platform for 2D/3D Content Re-use

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ABSTRACT

In this paper, we propose a novel image indexing platform, so-called INVENIO (INdexing Visual ENvironment for multimedia Items and Objects). INVENIO offers to professional users both 2D and 3D content re-use facilities. Concerning the 2D aspects, the system is entirely based on the ISO/MPEG-7 normative specification. INVENIO integrates visual metadata extraction engine, annotation tools, image databases management tools, as well as appropriated, ergonomic user interfaces. In the case of 3D graphical content, INVENIO makes it possible to exploit existing animation curves for generating new content and thus accelerating the content production process.

INTRODUCTION

The field of content-based retrieval has known a spectacular break-through starting from early 1990's, as testifies the important volume of scientific literature dedicated to this issue. The reader is invited to refer to [1, 2] for comprehensive surveys of this research field. Within this context, an important step has been reached at the beginning of the 2000 years, with the publication of the ISO/MPEG-7 standard [3, 4]. Officially called *Multimedia Content Description Interface*, the MPEG-7 standard proposes a rich set of multimedia description technologies, including both textual and content-based approaches. In particular, MPEG-7 proposes a set of visual descriptors [5] and description schemes, expressed in a XML Schema-based data description language.

However, the relevance of the MPEG-7 technologies for real-life industrial applications still needs to be demonstrated. In order to achieve such an objective, it is mandatory to elaborate, validate and deploy efficient and ergonomic tools that can facilitate the processes of multimedia annotation, content querying, browsing and navigation in visual databases.

The proposed INVENIO (*INdexing Visual ENvironment for multimedia Items and Objects*) platform notably tackles this issue. INVENION

exploits a set of MPEG-7 visual descriptors and integrates, within a unified system, extraction utilities, search engine and ergonomic user interfaces.

In order to validate the INVENIO platform, we have considered an industrial application related to image indexing with texture/color descriptors for the audio-visual content production. The main issue of interest here concerns the re-use of existing visual content within the audio-visual production chain. This application was considered and treated by the HD3D-IIO and HD3D² projects supported by the CapDigital French competitiveness cluster¹.

An extension of the platform to 3D dynamic graphical content is also proposed. In this case, the objective is to re-use existing animation curves, associated to some initial animated 3D meshes, in order to animate new 3D meshes.

THE INVENIO PLATFORM

Being dedicated to content creators, the integration of INVENIO into a graphical and ergonomic environment is determinant for its successful deployment within the content production chain.

From a functional point of view, INVENIO supports the following features:

- query by example: the user can browse an image database, select an query, specify a sketch or select an image sub-part,
- query by pre-defined keywords: a mini-ontology, related to texture specification has been set up with the collaboration of graphical experts. It includes basic texture motifs, materials, shapes, colors, frequency of repetition...
- query by tags: a free text annotation mechanism has been included in order to make possible the use of personalized tags during the production process.

All the metadata considered, with both textual and content-based representations are based on the

¹ www.capdigital.com

MPEG-7 specification. Notably, INVENIO integrates the whole set of MPEG-7 visual descriptors [5].

Graphical user interface

The design of appropriate and ergonomic graphical user interfaces is a key element for the adoption of an image indexing platform by graphical experts. In our work, we have considered a 3D approach, implemented in OpenGL. Figure 2 illustrates the INVENIO graphical user interface.

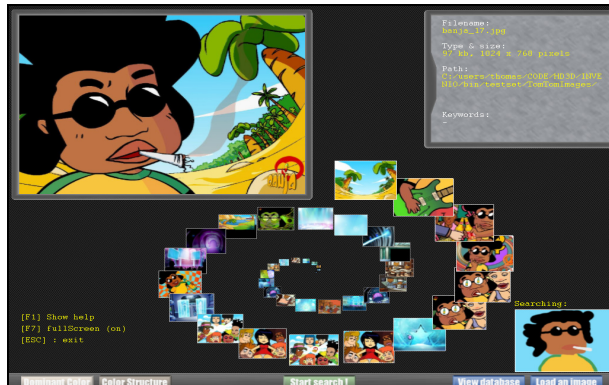


Figure 3. Query by sketch with INVENIO.

The image database is graphically presented as a rolling 3D spiral that allows the navigation through image databases and enhances the user experience by creating immersion within a 3D navigation space dynamically peopled with relevant images.

The INVENIO-3D features

In the industry of 3D graphics, 3D animated meshes are more often described in a BBA (*Bone-Based Animation*) representation, which is adopted by both professional 3D creation platform (*e.g.* Maya, 3DSMax., Blender...) or open standards such as MPEG-4/AFX [6].

The BBA representation consists of the following elements: a skin (*i.e.*, a 3D mesh representing the object), an animation skeleton (hierarchical structure of bones and joints), a set of 3D animation parameters associated to the set of bones, and a set of animation weights, which specify for each mesh vertex the influence of the corresponding bones within the animation process.

The animation parameters are generally model-independent (provided that the associated skeleton structures are topologically compatible). They define different types of movement that can animate a 3D model (*e.g.* walking, running, dancing, jumping...). The INVENIO 3D makes it

possible to re-use existing animations and clone them to different models to generate new content, as illustrated in Figure 4.



Figure 4. Mapping of a 3D animation cycle between two different 3D models (a girl and a soldier).

CONCLUSION

In this paper, we have presented the INVENIO 2D/3D content indexing and retrieval platform.

Based on MPEG-7 technologies for automatic, content-based description of visual content, INVENIO proposes ergonomic user interfaces and tools for browsing, navigation and search in image databases.

The INVENIO platform has been validated within the framework of the Capdigital HD3D-IIO French national project, for applications of content re-use within the audio-visual production chain..

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