

APIDIS Annual Report

APIDIS www.apidis.org



Autonomous production of images based on distributed sensing

APIDIS project description

APIDIS's overall objective is cost-effective autonomous production, so as to make the creation of audiovisual reports profitable, even in case of small- or medium-size audience.

To meet this objective, APIDIS first investigated the automatic extraction of intelligent content from networks of multi-modal sensors. Intelligence refers here to the identification of salient segments within the audiovisual content, using distributed scene analysis algorithms.

Then, second, APIDIS exploited that knowledge about segments of interest to produce **prototypes** that automate the production of video content for controlled scenarios, e.g. most notably **sports events or surveillance**. It considers personalized and potentially interactive content summarization mechanisms to address heterogeneous user needs and access conditions.

The potential applications of the integrated technology developed within APIDIS are numerous, ranging from personalized access to digital media related to local sport events through a web portal or a mobile hand-set; cost-effective and fully automated production of content dedicated to small-audience, e.g. souvenirs DVD, university lectures, etc; but also browsing assistance for video surveillance.

Summary of Activities

APIDIS started in January 2008 and has made steady progress towards the above objective. In 2009, APIDIS's second year, the major achievements have been:

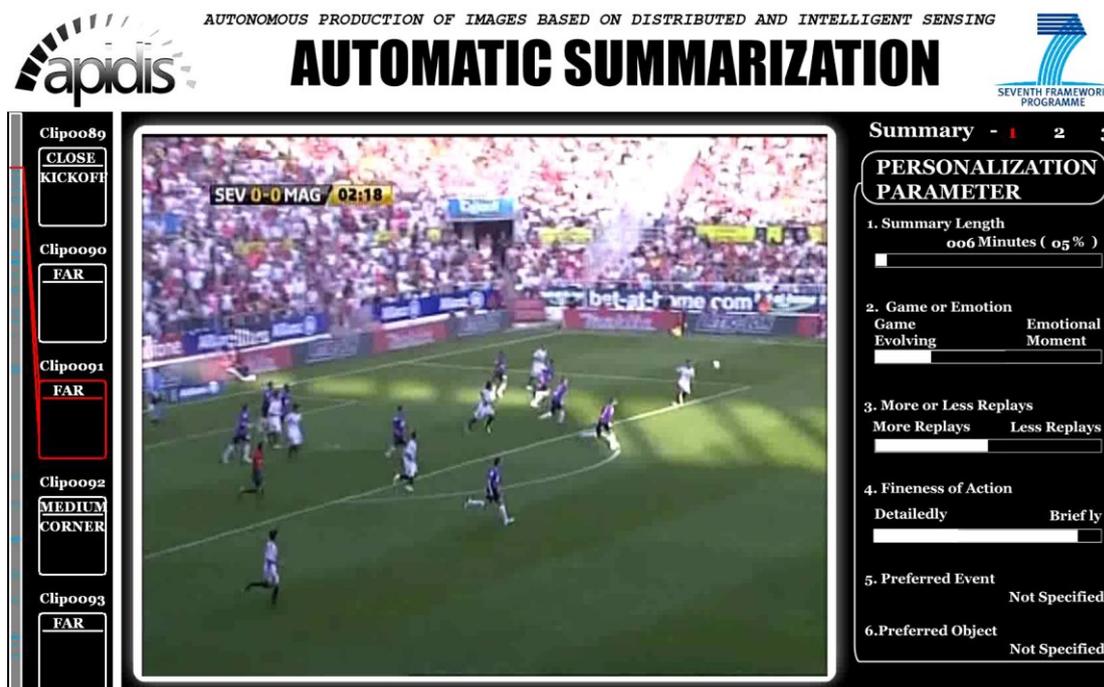
Additional video added to the APIDIS Dataset

This spring and summer, APIDIS partners acquired additional video for testing and demonstrating in the sports and surveillance scenarios.

Proof of concept trials for the APIDIS prototypes

The partners ran three proof-of-concept trials at mid-project, summer 2009, which successfully proved the three key concepts underlying the APIDIS prototypes (framework). The three prototypes demonstrated and tested were:

1. Automatic and personalized summarization of a video sequence, knowing its salient segments;
2. Generation of high resolution images in any viewing direction based on an array of omniscams
3. Distributed feature extraction and analysis for autonomous production



Technical advances

Innovations were made in the following areas:

- Omnidirectional vision
- Local features extraction and visual target object representation and tracking using distributed (omnidirectional) sensing
- Mapping audiovisual feature to camera view display parameters relevance
- Autonomous production of content
- Personalized summarization
- Interactive browsing of surveillance content

User Consultations

Partners presented results and demonstrated prototypes at academic conferences and industrial tradeshows. Users were engaged in consultations for the mid-project trials. Notably, APIDIS has demonstrated the automatic production and summarization prototypes at IBC 2009. Contacts have been taken with companies (ESPN, Cisco, NeuroTV, BeTV, ...), and a collaboration has been initiated with Telefonica Innovation Division.

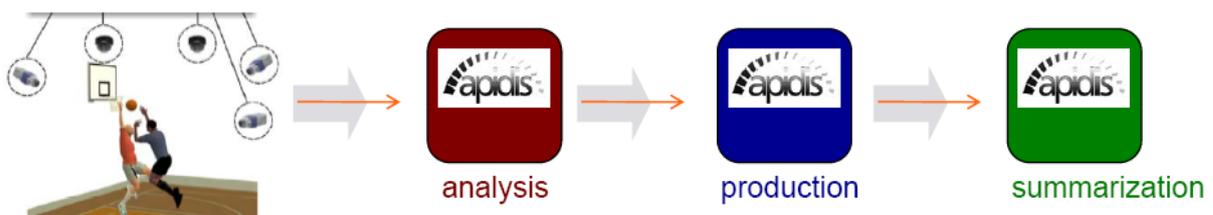
Technology and Market Analysis

Partners have analyzed the relevance of APIDIS technologies to the video surveillance and broadcast environments. Contacts made at IBC 2009 are being pursued. Plans to capitalize on IBC 2010 are underway. A business plan is being developed.

APIDIS future activities

The following activities are scheduled for 2010, APIDIS's final year:

- End of project trials for the prototypes.
- Finalized prototypes demonstration (e.g. at IBC 2010).
- Dissemination through scientific papers.
- Market analysis & business plan.



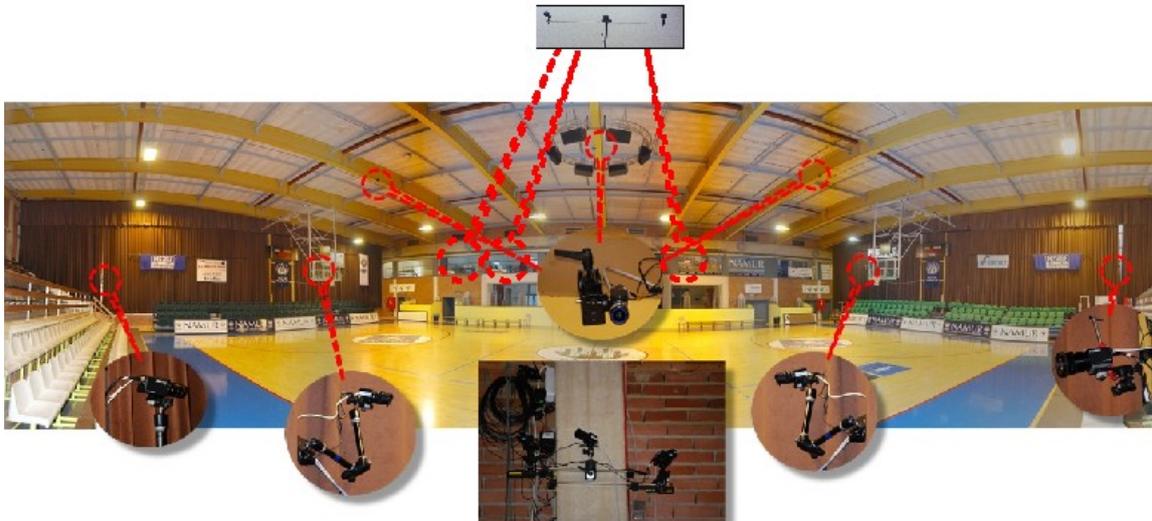
APIDIS important work areas

The APIDIS Dataset

In 2009, APIDIS partners acquired additional video for use in the sports and surveillance scenarios.

Partners UCL, QMUL, ACIC and MP collected additional basketball video from the Belgian Women's basketball league in April, 2009 in Namur, Belgium. The video is

being used to validate the sports production and summarization scenario results which were obtained from the first dataset. The basketball video acquisition system is shown below:



The APIDIS sports video content collection system

In 2009, partner ACIC collected two additional surveillance video datasets which partner BM then used to implement learning algorithms for the surveillance scenario. BM also used the datasets to implement the surveillance application interface that ACIC developed.

Partner MP provided additional football video from the Spanish 1st league (Seville-Malaga). The games are being used for additional prototype testing and development in the summarization scenario.

In total, the partners have collected two basketball datasets and three video surveillance datasets. Partner MP has provided several football matches. The data will be available for preparing the end-of-project trials. These data consist in video datasets, audio recordings, external metadata as well as manual annotations produced within the project.

The first basketball dataset is available for public distribution and has been released to six institutions. It was the basis for the IEEE/ACM ICDSC09 scientific challenge.

Proof of concept trials for the APIDIS prototype

The partners ran three proof-of-concept trials at mid-project, summer 2009, which successfully proved the three key concepts underlying the APIDIS prototypes (framework). The three prototypes demonstrated and tested were:

1. Automatic and personalized summarization of a video sequence, knowing its salient segments (UCL and MP). One of the subjective tests for the APIDIS summarization prototype is available here: <http://thetis.tele.ucl.ac.be/Apidis/Chen/www/subjective-test.html>;

2. Generation of high resolution images in any viewing direction based on an array of omniscams (EPFL and BM);
3. Distributed feature extraction and analysis for autonomous production (UCL, EPFL, ACIC, QMUL, BM)

The trials were designed with end-user feedback collected when initial versions of the prototypes were demonstrated in spring 2009. The trials included objective assessments and subjective tests with end-users. They allowed partners to collect valuable feedback about APIDIS technologies and expand the APIDIS user community to guide further prototype developments.

Detailed information can be found in the document “D7.1 Proof of concept trials” available on <http://www.apidis.org/publications.htm#PublicDeliverables>

Technical innovations

The following APIDIS technologies were advanced. Detailed information is available on <http://www.apidis.org/publications.htm#PublicDeliverables> :

Omnidirectional vision (D3.4) Method of generation of planar images from one omniscam. Generation of planar images from a multi-omnidirectional camera system.

Local features extraction and visual target object representation and tracking using distributed (omnidirectional) sensing (D4.2) Methods employed for object-level feature extraction and tracking, applied on the image plane and on the ground plane. Motivations for the choice of features for object tracking. Various deterministic and probabilistic tracking algorithms are proposed for multi-target tracking in single and multiple cameras. The performance of the trackers is compared using standard evaluation metrics.

Mapping audiovisual feature to camera view display parameters relevance (D5.1), How the camera viewpoint to render an action can be selected from the signals captured by a distributed set of audiovisual sensors. In short, multiple audio and visual signals are jointly processed to locate the objects (players, referees, ball) that are of interest to define the index and cropping parameters of the rendering camera. A patent is pending in relation with that work.

Autonomous production of personalized summaries (D6.3) The prototypes (framework) and the results obtained with respect to the autonomous production objectives of APIDIS. Multi-view content is considered. Metadata information about occurrence of events of interest and position of salient objects is assumed to be available. Given those inputs, the proposed framework supports both autonomous production (= selection of viewpoints along the time) and personalized summarization (= selection and organization of video segments into a relevant story) of the content. The proposed framework is generic in the sense that it can integrate a large range of user preferences including transmission or display resources, semantic interest (like preferred player or

action), or narrative preferences (dealing with the preferred way to visualize the story, e.g. small snapshots of numerous events versus detailed coverage of fewer events).

Interactive browsing of surveillance content (D6.4) How to learn a camera topology from recorded videos in a multicamera surveillance setting. Moving objects are tracked, and clustering is applied to form a set of entry/exit zones. Finally, cross-correlation is applied to detect connections between cameras. How to incorporate topology learning into a state-of-the-art surveillance application.

Technology and Market Analysis

Partners have analyzed how APIDIS technologies can be applied to the video surveillance and broadcast environments. Contacts made at IBC 2009 are being pursued. Plans to capitalize on IBC 2010 are underway. A business plan has been stated.

APIDIS User Involvement, Promotion and Awareness

Academic and professional end-users group consultations were held for the autonomous production and summarization prototypes and for the generation of planar images prototype. Lessons were drawn and future work defined based on this user feedback. All partners made presentations at academic conferences and industrial tradeshows to promote the project. APIDIS maintains contact with the APIDIS user community through a newsletter and mailing list.

The following is a list of events and activities where user feedback was collected and the project publicized for the Autonomous production prototype (distributed feature extraction for video production):

- The WIAMIS conference in May where the initial prototype was demo'd to 25 viewers conference in May, <http://wiamis2009.qmul.net/>. The feedback collected (via questionnaires) helped to design the mid-project trials.
- The ICDS09 conference in August where APIDIS organized a sports video challenge. (APIDIS partners also had 3 papers accepted.) <http://www.icdsc.org/challenge.html>
- In experiments that were part of the mid-project trials, users rated video automatically produced by the prototype compared to video manually produced by production experts. In experiments, also part of the mid-project trials, users were consulted to understand how to adapt the automatic production system as a function of the resolution of the output video signal.
- At the IBC 2009 tradeshow where the production and summarization prototypes were demonstrated to professional broadcasters, system integrators, IPTV providers, media distributors, telecommunication and mobile operators. In particular, feedback from these professional sectors have revealed strong interests from the market, and helped shape realistic market prospects and user requirements.



APIDIS at IBC

The main lessons drawn for the production prototype:

- The automatic production system regularly outperforms the human-made production actions of experts.
- The requirements of users in terms of production actions are somewhat heterogeneous. As an example, coaches are primarily interested in continuous rendering of the scene, while general public is more interested in close rendering. This observation gives even more sense to an automatic and personalized approach to content production.
- The main visual artifact pointed out by users has to do with undesired oscillation of viewpoint size (succession of zoom-in and zoom-out actions).

Based on this feedback, future developments plan are:

- To solve the few visual artifacts pointed out by viewers.
- To reduce the computational complexity of the process.
- To define production profiles, matching different user needs. Here, a profile is defined by a particular instance of the production parameters, e.g. to forbid some views, or to favor continuous production at the cost of reduced closeness.
- To investigate the production of close views and replays, so as to enrich the local stories of summaries that will be created a posteriori

The following is a list of events and activities where user feedback was collected and the project publicized for the Automatic and personalized video summarization prototype

(Automatic and personalized summarization of a video sequence, knowing its salient segments)

- In experiments that were part of the mid-project trials, users made pair wise comparison of summaries of football video resulting from distinct user preferences
- In experiments part of the mid-project trials, users were asked to tell us for which part of the football summary they perceived some visual artifacts and/or felt unsatisfied with the content (incomplete action, too short segment, temporal discontinuity, etc).
- At the IBC 2009 tradeshow, and through subsequent industrial consultations.
- With Telefonica where there is a possibility to demonstrate and exploit the complementarity between the APIDIS summarization framework, and the tool designed by Telefonica to extract salient segments from audio commentary analysis.

The main lessons drawn and future work for the summarization prototype:

First, we plan to extend the framework to autonomous production and summarization of basketball summaries. In this scenario, lots of semantic information about the content is available from the scene analysis process, which should offer increased personalization capabilities.

Second, we plan to address the problems encountered with the first prototype. The most significant artifacts in the summaries appear to be due to the omission of semantic dependency between segments. Hence, we intend to investigate how interactive and collaborative annotation mechanisms could enrich the summarization, by providing higher level semantic information about the events at hand. The idea is to make video summaries available to a community of users. To get access to additional summaries, each user would then be invited to fill in an annotation form about a particular action of the game. The action to annotate would be selected by the summarization system, so as to improve the global knowledge it has about the salient parts of the content. Initial knowledge about salient segments would typically be inferred from the presence of replays, and from the audio commentary analysis.

User feedback was collected for the generation of planar images (Generation of high resolution images in any viewing direction based on an array of omniscams)

- In experiments part of the mid-project trials, users' opinions were collected when generated planar images or image sequences from the basketball dataset were presented to them.

Lessons learned and future work for the generation of planar images:

The tests validate the universality of the proposed prototype and show the superiority of one planar generation method (TV regularized method) in terms of reconstructed image quality. Future work will focus this method to reconstruct planar images from several omniscameras. This should offer increased quality and/or semiarbitrary viewpoint

reconstruction. Future work will also focus on possible solutions to speed up the time needed to process and image.

More about the user feedback and conference papers can be found in D7.1 Proof of Concept trial www.apidis.org/publications

APIDIS Future Work or Exploitation Prospects, as appropriate

The following is a brief list of major activities planned for 2010, APIDIS's final year.

End of project trials for the prototypes. At the end of 2009, partners defined the scenarios and the associated measures of success for the end of project trials. The trials will deal with three scenarios; interactive and semantically-driven access to video surveillance content, sharing and remixing content, and automatic generation of content for Internet portals. The trials are scheduled for summer 2010

IBC in September 2010. Plans are underway to demonstrate APIDIS at IBC in 2010.

Final prototypes and showcase will be produced in October 2010, based on IBC demos.

Further Information

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