Innovation Reports

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(ITEA ~ 05010)

Advanced digital video content analysis improves medical diagnosis, video surveillance and home entertainment

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Turning TV watching into a personalised interactive experience

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CANTATA
(ITEA ~ 05010)

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improves medical diagnosis, video surveillance and home entertainment

The amount of digital video content now available makes automated interpretation essential to ensure optimal use of data in the shortest possible time. The CANTATA project set out to make digital video processing systems content-aware. Advanced digital technologies and greater system power enabled the development of robust analytical algorithms for content interpretation, a scalable platform facilitating analysis across a wide range of applications, content presentation that adapts to the device, user and content, and a common understanding of quality levels in content analysis. Systems demonstrations in surveillance, medical and domestic applications have already led to commercial products.

Digital video content is being adopted widely in a variety of business domains as well as by home users. Massive expansion of video applications over Internet and corporate networks is becoming a reality and additional content-analysis-based applications are about to follow. As a result, the quality and reliability of content-analysis features will become an important discriminating factor.

Many of these applications involve transferring and interpreting huge amounts of data:
- In *surveillance*, multi-camera security installations function 24 hours a day, 7 days a week to secure areas, prevent incidents arising and enabling subsequent analysis;

- In *healthcare*, an increasing amount of graphical information from for example high resolution 3D scanners is being used for diagnoses, putting a high stress on the medical experts involved; and
- In the *home*, consumers have access to virtually unlimited multimedia content, particularly over the Internet.

However, state-of-the-art multimedia systems have no notion about the content; some form of human interpretation is required currently to use or enjoy such systems selectively. So, there is a growing need for systems that are aware of the content and can use this knowledge to establish an action or control the environment autonomously.

BRIDGING THE GAP BETWEEN THEORY AND ECONOMICS
CANTATA set out to bridge the gap between academic research into such content analysis and economic feasibility. Developments included: algorithms for content analysis in different domains; an analytical and presentation platform suitable for all areas; visualisation and user interaction, focusing mainly on home consumers; and methodology for validation of content-aware products.

Key innovations were demonstrated in home multimedia, video surveillance and medical diagnostics and have been exploited commercially very quickly after the end of the ITEA project.
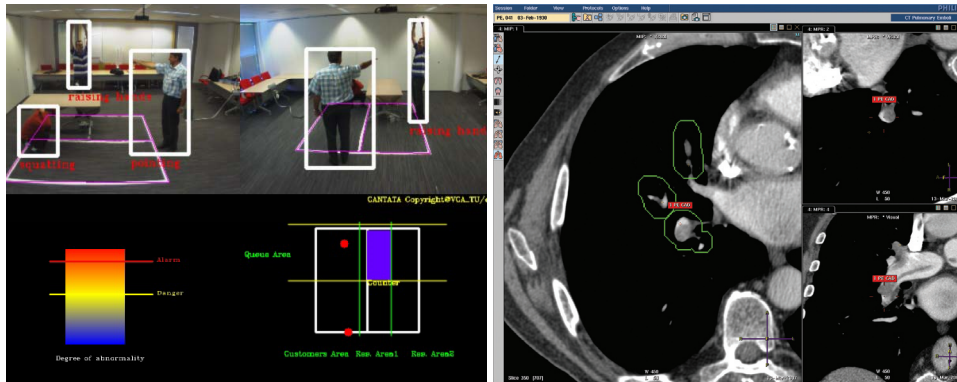
Home multimedia

The volume of multimedia content in the home is growing daily with broadcast services over the airways, by cable, by satellite or increasingly over the Internet – a fast-growing alternative offering a wide range of exciting new services – as well as commercial and personal recordings. However, customers want a service that gives them personalised viewing of what they want, when they want it, and paying for what they watch, combined with easy navigation.

CANTATA therefore developed a content-aware interactive TV system based on a flexible arrangement of computer tasks on multiple information-processing components that allowed smooth integration. The system offers a host of new features deploying awareness of what the multimedia content is actually about. For example, it can automatically summarise broadcast news and sports items, showing only highlight such as goals. Moreover, the TV recommends content, depending on the user's mood and preferences as well as on multimedia content played before.

The result is a significantly improved user experience and the concepts developed are already being incorporated in commercial products for home entertainment, such as an content-aware IPTV set-top box from Ortikon.

Video surveillance

Security officers in video-control rooms face an ever-increasing number of screens that are just not possible to control without some form of help – especially as it is not possible to concentrate on such displays for longer than around 20 minutes. Embedded content-awareness technology can offer this assistance. CANTATA developed an intelligent surveillance camera providing advanced video content analysis combined with state-of-the-art video compression for streaming over Internet. And the project resulted in a series of robust software algorithms able to recognise automatically the posture of human beings, allowing detection of abnormal behaviour. The results were demonstrated in a bank-robbery scenario.

Such modelling of video content allows robust behaviour analysis and solid reasoning for decision making. The results of CANTATA have already been incorporated into VDG Security video-surveillance systems offering multiple camera and multiple video-content analysis channels. Notable applications include a 300-camera system covering all 32 stations in the Charleroi metro system in Belgium, offering central control and fast reaction to security incidents. And a 350-camera system that was installed in time for the recent Dubai Formula One race – a project that took five months, replacing a previous supplier that had tried for over two years to build such a system but had admitted defeat.

Moreover, VDG Security has also just launched its intelligent surveillance camera.

Healthcare

Deep-vein thrombosis and its fatal complication pulmonary embolism pose serious health problems, affecting some 2.5 million people in the EU and the USA each year with fatal results in a third of cases. A pulmonary embolism is particularly difficult to detect though timely diagnosis and appropriate therapy can reduce mortality to under 10%. Multi-detector computed tomography (MDCT) has radically improved diagnosis – not only directly by fast identification of pulmonary embolisms but also often by providing an alternative diagnosis when such embolisms have been ruled out.

While MDCT is fast and patient friendly, it requires the radiologist on call to check hundreds of images – a time-consuming process subject to human failures. CANTATA developed computer assistance that makes quantification an acceptable part of the diagnostic routine. The system not only detects pulmonary embolisms automatically but also provides a quality-critical compressed image for transmission over bandwidth-limited network without affecting the quality of the medical content.

Clinical evaluation of such computer-aided diagnosis was carried out in several Dutch hospitals. The first computer-aided detection systems for pulmonary embolisms from Philips Healthcare are already entering the market.

VALIDATING AND BENCHMARKING PRODUCTS

Various steps were taken to enable the validation and benchmarking of content-aware products for quality and robustness. CANTATA initiated the development and sharing of a common methodology with the community of content-aware system developers. Common data sets have been made available on the Internet. And the content-aware technology developed in CANTATA has been validated according to this methodology.

Overall, the ITEA project not only resulted in a series of products that are already being commercialised but has also enabled many of the partners involved to grow. Spin-off companies have developed significantly since the start of the project. For example, high-tech start-up ViNotion, which specialises in automation systems based on video-content analysis, has grown from zero to six full-time equivalents. And VDG Security has nearly tripled its research staff to 20.

More information: www.itea-cantata.org