Research Motivation

The development of new platforms implies the need to get real-time access to audio-visual content according to the required quantities and typologies. Hence derive the central role of the Department for Archives ("Teche"), and thus the need for documentation and indexing systems more streamlined and economical. In this context, the Research Centre is experimenting with technologies of automatic analysis of texts and audio-visual signals, in collaboration with research institutions at home and abroad. To summarize some key points in the course of study in this area, we may find the following essential elements:

- Indexing of multimedia content is generally essential to their recovery and their use, regardless of distribution model;
- Interactive, web-based access requires more stringent production constraints than in the past;
- Migration to the web domain implies the need to integrate information from heterogeneous and independent sources.

These three cardinal points are the reference map in which we place our work and goals.

Automatic Newscast Transcription System (ANTS)

We devised a platform, named ANTS, targeted to automatic news programs. It is a modular system in which different audiovisual signal analysis tools are coordinated by a process management engine, whose goal is making sequential the development phases and to aggregate the resulting data. The key technology used is the Automatic Speech Recognition (ASR), which can provide a true verbatim transcript of what is said in the programme.

The adopted ASR was optimised to work in the domain of news through training on a large number of manually transcribed news. The obtained transcription quality is about 90% correct recognition. Since the text is synchronized with the multimedia signal, given a word you can have immediate access to the segment where it is pronounced. In addition, the validator performs a segmentation of the signal based on the speech footprint of the speaker.

The obtained transcripts are good enough to be used for text-based search and information discovery by, for instance, full-text search engines and artificial intelligence techniques.

The Segmentation in News

The news story segmentation task is performed by a system designed and developed by the Research Centre and is done exploiting aural and visual cues with the help of a three-layered heuristic framework.

The first heuristic (H1) consists in considering boundaries of shots containing the anchorman as equivalent to news stories boundaries. In order to detect anchorman shots we use a second heuristic (H2), consisting in observing that the most frequent speaker is the anchorman and that (s)he speaks many times during the programme, and for periods of time distributed all along the programme timeline. This observation allows to select the speaker who most likely is the anchorman, provided that a speaker clustering process labels all the speakers present in the programme and associates them to temporal segments of the content.

The application of the first two heuristics is not yet enough to discern situations in which the anchorman introduces several brief stories in sequence, without interruptions filled with external contributions. To overcome this limitation we use a third heuristic (H3), i.e. knowing that in the great majority of observed cases the introduction of a new brief story is accompanied by a camera shot change (e.g., from a close up shot to a wider one).

The correct identification of news media change has an average accuracy of about 80%. After the segmentation in news, we apply a semantic analysis module. This allows automatic classification of a text according to the scheme used by Rai ar-
chive operators, based on 28 main categories relating to journalism. The accuracy achieved is comparable to that of a human operator.

The results of the outlined processes are summarised and published through a web browser interface, exemplified in the figure.

**Hyper Media News (HMN)**

Hyper Media News is a system capable of integrating information generated automatically from ANTS with that made available from Web news sources, such as online newspapers or users’ blogs. The system Hyper Media News, along with ANTS, has already been successfully demonstrated on several occasions during international scientific conferences and during Prix Italia 2009.

HMN is based on an innovative hybrid clustering algorithm, which allows the aggregation of data coming from heterogeneous sources, i.e. the textual content from the Internet and the television content processed by ANTS

The developed technology is able to automatically select representative objects among those included in the generated aggregations, and allows the delivery of the following innovative information services:

✓ multimedia RSS (Really Simple Syndication)
✓ Hot News Services and Topic Tracking
✓ Advanced Visual Navigation

multimedia RSS services are provided by the publication of RSS feeds containing the information discovered by the aggregation process. The RSS feeds are displayed according to different criteria, e.g. date and time, importance, category, and indexed based on user preferences.

Hot News services consist of daily reports containing the most important news of the day, with links to services and RSS content, automatically annotated with keywords (tags).

The system maintains an archive of these reports, for future reference. The Hyper Media News Portal is shown in the figure.

In order to provide interactive visualisation of the generated aggregations for news retrieval, browsing and editing, the system provides an advanced interface that enables users to track down the structural, spatial (i.e., inter-aggregation) and temporal properties of the discovered aggregations and, at the same time, navigate and manage its contents. The interface is accessible through a Web browser. Each aggregation is displayed as a browsable graph whose nodes are the included RSS items and whose edges are the relationships among these nodes. The Users can visually select subsets of the graph, which correspond to subtopics of the main topic. Also, from the selected nodes, users can watch the related TV news stories and read the corresponding online articles.