

Automatic Program Extraction From TV Streams

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ABSTRACT

This demo presents a method of detecting television programs in TV streams. The objective is to automatically detect the precise start and end of broadcasted television programs. The method first detects inter-programs (commercials, trailers...) as repeated sequences in the broadcast stream, and then deduces the programs boundaries. The extracted programs can then be stored in a database to be used in novel services such as TV On Demand. The demo shows examples of repeated inter-programs detection and program extraction, performed on several days of French television from two different channels.

Categories and Subject Descriptors

H.3.1 [Information Storage and retrieval]: Content Analysis and Indexing; I.4.9 [Image Processing and Computer Vision]: Applications

Keywords

Video indexing, video processing, commercials detection.

1. INTRODUCTION

TV On Demand services aim at making TV content available to viewers without any constraint of location and/or time. Viewers have the possibility to access past TV programs from a large range of channels. To build these services, a way of extracting individual programs from television streams is needed. One of the solutions used nowadays, is to perform this extraction manually. This is not efficient and may prove difficult and costly to achieve, when a large number of programs and channels is considered.

Metadata, like Event Information Table (EIT) or Electronic Program Guide (EPG), provide information on the structure of TV streams. They are unfortunately imprecise, incomplete and not always available [1]. Moreover, TV channels cannot usually provide accurate metadata because of technical limitations, especially the complexity of the audio-visual chain. For historical and organizational reasons, services making use of TV content are also generally developed by third parties [2].

This demonstration is based on the novel techniques proposed in [2, 3, 4]. It shows how these techniques can be put together in order to perform accurate and fully automatic TV program extraction.

2. OVERVIEW OF THE SYSTEM

TV programs are heterogeneous and do not share any common features. It is therefore very difficult to detect them directly. However, Inter-Programs (IP), e. g. commercials, sponsorship, trailers, self-advertisements... are generally broadcasted several times a day in the stream. IP can thus be automatically detected as near-identical repeated sequences, and programs can be deduced as the rest of the stream. This is a very generic solution that can be applied regardless of the channel or the country, and does not make any assumptions about broadcasting rules (e.g. black frames...). This is the basic principle of our approach. Repeated sequences are first detected. They are then classified and IP are identified. Programs are then finally deduced.

This demonstration presents results on TV streams from two French channels (one public, one private). The demonstration is composed of two modules: the first one shows how inter-programs are detected; the second one shows how programs are extracted.

2.1 Module 1: inter-program detection



Figure 1: Near-identical repeated audiovisual sequences. (1) Detected repeated sequences. (2) Occurrences of the selected repeated sequence. (3) Some of the occurrences played in parallel. (4) Date and time of the occurrences.

IP are detected by their repetition property. The method identifies repeated sequences from a clustering-based approach that groups similar keyframes [2]. Similarity of keyframes is computed on a visual descriptor built from quantized DCT coefficients [2]. Repeated sequences are then used to segment the stream: each occurrence of a repeated sequence is considered as a segment and each gap between two consecutive segments is also a segment. Each of the resulting segments could, hence, be part of a program or of an inter-program. Therefore, these segments have been classified based on their intrinsic features (e.g. duration, number of repetitions) and on the relational and contextual information of the repeated sequences as explained in [3].

Figure 1 shows near-identical repeated audio/video sequence detection results. The set of detected repeated sequences can be easily browsed, and it can be checked that all detected sequences are actually repeated sequences: (1) all detected repeated sequences can be viewed with their mean duration and their number of repetitions, (2 & 3) several occurrences of one repeated sequence can be played in parallel in order to compare their content and their context and (4) all occurrences are placed on a calendar to show their frequency.

Through the same interface, it is also possible to browse the whole set of resulting segments, or to focus on segments classified as inter-programs.

2.2 Module 2: TV program extraction

The previously classified segments are used to segment the stream. Consecutive segments that have been classified as inter-programs (resp. programs) are merged. The resulting program segments are then labeled using a straightforward matching procedure using the available metadata. The programs are finally extracted.

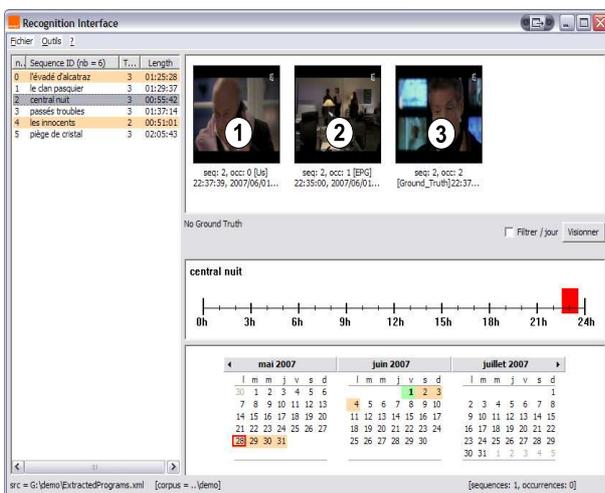


Figure 2: Extracted TV programs. (1) Our program extraction. (2) EPG-based program extraction. (3) Ground-truth-based program extraction.

Figure 2 shows extracted TV programs. Results (1) are compared to the EPG (2) and to the ground-truth (3). This interface allows us to see that our solution is very accurate. All the programs can be played in parallel. In [3], an evaluation study of our programs extraction solution is presented on 18 hours of TV streams. The obtained results are summarized in Table 1. This table presents the mean of the absolute values of the differences between the obtained

start (resp. end) times and the ground-truth start (resp. end) times of programs. This table also provides the accuracy of an EPG-based program extraction.

| | Program Start time | Program End time |
|--------------|--------------------|------------------|
| Our Solution | 5.6 s | 11.7 s |
| EPG | 2 m 14.0 s | 4 m 6.5 s |

Table 1: Accuracy of program extraction.

Overall, these results show that the proposed method of program extraction is very accurate and outperforms the metadata.

3. CONCLUSION

This demo shows how the modules of our automatic TV program extraction system work. It performs automatic extraction and labeling of TV programs from a television stream. It also allows us to explore results obtained on real TV streams of two representative French TV channels. Future extension will consist in building an online system, capable of extracting programs on the fly.

4. REFERENCES

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