

# Recommender System for the Multi-Channel TV Production

Janez Zaletelj

University of Ljubljana, Trzaska 25, 1000 Ljubljana, Slovenia  
janez.zaletelj@ldos.fe.uni-lj.si

**Abstract.** This paper presents the concept of content recommendations for the production of multi-channel TV shows. Within the IST project “LIVE – Live Staging of Media Events” [1] we are developing a production support system which will have a functionality of content recommendations and will support production of multi-channels programs. The paper outlines a concept of a recommender system for the multi-channel TV production and presents basic architecture and workflows within the system. The recommendation of the archive content for a given channel is personalized by taking into account the profile of the target audience.

**Keywords:** recommender system, personalization, iTV production

## 1 Introduction

Today’s TV production workflows are highly standardized and adapted to produce linear, broadcast media format. The production of TV programs typically contains the pre-production, live production and postproduction phases. In the preproduction, the planning of the live event is done and editor selects and prepares background material on the event from the archives. During the live production the director can use the background material to add additional audio-visual clips to the program.

The first problem of the standard workflow is that it does not provide the necessary flexibility which is needed for the coverage of the live event such as sport competition. If something unexpected happens, for example an unknown athlete wins a race, the director does not have the necessary tools to react to this event. Director is not able to search and retrieve additional background information which is needed during live production. The second drawback is that the standard workflow produces a single stream for all viewers, and thus the variety of audience preferences is ignored. The digital TV broadcasting allows for additional flexibility of transmission of multiple channels within one program, and each channel can be targeted to different class of viewers. However such scenario imposes further requirements on the production workflow and equipment.

Within the 6th Framework project “LIVE : Live Staging of Media Events” [1] we are developing new concepts of TV production [4] based on iTV technologies. The key challenges that need to be addressed are how to efficiently support the production

team to be able to produce several interlinked thematic channels simultaneously, and how to enable reuse of AV material from vast TV archives on the fly, during live production.

The concept of content recommendation system within the TV production is being developed to address the issue of the on-the-fly content selection from TV archives and its reuse during live production. In this paper we start by defining the roles of production recommender system, we outline the different workflows and system architecture of the recommender system, and we present how the recommender system will work in the production workflow. Finally, the concept of personalization of TV programme to the target audience is presented.

## **2 Roles of the Production Recommender System**

One of the main goals of the LIVE project is to develop new tools and concepts to support the TV Director in the authoring of new type of live TV content, which is generated live and substantially influenced by the viewers' preferences [2]. The Director should be able to react in real-time to the live events by including related information and AV material into the program. At the same time, he should be able to review Consumers' feedback on the program, which would influence his future decisions on the program content. These functionalities will be supported by the Production Recommender System.

The main role of the Recommender System will be to support new production workflows of the LIVE system by providing recommendations of content suitable to be included in the program. The Recommender System implements automatic methods to find and recommend archive content, which will be used to help the Director in finding the related audio-visual content from the archives, and will enable him to react to live events. Because of the huge amounts of AV material available in the TV archives, the content selection and finding functionalities of the Recommender System can be also successfully employed during program preparation phase, where the editor would get automatic recommendations of archive content for the given subject.

On the other hand, the Recommender System is the system component through which information links to the Consumer systems are established. The Consumer System is represented by the application running on the consumer's set-top box or other end device, which is connected to Recommender system through suitable communication channel (also called the Feedback Channel). The availability of consumer feedback information is one of the central requirements to the LIVE system. The feedback from each Consumer will be collected, stored and analyzed by the Recommender System services. Analysis of feedback will provide two kinds of information. First, the analysis of the feedback from the single consumer will be performed, which will result in a detailed user model of the Consumer. This information will enable personalized services for the consumer. The second goal of the analysis is to calculate statistical information on the whole TV audience, which will be available to the Video conductor. Feedback from many (or all) of the TV consumers will be taken into account to derive statistical information on the audience.

### 3 Workflows and usage of the Recommender System

Recommender System is part of the general LIVE Production Support System. Its main goal is to provide support for the production of live, interactive, multi-channel TV programs. The Recommender system thus provides professional users with information and services necessary to build interactive, personalized live TV formats.

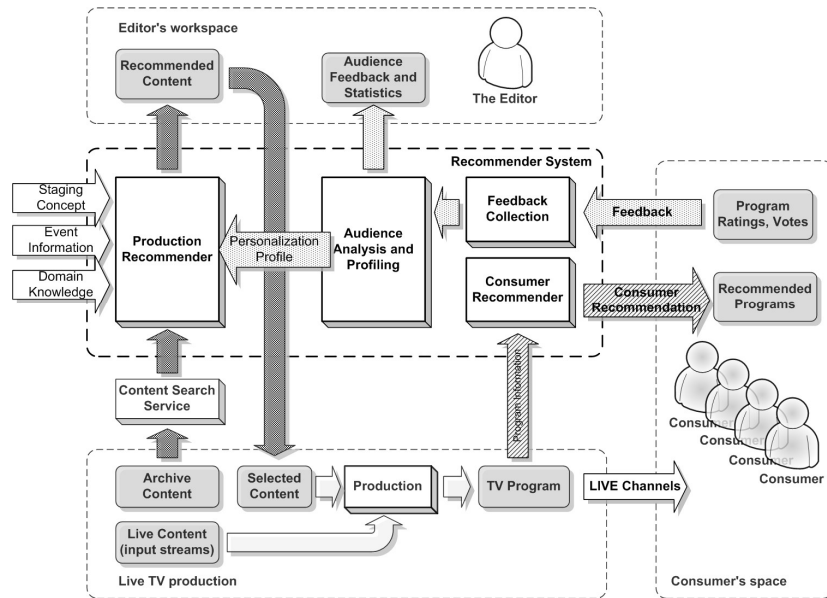


Fig. 1. Architecture and main workflows within the TV Production Recommender system.

Main workflows within Recommender System are shown on the Fig.1:

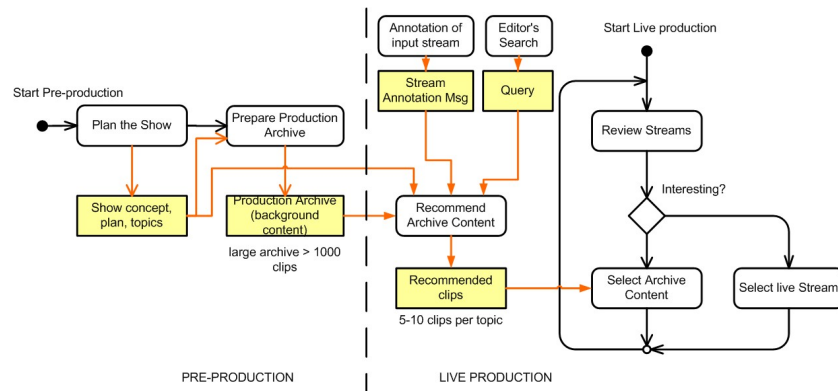
- **Selection and organization of content from the Archive** during live production. Inputs to this workflow are a staging concept, event information, domain knowledge, search specification and content from the archive. An output are **recommended content items (clips, segments) from TV Archives**, targeted to Editor and Director who can select from these recommendations the content for their show.
- **Collection of user feedback.** Feedback is collected from consumers and stored to the feedback database.
- **Analysis and presentation of feedback:** this workflow is a logical sequel of previous workflow. Stored feedback is analysed and presented to the professional user. Within the same workflow user profiles (consumer profile and audience profile) are also built or updated from the collected feedback and stored to the user profile database. **Audience profile and channel statistics** are computed and displayed to the Video conductor in real-time which allows him to evaluate the reaction of viewers to his show.

- **Generation of consumer recommendations:** this workflow is coloured in orange. Consumer recommendations are created on the basis of the individual consumer profiles and broadcasted program information. Recommendations are delivered to the consumer in form of personalized EPG or Programme Alerts.

### 3.1 The production workflow using content recommendations

The workflow involves two actors. The Editor is using the Recommender system interface to search for content, and the Video Conductor is reviewing the materials and deciding on the inclusion of content to the live program.

The role of the production recommendations within the future production workflows is shown in Figure 2. The workflow starts in the pre-production phase by content planning, where the topics of the future show are defined. During this phase, the Recommender system assists the Editor in performing searches on the available archive material in the long-term AV archive. The result of this phase is that the production archive for live production is prepared, including for example background information and interviews with athletes appearing in the event.



**Fig. 2.** The production workflow using archive content recommendations provided by TV Production Recommender system.

During live production the input camera streams are annotated by human or automatic annotations. The Recommender system analyses these messages and automatically produce recommendations of the illustrating material. For example, if an athlete takes a lead, a director immediately receives recommendations of background archive material on this athlete. In case of an unpredictable or unexpected event, the Editor can use the search interface to specify query and search in the archive for the AV material. The final archive recommendations are evaluated by the Director and selected for the program. The Recommender System User Interface was developed for the Editor which allows him to perform queries and review the recommended content.

### 3.2 Personalization scenario

In the personalized TV scenario the TV content is produced according to the profile of the target user group (individual TV viewer or group of people). On the other hand, personalization might also include personalized presentation of content to the user, for example through personalized user interfaces or personalized selection of content.

The concept of program personalization in LIVE project is based on group or massive personalization, where the recommendation takes into account the preferences of a target group of consumers, specified by the **target audience profile**. The concept of **audience personalization** means the selection of the content according to the audience profile, so that the acceptance of content is maximized within the audience. For example, the audience profile will include statistical preferences of the general TV audience towards specific TV program types, different sports, different commentators etc. It will be generated and updated by collecting information on consumer actions during watching. The details on the computation of recommendations are given in [3].

## 4 Conclusions

The proposed concept of recommendation system integrated into the TV production will enable a significant step towards enabling live production of personalized multi-channel TV shows. The integrated user tracking and profiling enables personalization of the program to different target audiences, and gives a Director a new capability of observing the audience feedback in real-time. The Recommender system will be evaluated in the field trial during Olympic Games 2008 in real production environment. We expect that this field trial with 1000 households receiving multi-stream ORF Olympic channel will prove the proposed concept.

**Acknowledgment** This work was partially funded by the European Commission within the 6<sup>th</sup> framework of the IST under grant number FP6-27312. All statements in this work reflect the personal ideas and opinions of the authors and not necessarily the opinions of the European Commission.

## References

1. LIVE – Live staging of media events; project web-site: <http://www.ist-live.org> – Last visited: 1.03.2008
2. Richard Wages, Carmen Mac Williams, Stefan M. Grünvogel, Georg Trogemann 'Video Composer and Live Video Conductor: Future Professions for the Interactive Digital Broadcasting Industry', Proceedings of the EuroITV 2006: Beyond Usability, Broadcast, and TV - Fourth European Conference on Interactive Television, May 25 - 26, 2006, Athens, Greece. pp. 32-38.
3. Janez Zaletelj, Richard Wages, Tobias Bürger, Stefan M. Grünvogel, 'Content Recommendation System in the Production of Multi-Channel TV', Proceedings of the AXMEDIS 2007, 3rd International Conference on Automated Production of Cross Media Content for Multi-channel Distribution, 28-30 Nov. 2007, Barcelona, Spain