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## Dynamically updated personalized recommendations for broadcast television

Marcos Calvo

Joan Pastor

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## **Dynamically updated personalized recommendations for broadcast television**

### **ABSTRACT**

The large number of channels available on television can make the process of searching for the appropriate TV channel cumbersome and time consuming. This disclosure describes techniques to make real-time personalized recommendations for live TV programming, implemented with the user's permission. The recommendations are based on the application of a trained machine learning model. Upon being turned on, the TV is automatically tuned to a channel showing the program that is identified as being most likely to be watched by the user, chosen from all programs available at that time. Further, the user is shown a dynamically updated personalized shortlist of other channels that are broadcasting programs of likely interest to the user. Further, a notification can be shown to alert the user when a channel other than the one currently being watched starts broadcasting a program the user is likely to find of greater interest than the one on the current channel.

### **KEYWORDS**

- Smart television (TV)
- Program guide
- TV recommendations
- Personalized recommendation
- Broadcast television
- Live programming
- Program metadata
- Recommender system

### **BACKGROUND**

When a user turns the TV on, it is typically tuned to a default channel, e.g., the first available channel or the channel that was being watched when the TV was last turned off. When the user turns the TV on with the intent to watch a particular program and the particular program is not on the default channel, the user must search through the available channels to find the one showing the TV program of interest. Alternatively, if the user does not have a specific TV program in mind when turning the TV on, all channels need to be explored to find one currently showing a program the user would like to see. The large number of channels available can make the process of searching for the appropriate channel cumbersome and time consuming.

To help users find the channel of interest, TVs typically provide an Electronic Programming Guide (EPG) that displays dynamically updated information about current and upcoming programs broadcast on each of the available channels. EPG information is typically presented in the form of a grid, e.g., with channels forming the rows and time slots forming the columns. Each cell in the grid provides the program shown on the corresponding channel during the corresponding time. Despite the interactive visual experience of the EPG, the sheer volume of the information included can make it difficult for users to locate and select a channel of interest.

To reduce the burden of such exhaustive searching, many TVs provide mechanisms for the user to specify a short list of favorite channels. However, curation of the list and selection of the channels in the list is still a manual process. In contrast, many platforms for on-demand video streaming include features that recommend video content that may be of interest to the user. However, these platforms do not typically serve content available live on broadcast television channels.

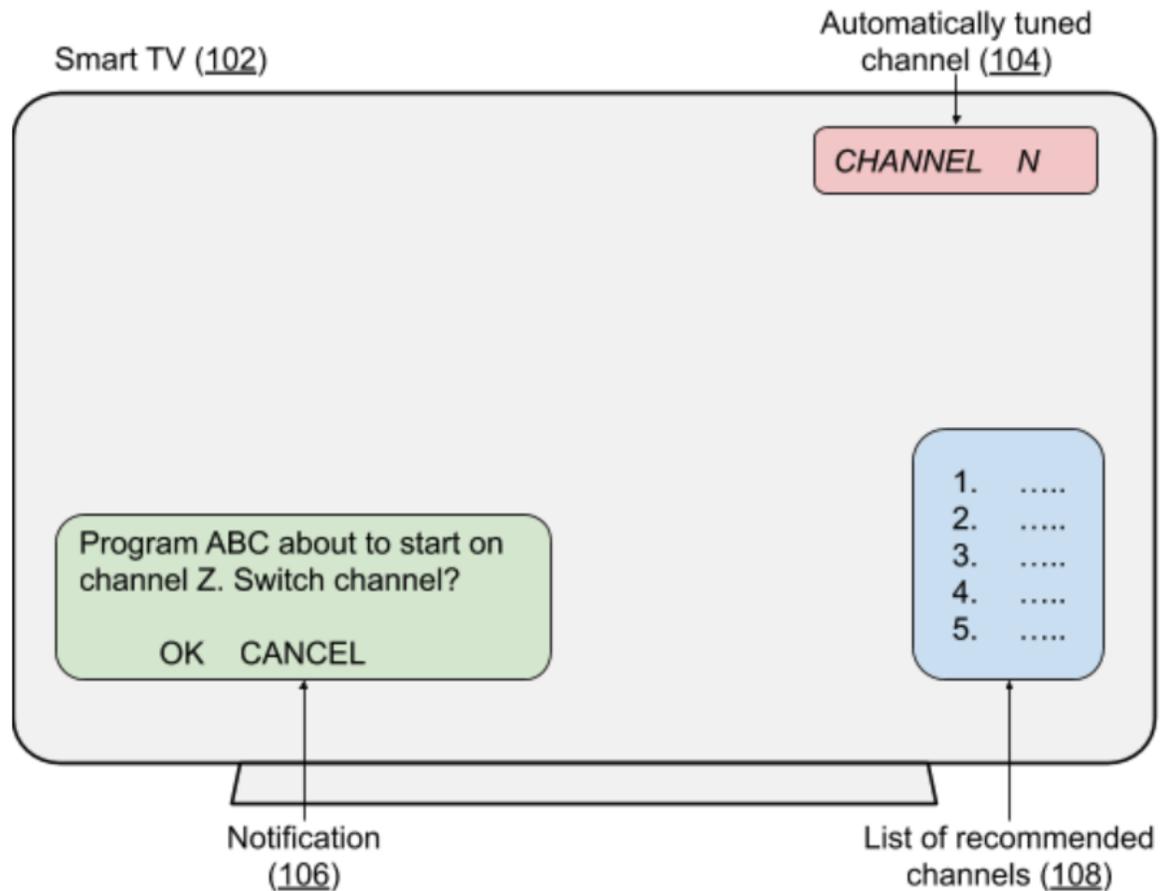
## DESCRIPTION

This disclosure describes techniques for making real-time personalized recommendations for live TV programming with the user's permission. If the user permits, upon being turned on, the TV is automatically tuned to the channel showing the program that the user is most likely to want to watch among all programs available at that time.

Additionally, with permission, the user is shown a personalized shortlist of other channels that are broadcasting programs of likely interest to the user. The personalized shortlist is dynamically updated and curated to ensure that it stays up-to-date as channel programming and/or user interests change. As an additional feature, a notification can be shown to alert the user when a channel other than the one currently being watched starts broadcasting a program the user is likely to find more suitable than the one on the tuned channel. When the user permits, the user's TV viewing history can be taken into account when updating the suggested shortlist of channels relevant to the user's viewing interests.

The above described functionality is based on a user's TV viewing information obtained with the user's permission. For instance, such information can include one or more user-permitted factors such as: the types of programs watched (e.g., talk shows, action movies, live sports, news, documentaries, etc.), the corresponding times at which the programs are watched, the duration for which the programs are watched, the number and time of channel switches during the programs, etc. A recommender system is used to analyze the metadata of the different programs being broadcast and score each available program based on its likelihood of interest given the information acquired in the user's viewing profile. The channel showing the program with the best score is selected automatically as the one shown when the TV is turned on. The shortlist of suggested additional channels is determined based on the programs with the topmost scores by sorting the scores in descending order. The number of channels presented in the

dynamically updated list of recommended channels can be, e.g., determined by the developer and/or specified by the user. The number can also be dynamic, e.g., based on the number of channels that have a score that meets a recommendation threshold



**Fig. 1: Recommending TV channels of high interest to the user**

Fig. 1 shows an operational implementation of the above techniques on a smart TV (102). When the user turns on the smart TV, it is initially tuned automatically to the channel that is likely to be of most interest to the user (104). In addition, the user is shown a list of other recommended channels (108) that are showing programs relevant to the user's interests. At a later point, it is detected that another channel is about to begin broadcasting a program that may interest the user more than the one on the channel currently being watched. The user is shown a

notification to that effect (106) along with options to switch to the other channel or ignore the notification.

The recommendation system described above can be based on the application of a trained machine learning model employing any suitable machine learning techniques such as neural networks, decision trees, random forests, etc. or other types of recommendation systems.

Alternatively, or in addition, rule-based approaches can be used. The information processing can be carried out locally on the TV, or if the user permits and the TV is network-connected, can be performed on a server. With user permission, the recommendation system operates in real-time such that the recommendations are dynamic and up-to-date. The recommendations are refreshed by taking into account the start and end of the various programs being broadcast. The user can be notified whenever the refreshed recommendations suggest the availability of a program with a score higher than the one the user is currently watching.

Users can also be provided with options to provide feedback, e.g., mark any recommendation as an unsuitable or poor suggestion. Such user feedback is utilized to improve suggestions, e.g., to remove suggestions ranked as poor from future suggestions.

The user information used with permission for generating the channel recommendation can represent the collective of all individuals who use the particular TV. Alternatively, or in addition, if the user permits, the recommendations can be individually tailored by separating different users of the same TV, e.g., based on a login mechanism. If a user logs in with a username and password, recommendations are tailored to the logged in user's individual information with the user's permission. If no user is logged in, the generated recommendations are based on the collective information of all users of the TV used with their permission.

The techniques described in this disclosure can be implemented on any TV with appropriate information processing capabilities, such as a smart TV. Unlike the recommendations provided by platforms that stream video on-demand, the described techniques can provide recommendations for live TV broadcasts with programs shown at specific times. The recommendations can thus also be applied to include live broadcasts that may be available on non-TV video platforms. The described techniques improve the efficiency of TV channel selection and reduce the likelihood of missing a program of interest, thus improving the TV viewing user experience and increasing user engagement with broadcast TV content.

Users are provided with options to turn off use of viewing profile, e.g., one or more factors used to generate recommendations, or to turn off the recommendation feature entirely. Further, users can control storage and use of such data, e.g., users can specify that recommendations are to be generated locally on the TV. Users can also delete portions of their viewing profile, or delete the profile entirely.

Further to the descriptions above, a user may be provided with controls allowing the user to make an election as to both if and when systems, programs or features described herein may enable collection of user information (e.g., information about a user's social network, social actions or activities, profession, a user's preferences, or a user's current location), and if the user is sent content or communications from a server. In addition, certain data may be treated in one or more ways before it is stored or used, so that personally identifiable information is removed. For example, a user's identity may be treated so that no personally identifiable information can be determined for the user, or a user's geographic location may be generalized where location information is obtained (such as to a city, ZIP code, or state level), so that a particular location of

a user cannot be determined. Thus, the user may have control over what information is collected about the user, how that information is used, and what information is provided to the user.

## CONCLUSION

This disclosure describes techniques for making real-time personalized recommendations for live TV programming with the user's permission. If the user permits, upon being turned on, the TV is automatically tuned to the channel showing the program that the user is most likely to want to watch among all programs available at that time. Additionally, the user is shown a personalized shortlist of other channels that are broadcasting programs of likely interest to the user. The personalized shortlist is dynamically updated and curated to ensure that it stays up-to-date as channel programming and/or user interests change. As an additional feature, a notification can be shown to alert the user when a channel other than the one currently being watched starts broadcasting a program the user is likely to find more suitable than the one on the tuned channel. When the user permits, the user's TV viewing history can be taken into account when updating the suggested shortlist of channels relevant to the user's viewing interests. The techniques described in this disclosure can be implemented on any TV with appropriate information processing capabilities, such as a smart TV. The described techniques increase the efficiency of TV channel selection and reduce the likelihood of missing a program of interest, thus improving the TV viewing user experience (UX) and increasing user engagement with broadcast TV content.