

# Letting Users Assist What to Watch: An Interactive Query-by-Example Movie Recommendation System

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**Abstract.** In this article we propose an interactive Web-based movie recommendation system namely *MISRec* employing object recognition for movie thumbnails. The proposed system carries out object recognition on movie thumbnails or DVD cover-photos in a real-time manner, and recommends movies based on user's historical preferences and the query intention. Unlike typical preference-based recommendation systems which provide recommendations merely by using the user's historical preference, *MISRec* provides a user with a choice to specify her *search intention* in a user-friendly and interactive manner and to alter/adjust the recommendation results which in turn can lead to increased utility of recommendation and user satisfaction.

## 1 Introduction and Context

Imagine it is the weekend and you are sitting alone or with your partner at home and plan to choose a right movie to watch. Among the many available choices *e.g.* provided by an online Video on Demand (VoD) service such as Netflix, it is not surprising if you soon find yourself overwhelmed with numerous possibilities in the movie catalog. Recommender systems (RSs) are subclass of information filtering and search techniques which ease this task by providing recommendations about unseen items. However, what happens if the movies recommended by the Netflix RS are not the type of the movie the user is expecting to watch?

Preference-based recommender systems typically provide recommendations by predicting a user's preference on unseen items based on her historical preferences without giving her the opportunity to alter or modify the recommendation results. Although such form of *passively* receiving recommendations can assist a user with discovery of new items, it can also refrain her of *actively* inputting her interests to obtain different recommendations as in reality, users can have multiple *watching interests* or *search intentions* [1,2]. On the other hand, many users prefer to buy and keep the DVD form of their favorites movies from a media store or video rental shops. While exploring the movies in the media store, a user may find one of the movie DVDs that he has recently watched and liked and prefer to watch a movie similar to the one. However, in order to find movies

similar to that, she has to input some keywords on Google to indicate his/her preferences on movies.

Based on these situations, in this paper, we propose an interactive Web-based movie recommendation system namely *MISRec* which carries out object recognition on movie thumbnails or DVD cover-photos in a real-time manner. By pointing the DVD cover-photo toward the Webcam of *MISRec*, a user can receive a recommendation based on her past preferences and the current search query intention. We designed and implemented the system to be used easily and intuitively during shopping at media stores or at home [3]<sup>3</sup>.

## 2 MISRec Application

For the purpose of our study, we have developed *MISRec*, a web-centric testing framework for the movie domain which can be easily configured to facilitate the execution of controlled empirical studies. *MISRec* contains a catalog of movies containing about 12K movies where users can browse, retrieve the detailed description of each item, rate them, and receive recommendations. In this subsection, we describe the flow of how to use the proposed system from initial preference elicitation during sign-up process, the product recognition until the user receiving the final recommendations

**Step 1:** The interaction begins with a sign-up process, where a user is initially asked to provide his/her personal information: age, gender, nationality, some optional social media data and an indication of number of movies watched per month. This step is shown in Figure 1a.

**Steps 2:** Afterward, the user is invited to browse the movie catalog and select 5 movies from her favorite genre which she can do by scrolling through movies' years of production in a relatively easy manner. These steps are shown in Figure 1b and 1c .

**Steps 3:** The user is then invited watch the trailer of the selected movies online and rate them using a 1-5 point scale (1 = low interest for/appreciation of the movie; 5 = high interest for/appreciation of the movie). This step is shown in Figure 1d and 1e.

On the basis of these ratings, a profile is built for the user based on 3 attributes of the movie (i) the genre (ii) the style [4,5], and (iii) semantic features from social tags.

**Step 4:** In this stage, the user is invited to show the image of her interest movie to the system. The user can do this by showing the movie thumbnail to the system Webcam easily through her cellphone or (if in a media store) by showing the DVD cover-photo of the movie. The system is engaging in order to motivate users to use the system and provide feedback as shown in Figure 1g and 1h.

<sup>3</sup> The work is partially covered by a US patent application under the title of "Enhanced content based multimedia recommendation method", with application number 15/277490 [http://www.polimi.it/index.php?id=6247&sel\\_brevetto=5093](http://www.polimi.it/index.php?id=6247&sel_brevetto=5093)

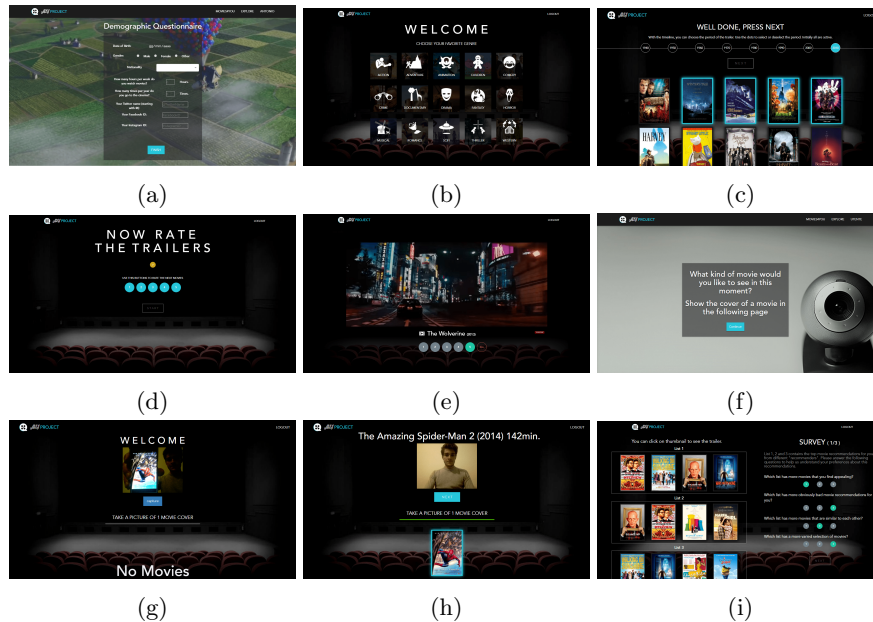


Fig. 1: Screenshots from the MISRec online Example-Based Movie Recommendation Web application

On MISRec backend works a product recognition system developed by Telecom Italia (TIM) industrial partner, which is trained by thousands of movies cover photos obtained from IMDB and that can recognize an input query image based on its visual similarity to the training covers dataset. This module implements the MPEG Compact Descriptors for Visual Search (CDVS) standard and perfectly fits the performance requirements of these kind of scenarios [6,7].

- **Step 5:** In this stage, the aim is to provide a query-based movie recommendation that recommend a list of items  $\mathbf{I}$  to a user  $\mathbf{u}$  based on her previous preferences and an input query  $\mathbf{q}$ . MISRec embeds an online questionnaire system that allows researchers to collect quantitative and qualitative information from the user in a relatively easy way. The user is asked to watch the trailers of the recommended movies within each of the lists and reply to a set of questions related to the quality of the recommendations. Users are asked to indicate their answers to each of the questions by selecting one of the lists.

Motivated by [1], the mathematical formulation for the query-based recommendation can be stated as follows:

$$f_{\theta}(u, I, q) = \underbrace{\beta \times f_{\theta}(u, I)}_{(a)} + \underbrace{(1 - \beta) \times f_{\theta}(I, q)}_{(b)} \quad (1)$$

where (a) is the user preference (user profile) term and (b) is the query intention term and  $\beta \in [0, 1]$  is a weight term balancing the effect of two terms.

### 3 Conclusion and future Work

Our goal is to improve the state-of-the-art of multi-media recommender systems by designing user-engaging interaction paradigms. We plan to conduct a user study in order to measure effectiveness of the proposed system. We hope that our interactive cover-photo recognition systems can pave the path for design of other user-friendly interactive scenarios in the design of next generation RSs. Some examples include: object recognition on kids' toys in order to recommend their favorite cartoons/programmes, gesture-based interaction and emotion recognition using user's facial expressions [8,9] .

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