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Working title: Collaborative online radio for Android.

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Abstract: Nowadays users can find a vast assortment of services on the Internet. This increases the necessity of websites that support these services, not only in science, academic or business contexts, but also in entertainment.

Online radios have currently become one of the most used services by Internet users, due to its ease of use and the fact that music can be regarded as "cultural heritage of humanity". Online radios are based on "Webcasting", i.e. sharing multimedia content over the Internet. For this, it is used "Streaming" technology, which allows users to play music asynchronously without necessity of download it in their devices.

In this area arose the so-called collaborative personalized radios that help users to finding new music they like, based on their own preferences. Some well-known examples of collaborative personalized radios are: Pandora (www.pandora.com) or Last.fm (www.lastfm.es). The success of these radios lies in the use of *Collaborative Recommender Systems*, whose recommendations are made based on terms of similarity between users, i.e., recommended items are liked by other users with similar interests to the one that will receive the recommendations.

Given the importance of the collaborative online radios, we have considered the possibility of using them on Android mobile devices. Taking into account that Android (Mobile Operating System owned by Google in 2005) used by millions users around the world, this contribution presents an online radio Android app based on a Collaborative Recommender System, in which the music delivered and recommended to users is under Creative Commons licenses (http://creativecommons.org/).

To do this, first it has been necessary to choose an appropriate collaborative filtering algorithm for our Recommender System. Afterwards, we have integrated in the app a significant sample of music licensed by Creative Commons. Based on such a sample, we

have designed, developed and deployed a REST web service where the music is retrieved. Finally, we have developed an Android Application which the user can play music, rate songs based on whether they liked or not, and receive recommendations based on his/her preferences and those music rated positively by other users with similar profile. Future studies could consider the mood of the user to further personalize the recommendations in this application session.

Collaborative Online Radio for Android

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Introduction

Online radios have currently become one of the most used services by Internet users, due to its ease of use and the fact that music can be regarded as "cultural heritage of humanity". In this area arose the so-called collaborative personalized radios that help users to finding new music they like.

In this work is presented *Collaborative Online Radio for Android*, an Android Application with a personalized online radio, based on the user preferences. To do this, we have designed, developed and deployed a REST web service where the music is provided to the Android Application. The presented radio broadcasts and recommends music licensed by Creative Commons.

Recommender Systems

Recommender Systems (RS) help users to select items (e.g. products or services) they may be useful or of interest among a broad set of possible items.

Currently there are several types of RS, amongst which we highlight Collaborative RS, Content-based RS, Knowledge-based RS, Community-based RS, Demographic RS and Hybrid RS. Collaborative Online Radio for Android is based on a Collaborative RS.

Selection of neighbors   **Prediction**
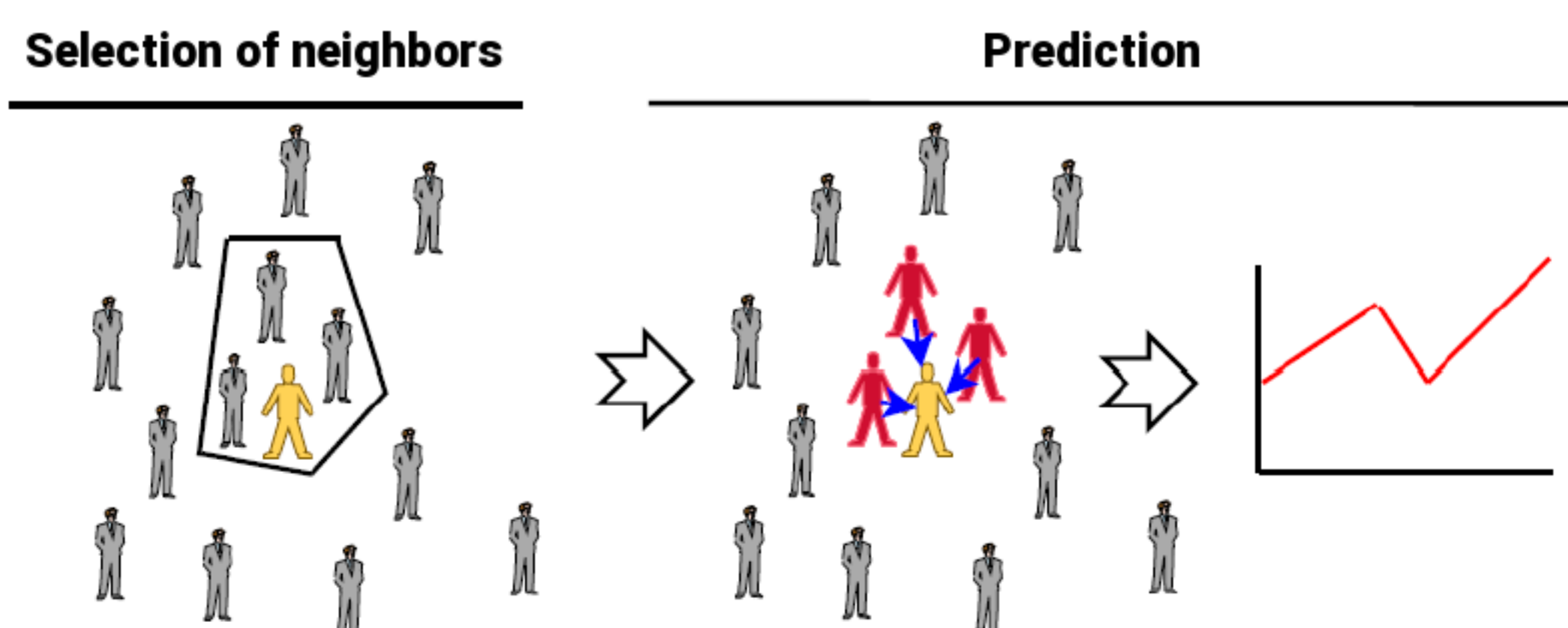
Recommending process for Collaborative Recommender Systems

Collaborative Recommender System recommendations are made based on terms of similarity between users, i.e., an user receives recommendations over items which were positively rated by other users with similar interest.

Collaborative Filtering Algorithm

It makes user gruops with similar profiles, and it will make a recommendation to a user from objects that he doesn't know yet, but are liked by other users in the group.

There are different types of collabortive filtering algorithm, most used are:

- **User-Based**: Also known as neighborhood-based, are one of the most popular stra-tegies of collaborative filtering.
- **Item-Based**: Similar to user-based but, instead of looking for neighbors among users, they look for similar items.

Android and REST Web Services

Android is a Mobile Operating System owned by Google in 2005. Taking into account that Android is used by millions users around the world, we have considered the possibility of using the online radio anytime and anywhere thanks to Android.

A Web service is a software system designed to support interoperable machine-to-machine interaction over a network. There are several technologies to develop a Web service, we have chosen REST.

REST is an architectural style consisting of a coordinated set of architectural constraints applied to components, connectors, and data elements, within a distributed hypermedia system. We have designed, developed and deployed a REST Web service where the music is retrieved.

Collaborative Online Radio for Android

Collaborative Online Radio for Android is an online radio Android app based on a Collaborative Recommender System, in which the music delivered and recommended to users is under Creative Commons licenses. Also a user can mark a song as favourite in order to listen all his/her favourite songs anytime.

Images from the Android Application

It is based on four basic components:

1. SONGS DATABASE

A key factor in selecting the set of music files has been the choice of a license that permits their free diffusion. The radio now has 12111 songs of 18 different genders.

2. APPLICATION INTERFACE: ANDROID

3. COLLABORATIVE FILTERING ALGORITHM

Collaborative Online Radio for Android uses a item-based algorithm, whose approach is based on a "Nearest Neighbour" (K-nn) model.

Similarity measure used is Cosine Coefficient:

$$s(x,y) = \frac{\sum_{i=1}^{n} x_i y_i}{\sqrt{\sum_{i=1}^{n}(x_i^2)\sum_{i=1}^{n}(y_i^2)}}$$

The algorithm makes user groups with similar features. With these groups recommendations (predictions) are calculated for each user, applying "Weighted Sum" technique.

$$p(u_a, i_a) = \frac{\sum_{h=1}^{k} s(i_a, i_h) r u_a, i_h}{\sum_{i=1}^{k} |s(i_a, i_h)|}$$

4. WEB SERVICE: REST

Communication between server and Android application.

Conclusions and future works

In this contribution, we have presented an online radio application for Android, that recommends songs taking into account the preferences of other users with similar profiles, and allow users to play music with Creative Commons license.

Future studies could consider the mood of the user to further personalize the recommendations in this application session.

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