AGReMo: Providing Ad-Hoc Groups with On-Demand Recommendations on Mobile Devices

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ABSTRACT

Recommender systems provide users with suggestions of artefacts or other users. Group recommender systems facilitate decision making in groups of users who need to make a choice together. In this paper we introduce a novel approach providing ad-hoc groups of users who want to watch a movie together with shared on-demand recommendations on mobile devices. We present the *AGReMo* system and report on a user study.

Author Keywords

Group Recommender System, Group Recommendation Process, Mobile System.

ACM Classification Keywords

H.5.3: Group and Organisation Interfaces – Computer-Supported Cooperative Work.

General Terms

Design, Human Factors, Theory

INTRODUCTION

Recommender systems aim at facilitating users' decision making by providing suggestions of choices to make, even if users lack the personal experience of the alternatives [12]. They 'create recommendations tailored to individual users rather than universal recommendations for, well, everyone' and 'the term "recommender system" has largely supplanted the older phrase "collaborative filtering" [7, p. 15].

Typically users take an active role. For instance, Tapestry provides recommendations for email based on users' annotations [2], and GroupLens provides recommendations of Usenet News based on users' ratings of articles [11]. Whereas most recommender systems provide suggestions of artefacts such as documents or products, some systems point users to other users [5, 12]. With the spreading of mobile devices like mobile phones and personal digital assistants mobile recommender systems emerged, such as the Restaurant Recommendation system [10].

While recommender systems in general greatly facilitate decision making for individual users, only few systems target at groups of users who need to make a choice together. The PolyLens system [9] is an example generating recommendations of movies for groups of users.

In this paper we introduce a novel approach for providing groups of users with shared recommendations of movies that departs from a thorough understanding of the decision process [cf. 4] as well as user interaction and comfort [cf. 1, 8]. The *AGReMo* approach is based on three core requirements for dynamic group recommendations: ad-hoc groups (who can form spontaneously with the help of a domain-specific decision process model); on-demand recommendations (anytime, without any technical effort); and on mobile support (client application for the Apple iPhone).

In the following we introduce the *AGReMo* system, report on a user study, glance at related work, and conclude with a discussion.

AGREMO

The *AGReMo* (Ad-hoc Group Recommendations Mobile) system leverages on a process model, a mobile app, and a software architecture.

AGReMo Process Model

The *AGReMo* process model is democratic yet streamlined—it stimulates the engagement of all group members while at the same time accelerating the consensus finding with short steps and minimal user effort. It provides a dynamic recommendation process for ad-hoc groups, requesting on-demand recommendations for watching movies together, on mobile devices. It facilitates the interaction among the individual group members and with the *AGReMo* system. Ad-hoc situations can originate from spontaneous group forming but also from new members joining a group. The *AGReMo* process model is based on three phases: Preparation, Decision, and Action (cf. Figure 1).

It starts with the *Preparation Phase*, in which prerequisites are established. Before the group meets, individual users rate movies they already watched. The system then generates individual profiles based on each user's ratings. In the group meeting the group members agree on an agent who coordinates and enters the group's preference specification. The preferences for groups comprise essential and optional attributes. Essential attributes are the group members, the vote weight of each group member, and the date and time to watch the movie. By default all group members have the same vote weight,
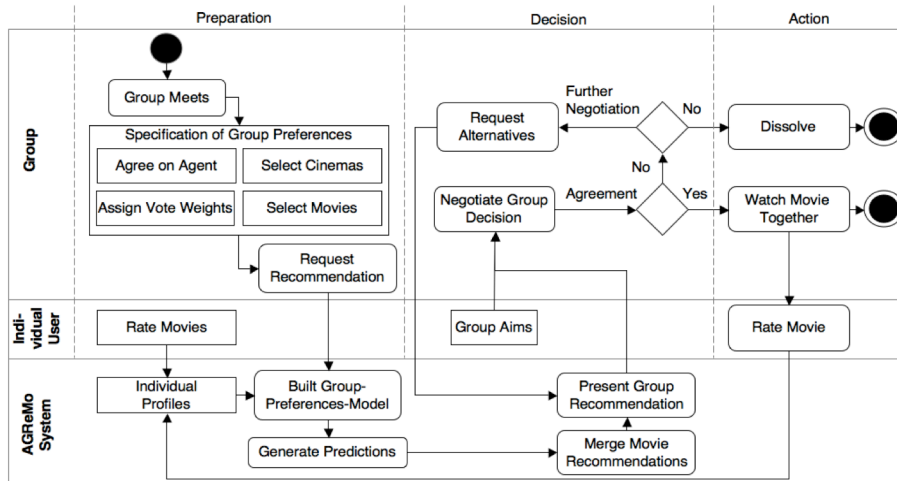
Figure 1. The AGReMo process model.

which can be doubled or tripled for privileged group members. New group members can be added easily anytime. The group can decide on a date and time to watch a movie and enter it. Optional attributes are a pre-selection of cinemas and movies. The list of available cinemas includes all movie theatres in the current city. The agent can deselect cinemas to exclude or movies that the group does not want. The Preparation Phase concludes with a request for movie recommendations. The *AGReMo* system then builds a data model collecting all relevant data of the group with the individual profiles and the group preferences. For this purpose it checks that all group members have an individual profile and eliminates movies that have already been watched by one or more group members. It then generates specific predictions for each individual movie of each user.

The *Decision Phase* aims at a group recommendation, which is the most adequate movie with the best compromise of the individual group members' movie recommendations. The compromise is based on the principle of least misery [9], maximising the minimal frustration among all group members. The system presents the most adequate movie together with optional explanations of the system's suggestion [13] as well as additional information about the movie (e.g., the plot and poster). If the group does not agree on the first suggestion, it can request alternative recommendations.

The final *Action Phase* is where the group either finds an agreement or dissolves. Later, the individual group members can rate the movie watched.

AGReMo Mobile App
The AGReMo mobile app for the iPhone follows Apple's productivity application guidelines.

After login the main view allows initiating a recommendation process, and eventually shows recent group recommendations. The agent enters the essential and optional attributes. A list of cinemas (with details on each

cinema on demand) is generated automatically according to the current position (i.e., a match of the first three digits of the zip of the location). Here cinemas can be deselected. A drop-down list presents the selection for date and time: today, this evening, or all show times within the current week. In the next step, the agent selects the group members from the friend list. Profile pictures and real names allow for a convenient selection. Friends can be added to the group by selecting them from the list. The last and optional step allows preselecting movies. A list of movies is automatically generated based on the specified cinemas and show time—unwanted movies can be excluded form the list.

Then the agent can press the start button for requesting the group recommendation. As result the top recommendation along with short explanations is presented. On demand all group recommendations and relevant explanations are available.

AGReMo Implementation
The *AGReMo* implementation provides mechanisms for advanced group recommendation generation, elegant data handling, and data delivery to attached clients.

The software architecture comprises four systems (cf. Figure 2): the *AGREMoGroupRecommender* server system is responsible for generating group recommendations; the *AGReMoWebServer* intermediate system facilitates communication between server and mobile clients; the *AGReMoMobileApp* client system provides the user interface; and the *SingleUserRecommenderService* encapsulates interfaces of an existing single-user system.

The *AGREMoGroupRecommender* server system contains four subsystems: one for generating predictions and merging recommendations, one for providing common data structures and accessing properties, one for allowing clients to connect via XML-RPC, and one for holding data models and connection. It is implemented in Java 1.6.17.
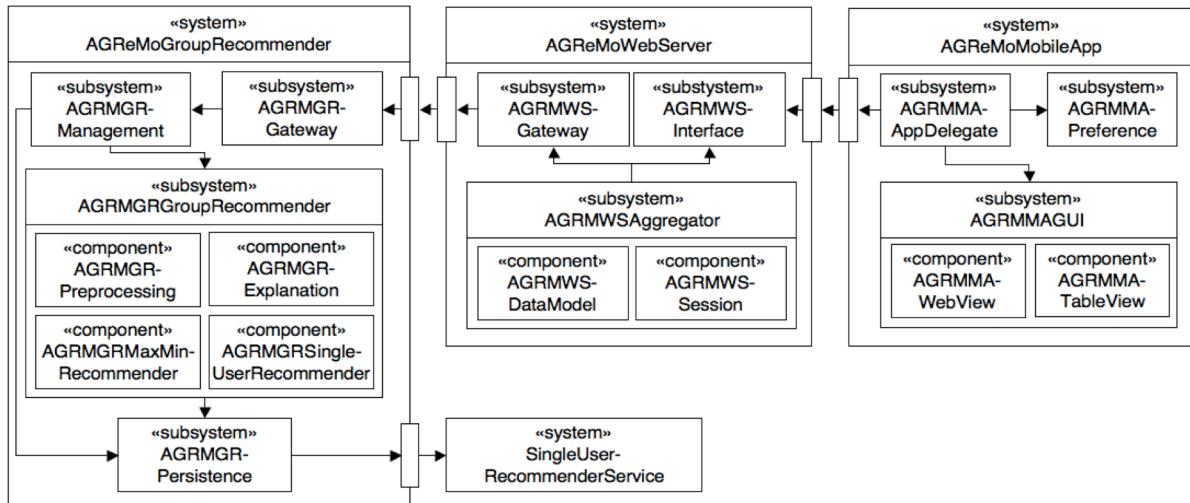
Figure 2. AGReMo software architecture as UML component diagram.

The *AGReMoWebServer* intermediate system connects to the server's gateways, and to attached client apps via a RESTful API. It encapsulates data models and sessions for assembling client requests and pre-processing results.

The *AGReMoMobileApp* client system provides the user interface to the group on the mobile device; it includes a native Objective-C-based application responsible for presenting the GUI, and a Web XHTML/PHP/ JavaScript-based application that prepares and provides the individual views of the GUI. It also connects the GUI with the intermediate system for delivering preferences and data, and acts as local data storage.

The *SingleUserRecommenderService* provides a single-user GUI for individual users for rating movies, collects the rating data, and generates single-user predictions using collaborative filtering algorithms.

USER STUDY
In this section we present a qualitative user study of AGReMo and report on its results.

Setting and Analysis
15 participants (between 23 and 30 years) were recruited from a course at our university; they all received five general bonus points for their course grade. Before the study each participant rated 150 watched movies to build up a personal profile. The similarity of individual ratings in movies varied between 38% and 63%.

The participants were anonymously assigned to groups of three. The groups had the task to agree on a movie to be watched together. They requested on demand recommendations using the *AGReMo* mobile app installed on an iPhone 3G connected via WiFi.

After an introduction to the *AGReMo* process model and client app, they started negotiating an agent. The agent interacted with the app while showing it to the group. Finally, each participant filled in a questionnaire with 15

questions on the process model, the client app, as well as on the participant's skill with touch-based applications, and relation to the other group members.

Results
Overall the process was perceived as positive. Three groups agreed on the top recommendation, two groups chose an alternative. Participants knew each other from courses, but four of five groups said that they felt as ad-hoc groups. The agent emerged coincidentally (e.g., one group member happened to sit close to the device) and from articulated rejection (e.g., little experience with touch-based devices). In both cases the group members were pleased with the concept of a moderating agent. All groups handled the essential attributes easily— agreement was found quickly. The groups used optional attributes differently: three groups included all cinemas suggested, only two groups excluded some cinemas. No group adjusted the vote weights of its members.

All groups looked carefully at the movie list. Four groups excluded some suggested movies, while one group just checked the movies included.

Detailed information for each movie (i.e., poster and short description) contributed to the negotiation of the recommendations.

Participants also stated that the prediction value for each movie influenced their discussion. The provided explanations were perceived as less useful.

The participants appreciated the user interaction concepts of the app. The groups expressed a positive overall effectiveness in contrast to group discussions without group recommendations. However, two suggestions for improvement were made: The app should be more responsive concerning input and provide more activity indicators. Some group members wanted a wizard to guide them through the process. All groups noted that the recommendation generation took too long.

RELATED WORK

AGReMo supports groups recommendations for movies and cinemas on a mobile client. The PolyLens system [9] gives movie recommendations to groups of users. While this is a great early system, compared to *AGReMo* it lacks mobile support and does not allow users to specify optional parameters. The MovieLens Unplugged system [6] is a mobile recommender system for movies, addresses single users and requires a pre-synchronisation before recommendations can be used. The Restaurant Recommendation system [10] provides mobile recommendations to groups of users, but it is not based on a detailed process model for group decision making and it focuses on restaurants rather than movie recommendations. Jameson [4] suggests a generic four-phased group recommendation process where members specify their preferences, the system generates recommendations, presents the recommendations, and the members make decisions. Our decision process model is more specifically targeted at movie recommendation processes.

DISCUSSION AND CONCLUSIONS

We introduced *AGReMo* providing a mobile group recommender system with a domain-specific process model providing ad-hoc groups with group recommendations on demand. The process model and the user interaction of the mobile app were investigated in a user study.

The study shows that the process model supports ad-hoc groups. It revealed that vote weights were not used (i.e., all groups used the default equal vote weights for all group members). Some users reported that they would like to adjust the weight later, during the decision phase.

Concerning the user interaction with the *AGReMo* app we learned that it is important to provide a concise presentation of the recommendations as well as details on explanations and further movie information on demand. The GUI should be responsive in all steps and even small delays reduce user satisfaction.

Besides the results on the model and the user interaction we also had unexpected findings: the group outcome was strongly influenced by price and risk taking. Some participants said the entrance fees of the cinemas reduce their willingness to take risks. They explicitly mentioned that they would take more risks in following recommendations of unknown movies, if the price was lower such as for instance in a DVD rental store.

Future work should address quicker recommendation generation leveraging on parallelisation and distribution of prediction [3]. Further studies with more groups are needed to better understand and generalise the existing findings. The current *AGReMo* process model departs from a single agent for each group. It would also be interesting to extend the process model and have multiple agents per group with connected client apps supporting online preparation and decision.

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