

# Context-Aware Recommender Systems Evaluation

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As the amount of data provided by various software systems increases, there is a need to offer a filtered set of items personalized to user's needs. To enhance user's comfort and thus to satisfy him, we call for recommender system. Recommender systems suggest a set of items that a user might be interested in or might find them useful. Basically, accomplishing recommendation task consists of two steps. At first recommender system has to collect information about user's activities and construct user model, which represents his preferences. Second step is to apply algorithm to compute over user's model and generate a set of items to suggest.

However, we may improve the quality of the set of suggested items by including information describing user's environment or state in the user model. These information's value in recommender system may vary depending on the domain of proposed recommender and type of the information (e.g. user's wealth may not be relevant while recommending a movie to watch, however it is relevant while suggesting an item to buy in an e-commerce system). Including context in the process of recommendation matters, because there is a correlation between user's behaviour in certain situations and contexts as Riboni et al. proved in [2].

The question now arises is how to evaluate the quality of suggestions provided by context-aware recommender system? As we mentioned before, context-aware recommenders consider various context information and include them in the user models. On one hand this allows recommenders to generate highly specific suggestions. On the other hand it makes the evaluation of the recommendations slightly more complicated.

The simplest thing to do, in the process of context-aware recommender evaluation, is to evaluate every recommendation only if all environment conditions given by recommendation are matched with real contexts. This approach is precise, however may be, and usually is, very costly (e.g. In the middle of the summer we want to evaluate recommendations suggesting user's actions in snowy weather.).

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This problem of costly evaluation may be solved by using so-called hypothetical situation [1]. In this case the evaluation process does not depend on the real contexts and thus is far more effective. The principle of this evaluation method is simply to ask a set of users how would they act in a given, hypothetical, situation. The basic premise is that some users may be more open-minded than others and their potential should be developed, as they may be used to evaluate recommendations dedicated to other users as well. On the other hand we must bear in mind the less open-minded users too.

Our first goal is to classify evaluating users depending on their answers to classification questions and in this manner we create their user model. Thanks to knowledge stored in user models, we decide how they would be used in the process of context-aware recommender system evaluation. Depending on user models we generate evaluation questions, which are presented to a proper user in a proper manner. By proper user we mean a user able to handle a set of recommendations to evaluate (e.g. an empathic user is more capable of evaluation recommendations dedicated for other users, however an apathetic user is more likely used only to evaluate recommendations dedicated to himself). By proper manner we mean personalized stylization of evaluation questions. If we reveal our purpose some users may be negatively influenced, because they tend to think they would act differently in a supposed situation. However this may be untrue. On the other hand for some users, the knowledge of our purpose might be helpful and therefore we should describe them supposed situation in as many details as possible.

To evaluate our method we use a set of movie ratings with context information (e.g. user's mood before and after watching a movie, his physical condition, etc.). At first we generate recommendations based on training set of ratings from this dataset. To achieve this, we prepare a simple context-aware recommender. This recommender system consists of the most used recommendation algorithms. Then we apply our evaluation method to generate evaluation questions for a collection of users. Finally we compare answers gained in the process of evaluation with action took by real users in the past.

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## References

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