Title: Latent Context-aware Recommender Systems

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Abstract

The relevance of Recommender Systems (RS) grew with the increase in the variety of products, content and activities that users are presented with nowadays. These types of systems are used daily by millions of people on services as diverse as Spotify, Amazon and Netflix. Initially they made use of relatively simple and straightforward data, such as user and item properties.

User preferences can change with context [1]. For example, a person running would listen to a different type of music comparatively to a person relaxing at night. Even though context is hard to capture, the ubiquity and interconnectivity of devices present an opportunity to do so. With the widespread usage of smartphones and other smart devices, huge amounts of data are generated daily. Context-aware Recommender Systems (CARS) constitute an approach that aims to make better use of more of the available data. CARS are a subset of RS that use contextual information such as location, time of day, or other relevant variables to improve the quality of the recommendations [2].

Contextual data can be obtained explicitly, being provided by the user or sensors, implicitly, through inference by data mining or by some hybrid strategy [3]. However, the explicit approach usually depends on manual user input and can only capture predetermined variables, for instance by asking users to select their mood as they select an item. The implicit approach can include methods such as Activity Recognition, which is a way to define the context for recommendations through the observation of the user's actions and his environment. An example is the inference that a person is running or riding a bus by the speed and other data captured from their phones' sensors. However, this usually results in less exact data and is not a complete substitute for explicit information [4].

Additionally, contextual data can be classified by whether it is latent or not. Non-latent variables' meaning is known and well-defined from the start, such as the ones aforementioned. Latent variables must be extracted from non-latent context, and their explicit meaning is unknown. Even so, capturing these variables can help model context more accurately. Non-latent variables can model context through predetermined variables, such as time and location. However, latent variables are extracted from those predetermined, non-latent variables, and can reflect hidden relationships or patterns related to both time and location. Even though non-latent variables are more prevalent, they might not reflect the underlying structure as accurately as latent variables. Therefore, latent context might be used implicitly to improve the end result [5].

In this project we will investigate if latent contextual variables are indeed meaningful to tackle representational and performance issues, among others. To do that, a representation for the latent variables will be learned, using different methods to extract these variables from non-latent context. Additionally, a non-CARS model will be evaluated against a CARS model. The CARS approach will be tested with both non-latent and latent context variables, in order to investigate which ones lead to better results. The project will be composed of several tasks: firstly, techniques to extract latent context variables from contextual variables will be employed. Next, an analysis of the variables will be carried out in order to try to find relations between the original variables and the ones extracted. The models will then be empirically compared in terms of computational performance and quality of the recommendations made. Additionally, a web application prototype will be developed to allow for context-aware recommendations.

References

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