DOCTORAL THESIS

Serendipity-Oriented Recommendations for Improving User Satisfaction

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Abstract

Online recommender systems have received increased attention from both industry and academia because they help people process the massive information provided by the internet and make decisions in their daily lives. However, conventional recommender systems are targeted at improving the single recommendation objective, i.e., recommendation relevance, and therefore face the problems of overspecialization. As one of the beyond-accuracy recommendation objectives, serendipity aims at balancing the relevance of recommendations to the target user's preferences and the unexpectedness of recommendations to achieve "pleasant unexpectedness". It has been paid attention to because it can help with user satisfaction. Our work is to investigate how to enhance recommendation serendipity from the perspective of user perception, thereby improving user satisfaction.

First, to the best of our knowledge, there has been no dataset that includes rich information about users' direct feedback on recommendations' serendipity and other objectives. Therefore, as the basis of our work, we conducted a large-scale user survey on a popular e-commerce platform to obtain users' feedback on the multiple objectives of recommendations (e.g., relevance, diversity, novelty, unexpectedness, and serendipity).

Second, based on this dataset and to better understand serendipity, we investigated what factors (from both items and users) may affect users' perceived serendipity. We conducted analyses on two user survey datasets (movies and e-commerce). Through statistical approaches, we identified both

domain-independent and domain-specific observations, which may be constructive in enhancing current serendipity-oriented recommender systems by better utilizing item features and user data.

Third, we applied our findings to propose a novel Temporal Unexpected Recommendation (TUR) approach. Specifically, we considered the complementarity of both implicit and explicit distances and modeled the unexpectedness in terms of the two from the latent space (i.e., embedding vectors) and the side information (i.e., item taxonomy), respectively. Meanwhile, we imported a module based on the time-aware Gate Recurrent Unit (GRU) to leverage the impact of timeliness on unexpected recommendations. Experiments on the large-scale e-commerce dataset containing users' real feedback on recommendation unexpectedness showed that our method TUR significantly outperforms the baseline methods in enhancing unexpectedness while still maintaining a comparable level of recommendation accuracy.

Finally, the introduction of serendipity as well as other beyond-accuracy objectives will inevitably introduce novel biases into recommender systems. So, we identified algorithmic user bias and evaluation bias in terms of beyond-accuracy objectives.

With open questions in serendipity-oriented recommendations to be answered, we believe our work is constructive for the understanding of serendipity and the development of serendipity-oriented recommendation approaches.