

RecProfile '16: Workshop on Profiling User Preferences for Dynamic, Online, and Real-Time recommendations

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ABSTRACT

This paper summarizes RecProfile '16, the first workshop on profiling user preferences for dynamic, online, and real-time recommendations, held in conjunction with RecSys '16, the 10th ACM conference on recommender systems. We describe the main themes arising in the workshop's papers.

Keywords

User profiling; user preferences; dynamic user profiling; graph algorithms; recommendation systems; dynamic community detection; matrix factorization; collaborative filtering; content-based recommender systems

1. INTRODUCTION

Constructing user preference profiles is obviously crucial for effective and accurate predictions in recommendation systems across diverse domains. For many traditional recommendation services, creating user profiles is well understood, either through explicit user preference elicitation or through tracking implicit user actions. The growing prevalence of dynamic online recommendation services, however, raises interesting challenges for maintaining and updating user profiles.

First, effectively representing user preferences in dynamic settings requires novel modeling techniques, for instance using latent factorization to allow dynamic updates and to alleviate cold start issues. Second, it might be infeasible to aggregate all the observed user profile signals in a sufficiently time-efficient and space-efficient manner, when the range of possible user options is large. Instead, one may need to resort to algorithms that balance accuracy with scalability, for instance using streaming or sketching algorithms. Third, there are significant engineering architecture challenges in maintaining, updating, and retrieving large volumes of user profiles in real-time and combining those profiles with other real-time signals to rank recommendations in milliseconds.

This topic is of considerable interest to both industrial and academic recommender systems researchers, since it is im-

portant for many state-of-the-art practical recommendation services, and opens up many interesting theoretical research questions of a more algorithmic nature.

The half-day workshop's program consisted of two invited talks and four accepted submissions all addressing these topics.

- Laurent Charlin (Invited). Modeling User Preferences.
- Jonathan Siddharth (Invited). Building User Interest Profiles in Real-time for a Content Recommender System.
- Takuya Kitazawa, Incremental Factorization Machines for Persistently Cold-starting Online Item Recommendation.
- Jorge Díez, David Martínez-Rego, Amparo Alonso-Betanzos, Oscar Luaces and Antonio Bahamonde. Metrical Representation of Readers and Articles in a Digital Newspaper.
- Ido Tamir, Roy Bass, Baruch Brutman, Yoram Dayagi, Guy Kobrinisky and Ronny Lempel. Powering Content Discovery through Scalable, Realtime Profiling of Users' Content Preferences.
- Megan Bingham-Walker and Richard Searle. Personalized User Profiling for Time-Dependent Recommendation of Structured Products.

These papers describe domains that are inherently dynamic and therefore force novel solutions that handle the change in user preferences. This is obviously true for news recommendations, which is a focus of the invited talk by Siddharth, the papers by Díez *et al.* and Tamir *et al.* A novel domain of dynamic recommendations is structured financial products as described by Bingham-Walker and Searle. The trend of highly dynamic recommendation applications can safely be expected to continue in coming years in an increasing number of domains.

Successfully dealing with the online nature of the recommendations and the dynamic changes in user preferences requires novel algorithmic solutions, both for collaborative filtering approaches and for content-based approaches.

Charlin's talk focuses on several extensions of collaborative filtering that add explicit modeling power to user profiles. In [1], Charlin *et al.* propose a dynamic extension of Poisson Factorization [2], which explicitly models changes in the latent factors representing user taste, as well as those representing items, allowing for more accurate prediction in

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RecSys '16, September 15-19, 2016, Boston, MA, USA

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ACM ISBN 978-1-4503-4035-9/16/09.

DOI: <http://dx.doi.org/10.1145/2959100.2959204>

dynamic contexts. In [3], the authors incorporate user exposure to items as part of the model. The model tries to distinguish between items that a user did not select due to genuine lack of interest vs. items that the user was not exposed to. This distinction allows for better balance between positive and negative training examples.

Kitazawa proposes an interactive version of Factorization Machines [4], which are usually applied in a batch setting. Meanwhile, Díez *et al.* encode the problem of predicting user trajectories algebraically, where each item is encoded as a vector, and then learn a transition matrix predicting the online trajectory of users along a session path.

Bingham-Walker and Searle avoid explicit matrix factorization, opting instead for a dynamic community-detection based approach on the full graph of users, items, and their attributes.

Finally, both Siddharth and Tamir *et al.* adopt a content-based approach, whereby they track the implicit content-based features of articles that users interact with, and aggregate them into a user profile. They then drive recommendations by finding articles that are contextually similar to the profile. The dynamic nature of user tastes require balancing users' short term and longer term interests within the profiles.

In summary, the workshop's submitted papers and invited talks covered multiple aspects of enhancing user profiles to handle dynamic, online, and real-time recommendations. We expect these topics to continue to be at the forefront of many recommender design problems in multiple domains.

2. ACKNOWLEDGMENTS

Special thanks to the workshop's co-organizer, Marko Grobelnik, and to the members of the program committee, Ronny Lempel, Mike Gartrell, Jan Neumann, Gal Lavee and Lior Rokach.

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