CS410 Technology Review: Collaborative Filtering

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Due 8 November 2020

1 Introduction

Over the last 20 years, the internet has become a primary component of everyday life. Individuals today spend countless hours browsing social media, reading news articles, communicating with friends, and shopping for everything imaginable. And internet activity is only expected to increase, from the perspective of both information consumption and information generation.

With this comes an immense challenge regarding information distribution: how does an online platform efficiently and effectively disseminate relevant information to its users? Generally, methods information access can be classified as either push or pull [1]. In the latter, users "pull" information through specific queries which usually satisfy temporary information needs. In the former, information is "pushed" to the use based on user preference or profile [1]. Thus, "push" systems are generally referred to as recommender systems, as they recommend relevant information to the users.

Within recommender systems, there are two main (but certainly not disjoint) ways by which the system recommends information: content-based filtering and collaborative filtering [1]. In content-based filtering, a system would recommend information based on previously-accessed information. In collaborative filtering, the focus of this technology review, information provided to the user is based off of judgements from other users [1]. In the context of social networks, the majority of recommendation systems use collaborative filtering [2].

In this technology review, I begin by briefly summarizing the main aspects of collaborative filtering in the context of social recommendation systems. Then, I discuss various research directions and the related literature relating to these directions.

2 Overview of Collaborative Filtering

Collaborative filtering can be split into two categories in the context of social recommendation: matrix-factorization based approaches and neighborhood based approaches [2]. In the former, user-item feedback history (purchases, reviews, articles clicked, etc.) is integrated with the existing social network (friends, family, who a user interacts with, etc.) to determine relevant information. Note the distinction outside the social recommendation context, where matrix-factorization based approach only consider user-item feedback history [2]. Neighborhood based social recommendation approaches can be further distinguished into two sub-categories: social network traversal and nearest neighbor [2]. The former leverages direct and indirect friends to create recommendations, and the latter integrates social neighborhoods into recommendation decisions [2].

3   Interesting Research Directions

One particularly interesting research line in collaborative filtering is the integration of time into user preference. This allows recommendation systems to take into account changes in user preference over time, rather than examining preferences at a specific instance in time. This technique has been applied to domains such as news recommendation [3]. Here, the authors developed a time-sequence similarity measure which compares users' preferences across time regardless of the individual time intervals. The authors also proposed a time-ordered filtering algorithm based off of this similarity measure. The resulting measures showed similar performance to traditional collaborative filtering similarity measures.

Another interesting research line in collaborative filtering is the application of modern deep learning techniques to predict user similarity and to recommend information. Recent results have shown machine and deep learning methods outperform traditional recommendation filtering techniques [4, 5]. As with many deep learning applications, the increase in performance comes at a cost of intuitive understanding. That is, it is more difficult to understand the decision metrics used for certain recommendation choices.

4   Conclusion

As the rate of information creation grows, the desire to consume that information will certainly keep pace. Collaborative filtering is one way to manage information dissemination, especially in the context of hyper-connected social networks. Modern collaborative filtering techniques show immense promise in efficiently providing users with continuously relevant information. In the coming years, we will certainly see groundbreaking developments in information recommendation, as better collaborative-filtering algorithms remove more and more friction from information creators to information consumers.

References

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