Understanding Echo Chambers in E-commerce Recommender Systems

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ABSTRACT

Personalized recommendation benefits users in accessing contents of interests effectively. Current research on recommender systems mostly focuses on matching users with proper items based on user interests. However, significant efforts are missing to understand how the recommendations influence user preferences and behaviors, e.g., if and how recommendations result in *echo chambers*. Extensive efforts have been made in examining the phenomenon in online media and social network systems. Meanwhile, there are growing concerns that recommender systems might lead to the self-reinforcing of user's interests due to narrowed exposure of items, which may be the potential cause of echo chamber. In this paper, we aim to analyze the echo chamber phenomenon in Alibaba Taobao — one of the largest e-commerce platforms in the world.

Echo chamber means the effect of user interests being reinforced through repeated exposure to similar contents. Based on the definition, we examine the presence of echo chamber in two steps. First, we explore whether user interests have been reinforced. Second, we check whether the reinforcement results from the exposure of similar contents. Our evaluations are enhanced with robust metrics, including cluster validity and statistical significance. Experiments are performed on extensive collections of real-world data consisting of user clicks, purchases, and browse logs from Alibaba Taobao. Evidence suggests the tendency of echo chamber in user click behaviors, while it is relatively mitigated in user purchase behaviors. Insights from the results guide the refinement of recommendation algorithms in real-world e-commerce systems.

CCS CONCEPTS

• **Information systems** → **Recommender systems**; **Web log analysis**; **Test collections**.

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†This work was done when Yingqiang Ge worked as an intern in Alibaba.

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KEYWORDS

E-commerce; Recommender Systems; Echo Chamber; Filter Bubble

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1 INTRODUCTION

Recommender systems (RS) comes into play with the rise of online platforms, e.g., social networking sites, online media, and e-commerce[16, 18, 19]. Intelligent algorithms with the ability to offer personalized recommendations are increasingly used to help consumers seek contents that best match their needs and preferences in forms of products, news, services, and even friends[1, 49, 50]. Despite the significant convenience that RS has brought, the outcome of the personalized recommendations, especially how it reforms social mentality and public recognition — which could potentially reconfigure the society, politics, labor, and ethics — remains unclear. Extensive attention has been drawn at this front, thus arriving at the two coined terms, *echo chamber* and *filter bubble*. Both effects might occur after the use of personalized recommenders and entail far-reaching implications. Echo chamber describes the rising up of social communities who share similar opinions within the group [41], while filter bubble [36], as the phenomenon of an overly narrow set of recommenders, was blamed for isolating users in information echo chambers [1].

Owing to the irreversible and striking impact that the internet has brought on the mass communication, echo chamber and filter bubble are appearing in online media and social networking sites, such as MovieLens [33], Pandora [1], YouTube [23], Facebook [37], and Instagram [39]. Significant research efforts have been put forward in examining the two phenomena in online media and social networks [4, 6, 7, 14, 20, 30]. Recently, researchers have concluded that the decisions made by RS can influence user beliefs and preferences, which in turn affect the user feedback, e.g., the behavior of click and purchase received by the learning system, and this kind of user feedback loop might lead to echo chamber and filter bubbles [26]. On the other hand, the two concepts are not isolated, since filter bubble is a potential cause of echo chamber [1, 12].