A Privacy-Preserving Framework for Personalized Recommendation Systems*

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Abstract

Account sharing, where multiple users use the same account, has been increasing with the rapid growth of subscription-based platforms. This phenomenon causes the mixing of different users' behavioral logs in recommendation system, leading to incorrect item correlations and a decline in personalization accuracy. This research proposes a methodology for detecting account sharing and estimating the number of users solely from user interaction data, without relying on external information such as device or location data. The proposed method enables account sharing detection and user count estimation using only interaction data, without violating user privacy, and mitigates the degradation in recommendation performance caused by account sharing.

Keywords: Account Sharing, Multi-User Detection, Recommendation Systems

1 Introduction

As subscription based platforms such as OTT(Over-the-top media service) streaming, online education, and digital content services continue to proliferate, account sharing—where multiple users jointly use a single account—has become increasingly common [1] [3]. Such behavior, along with unauthorized access through hacking or unpermitted use, poses challenges to maintaining personalized and secure environments. In recommendation systems, account sharing causes mixed behavioral data from different users to be treated as originating from a single user, leading to distorted item correlations and degraded personalization performance. Previous studies have shown that shared accounts exhibit up to 10-40% lower recommendation accuracy than individual accounts [2]. We propose a privacy-preserving framework that estimates the number of users within a shared account using only interaction data, without relying on external device or location information. The detected user profiles are then used to construct a primary-user-centered personalized recommendation system, improving recommendation accuracy under shared-account conditions while maintaining data privacy.

2 Method

The proposed system consists of two components: a shared-account detection module and a personalized recommendation module. The shared-account detection module determines whether an account is shared by analyzing inherent patterns in the item selection behavior of the account without using any device information. To extract the essential elements that reflect a user's unique preferences, the data are first refined by removing commonly selected popular items and duplicated interactions. This remaining interaction data is then projected into a

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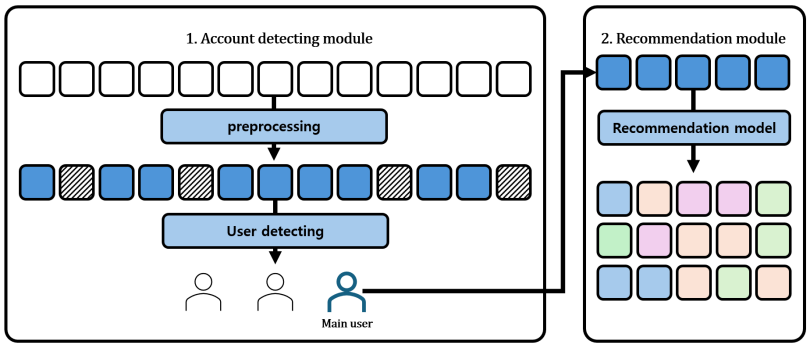

Figure 1: The system architecture

latent space to identify the number of clusters formed. The number of clusters corresponds to the estimated number of users, and the centroid of each cluster is interpreted as the preference of each user.

The primary user is determined based on the size of each cluster or the frequency of interactions. The personalized recommendation module takes the profile of the primary user extracted from the detection module as input and recommends items that align with that user's preferences. The detected user embeddings are integrated into existing collaborative filtering and Transformer-based recommendation models to improve personalization accuracy.

3 Conclusion

This research demonstrates that the proposed method can estimate both the presence of account sharing and the number of users using only interaction data, without relying on external information. The approach is significant in that it provides a detection mechanism that does not infringe on user privacy. Furthermore, by integrating the detection results into the recommendation system, the proposed method alleviates the degradation in personalized recommendation performance caused by account sharing and enables precise, primary-user-centered recommendations that better reflect the actual user's preferences.

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References

[1] Jyun-Yu Jiang, Cheng-Te Li, Yian Chen, and Wei Wang. Identifying users behind shared accounts in online streaming services. In *The 41st international ACM SIGIR conference on research & development in information retrieval*, pages 65–74, 2018.

[2] Xingbo Jing, Tao Lian, and Li Wang. Revealing, analyzing, and mitigating the adverse impact of shared accounts on personalized recommendations for single-user accounts. In *Companion Proceedings of the ACM on Web Conference 2025*, pages 2092–2101, 2025.

[3] Ignacio Redondo and Diana Serrano. Giants with feet of clay? an inquiry into user payment patterns for subscription video-on-demand services. *Administrative sciences*, 13(5):122, 2023.