

Information Imbalance and Responsibility in Recommender Systems

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Recommender systems [1] have pervaded people’s everyday life. They help us to find relevant products in online shops [2–4] such as Amazon, to learn to know new music [5, 6] such as on Spotify, or to find movies [7, 8] that meet the whole family’s interest such as on Netflix.

The ecosphere of a recommender system features multiple stakeholders—e.g., suppliers of items (i.e., products and services), users, platform provider—with multiple and possibly diverging interests and objectives. Thereby, recommender system providers are in a position to control the system, and hence, the items recommended. As a consequence, a recommender system provider may influence a recommender system regarding his own objectives, which may vastly differ from the users’ interests or other stakeholders’ interests. In cases with strong negotiation power by item suppliers (e.g., major labels in the music industry), item suppliers may be in a strong position to shift the control to their side (e.g., in the music industry, the repertoire by one label may only be provided for ‘favorable’ conditions such as its repertoire’s items being preferably handled in the recommendations).

Overall, the involved stakeholders in a recommender system have access to information with respect to the recommender system (e.g., user preferences, available items, item consumption details, item characteristics) in different degrees. In short, there is an information imbalance with information being distributed unequally among the stakeholders. For instance, the recommender system provider has information about the entire supply and the data that is exploited in the course of computing recommendations. Each user, in contrast, has information about his or her demand and preferences, about the purpose of the demand and his or her background, for example, in terms of earning capacity. Given this information imbalance, none of the stakeholders has full information, every stakeholder has only partial, imperfect information. Moreover, each of the stakeholders has interest in not disclosing certain information. At the same time, every stakeholder has possibilities—limited possibilities, though—to obtain further information from, for instance, outside sources. For example, in one scenario, the recommender system provider may control the information that he provides users with. For example, the provider may fully neglect certain items that might have been useful to the user, but do not fulfill the provider’s objectives.

In such a scenario, the user has comparably limited influence on the recommender system, namely by his or her behavior. For example, the user may fully

trust one recommender system and its ‘best fitting’ recommendations, or he or she can also obtain information from other recommender platforms or receive additional information on suiting items from other users.

The example of information imbalance that we discuss in this paper is only one of many examples in which one of the stakeholders may exploit the system, possibly at the expense of the other stakeholders. In the light of such unfair and biased circumstances, we—as a community—have to raise the following questions regarding the fairness and ethical aspects regarding recommender systems and their role in our everyday lives:

- Who is responsible for granting every stakeholder the possibility to receive what he or she wants and/or needs?
- How can we establish an equilibrium that best satisfies every stakeholder?
- Is it the responsibility of one stakeholder to ensure that the other stakeholders (or some of them) can fulfill their needs by considering their objectives (e.g., by ranking specific items higher in the recommendation list)?
- How can personalization approaches provide fair recommendations such that they are, for example, able to serve all user groups equally well?
- To which extent may we use recommendation approaches that privilege certain items (e.g., popularity bias)?

These are questions that have yet to be investigated. They have to be examined from various angles and need interdisciplinary research for pushing research on and solutions for ‘ethical recommender systems’ to the next level. This requires joint effort from researchers of computer science, information systems, economics, psychology, together with policymakers, and practitioners. For instance, the field needs the pivotal knowledge about technical capabilities of algorithms and their computational implications. While psychology may deliver the methods and results to investigate the individuals perception and information behavior, economics researchers may investigate the implications from a societal perspective. Besides research, policymakers and practitioners should be integrated in research and development endeavors right from the beginning. We stress that knowledge and efforts from all these fields are necessary for being able to making ‘ethical recommender systems’ a reality.

References

1. P. Resnick and H. R. Varian, “Recommender systems,” *Communications of the ACM*, vol. 40, no. 3, pp. 56–58, 1997.
2. H. J. Ahn, “Utilizing popularity characteristics for product recommendation,” *International Journal of Electronic Commerce*, vol. 11, no. 2, pp. 59–80, 2006.
3. S. Li and E. Karahanna, “Peer-based recommendations in online b2c e-commerce: Comparing collaborative personalization and social network-based personalization,” in *45th Hawaii International Conference on System Sciences (HICSS)*. IEEE, 2012, Conference Proceedings, pp. 733–742.
4. G. Oestreicher-Singer and A. Sundararajan, “Recommendation networks and the long tail of electronic commerce,” *MIS Quarterly*, vol. 36, no. 1, pp. 65–83, 2012.

5. M. Pichl, E. Zangerle, and G. Specht, "Improving context-aware music recommender systems: Beyond the pre-filtering approach," in *Proceedings of the 2017 ACM on International Conference on Multimedia Retrieval*, ser. ICMR '17. New York, NY, USA: ACM, 2017, pp. 201–208. [Online]. Available: <http://doi.acm.org/10.1145/3078971.3078980>
6. M. Schedl, E. Gmez, and J. Urbano, "Music information retrieval: Recent developments and applications," *Foundations and Trends in Information Retrieval*, vol. 8, no. 2-3, pp. 127–261, 2014.
7. H. Ma, T. C. Zhou, M. R. Lyu, and I. King, "Improving recommender systems by incorporating social contextual information," *ACM Transactions on Information Systems*, vol. 29, no. 2, 2011.
8. J. Wang, Y. Liu, and J. Sun, "Diversified recommendation incorporating item content information based on moea/d," in *49th Hawaii International Conference on System Sciences (HICSS)*. IEEE, 2016, Conference Proceedings, pp. 688–696.