

# A Tag-based Personalized Item Recommendation System using Tensor Modeling and Topic Model Approaches

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## ABSTRACT

This research falls in the area of enhancing the quality of tag-based item recommendation systems. It aims to achieve this by employing a multi-dimensional user profile approach and by analyzing the semantic aspects of tags. Tag-based recommender systems have two characteristics that need to be carefully studied in order to build a reliable system. Firstly, the multi-dimensional correlation, called as tag assignment  $\langle \text{user, item, tag} \rangle$ , should be appropriately modelled in order to create the user profiles [1]. Secondly, the semantics behind the tags should be considered properly as the flexibility with their design can cause semantic problems such as synonymy and polysemy [2]. This research proposes to address these two challenges for building a tag-based item recommendation system by employing tensor modeling as the multi-dimensional user profile approach, and the topic model as the semantic analysis approach.

The first objective is to optimize the tensor model reconstruction and to improve the model performance in generating quality recommendation. A novel Tensor-based Recommendation using Probabilistic Ranking (TRPR) method [3] has been developed. Results show this method to be scalable for large datasets and outperforming the benchmarking methods in terms of accuracy. The memory efficient loop implements the  $n$ -mode block-striped (matrix) product for tensor reconstruction as an approximation of the initial tensor. The probabilistic ranking calculates the probability of users to select candidate items using their tag preference list based on the entries generated from the reconstructed tensor.

The second objective is to analyse the tag semantics and utilize the outcome in building the tensor model. This research proposes to investigate the problem using topic model approach to keep the tags nature as the “social vocabulary” [4]. For the tag assignment data, topics can be generated from the occurrences of tags given for an item. However there is only limited amount of tags available to represent items as collection of topics, since an item might

have only been tagged by using several tags. Consequently, the generated topics might not able to represent the items appropriately. Furthermore, given that each tag can belong to any topics with various probability scores, the occurrence of tags cannot simply be mapped by the topics to build the tensor model. A standard weighting technique will not appropriately calculate the value of tagging activity since it will define the context of an item using a tag instead of a topic.

## Keywords

Tag-based Item Recommendation; Tensor Model; Topic Model

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## REFERENCES

- [1] Kim, H.-N., Ji, A.-T., Ha, I., and Jo, G.-S., Collaborative Filtering based on Collaborative Tagging for Enhancing the Quality of Recommendation. *Electronic Commerce Research and Applications*, 9(1): 73-83, 2010.
- [2] Golder, S.A. and Huberman, B.A., Usage patterns of collaborative tagging systems. *Journal of Information Science*, 32(2): 198-208, 2006.
- [3] Ifada, N. and Nayak, R. Tensor-based Item Recommendation using Probabilistic Ranking in Social Tagging Systems. In *Proceedings of The 23rd International Conference on World Wide Web Companion*, pages 805-810, Seoul, Korea, 2014.
- [4] Alper, M.E. Personalized recommendation in folksonomies using a joint probabilistic model of users, resources and tags. In *Proceedings of The 11th International Conference on Machine Learning and Applications (ICMLA)*, pages 368-373, Boca Raton, Florida, 2012.

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