MULTIMODAL APPLICATION OF GRAPH NEURAL NETWORK RECOMMENDATION ENGINE

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Abstract

This paper will be built around Things Solver's experience with transition from applying classical history-based types of recommender engines to the acceptance of innovative approaches from deep learning spectrum, in particular graph neural networks.

Keywords: recommendation systems, graph neural networks, e-commerce

1. Introduction

Even though over the last decade, recommendation systems have been gathering somewhat moderate levels of attention from academic audience compared to other topics, this type of machine learning application has experienced very broad real-life implementation in various industries and frequently it is referred to as one of the most impactful types of artificial intelligence nowadays. Since recommendation systems remained integral part of product portfolios of large number of cutting-edge tech companies, these systems still managed to evolve and preserve intense methodological development. This has been mainly accomplished by incorporating most recent advancements from deep and reinforcement learning fields. Some of these enhancements are implemented with a goal to optimize already existing types of recommenders and thus creating hybrid derivatives. For instance, recently developed language models enable higher levels of personalization for content-based recommenders, respecting geographical peculiarities of certain market segments, whereas deep neural network architectures become apparent alternative for learning low dimensional representations of users and items.

2. Motivation

In today's world of still intertwined offline and online shopping habits, besides general issues such as cold start, sparsity and ongoing shift in user preferences, new challenges are imposed in front of the recommendation systems. Increasing growth rates in e-commerce sales and wider global acceptance of e-trade in general are additionally strengthened by rising number of innovative ways to conduct purchases. The immensely competitive environment enabled consumer to shift preferences towards certain products, services, or suppliers in a very dynamic manner. Consequently, the complexity of the problems expected to be solved by recommender engines multiplied. In the era where big data is getting even bigger, traditional systems, besides already mention challenges, tend to be high maintenance in terms of costs related to data and model management, where issues such as large number of models, their duration and stability occur.

2.1 Theoretical concepts and methodologies overview

For a given recommendation sequences modelling problem, some of the previously

adopted methods, such as more conventional sequence modelling based on Markov chains, or application of RNN deep learning techniques will be briefly overviewed. Next, focus will be put on application of gated graph neural network, following approach of Wu S. et.al, 2019. Similarly, like in the original paper, we confirm findings that application graph neural network is highly suitable for session-based recommender problems. One of the main advantages of such approach is the option to use solely current sequential session data without accessing users' long-term preference profiles (Wu S., et.al, 2019). Moreover, as each product is represented in a graph as a node, this enables the usage of anonymous session subgraphs in a combination of a general products' graph, learned from all previously available transactions or interactions data.

Bearing this in mind, this approach is used as a starting point and almost identical methodological steps were performed on retail data, with the goal to optimize personalization capabilities of retailer's leaflet management systems and increase conversion rates of corresponding marketing campaigns.

3. Conclusion

Being able to train a single network which offers a combination of intuitive pools of products recommendations, depending on the provided customers base and global or local preferences of different segments, in addition to its ability to perform in offline and online regimes, makes graph neural network-based systems highly applicable and resource optimizing. Since these types of systems are just starting to gather researchers' attention, graph-based recommender engines might offer wide field for further improvements and experiments, especially if we account for the fact that, when there exist content features of node, such as descriptions and categorical information, this method can be further generalized (Wu S. et.al, 2019).

References

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