Deep Reinforcement Learning Term Project

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What is the problem to be solved?

Classical collaborative filtering algorithms aim at providing item recommendations that suit best with the users' interested learned from historic records. As such, they typically face the challenge of over-specialization, filter bubbles and user boredom. Therefore, it is not always ideal to optimize only for the similarity measures, as the users might also look for unexpected recommendations to broaden their horizons. In this project, my goal is to design a reinforcement learning-based method to provide novel and satisfying recommendations to the users simultaneously.

Who cares about this problem and why?

Most of the online business platforms and their consumers will care about this problem, as filter bubble has been a huge factor determining the online browsing experience. To improve user satisfaction as well as business profits, it is crucial to come up with novel design of recommender system that takes "unexpectedness" into account.

What have others done?

Unexpected recommendation serves as an important method to tackle these problems by providing novel, surprising, and satisfying recommendations at the same time. As shown in the prior literature, unexpected recommender system optimizes deviations of recommended items from user expectations and allows recommender systems to break from the filter bubble, thus leading to significant increase of user satisfaction. Therefore, many unexpected recommendation models have been proposed and even lead to successful industrial deployment.

What is your solution to the problem?

The key factor of providing effective unexpected recommendations lies in finding the optimal balance between the relevance objective and the unexpectedness objective. Note that existing models determine this balance either manually or through black-box models such as neural networks, without taking into account the users' real-time responses and update the model dynamically. As such, I propose a novel Dueling Double Deep Q-Network (D^3QN) model to determine the degree of unexpectedness incorporated during the recommendation process and provide unexpected recommendations accordingly.

How can you demonstrate that your solution is a good one?

Extensive offline experiments on three real-world datasets illustrate that the proposed D^3QN model significantly outperforms the state-of-the-art baseline approaches in terms of both accuracy and unexpectedness measures. In addition, I plan to conduct an online A/B test at a major video platform to illustrate our model achieves significant improvements over latest production models in several business metrics.