



Master's Thesis Presentation

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“User-Based Batch Sampling for Bayesian Personalized Ranking with Matrix Factorization (BPR-MF)”

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Abstract

Rendle, Freudenthaler, Gantner, and Schmidt-Thieme (2012) proposed BPR (Bayesian Personalized Ranking) combined with Matrix Factorization, known as BPR-MF. This algorithm is a Bayesian personalized ranking algorithm based on Bayesian posterior optimization. It employs pairwise learning, utilizing bootstrapping to select items that a user has viewed and items that the user hasn't viewed. The algorithm calculates gradients and updates parameters using Stochastic Gradient Descent (SGD) to optimize the ranking of recommended products for each user. However, the number of positive class labels, representing the number of viewed items for each user, can vary. This sampling method can lead to the frequent selection of popular items, resulting in frequent updates of certain parameters and slow convergence speed. Additionally, the algorithm employs stochastic gradient descent, which means that a gradient descent is performed for each pair of data. Although this allows for frequent updates, it lacks stability. Experimental results indeed show that the overall model accuracy improvement is relatively slow. Therefore, this study proposes a user-based batch sampling approach for BPR-MF, called User-based batch BPR-MF (UBPR-MF), combined with a time-decaying learning rate. The aim is to enhance the convergence speed of BPR-MF and improve the model performance for individual users. The empirical study is conducted on the Movielens1M dataset, and the predictive ability of the model is measured using Area Under the Curve (AUC). The study findings are as follows:

1. UBPR-MF exhibits a faster convergence speed compared to BPR-MF, while the AUC values are similar.
2. UBPR-MF outperforms BPR-MF in terms of AUC for users with a higher number of ratings and positive class labels.

Therefore, in training recommendation systems, UBPR-MF can be utilized as an algorithm for stable convergence in the early stage of training or to improve the predictive ability for users with a higher number of ratings in the later stage.