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Over-smoothing in Light GCN doesn't happen much

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Abstract

Recommendation systems help people make choices on the Internet, where a large amount of content and information is generated on various platforms. To efficiently implement such a recommendation system, Graph Convolution Network (GCN) is a widely used algorithm. In this paper, we evaluated the performance of LightGCN, one of the GCN models, by increasing the number of layers from 1 to 10. In our experiments, we found that LightGCN suffers from over-smoothing when the number of layers exceed 3, but in reality, it does not have a significant impact and can be stacked more than 3 layers.

Keywords: Graph Neural Network, Graph Convolution Network, Recommendation System, Deep Learning

1. Introduction

There's something called the paradox of choice. It refers to the phenomenon that when people are given too many options, it makes it harder for them to make a decision and they end up making a poorer choice than if they had fewer options, or even giving up on the choice altogether. This is true on the internet today, where there's a lot of content and information available on a variety of platforms. Therefore, there is a need for a recommendation system that filters and delivers the content or information that users want. These recommendation systems are a type of information filtering technology that recommends suitable content or information to users based on their preferences and past behavior. Many companies, such as Netflix, Amazon, and YouTube, are using recommendation systems to reduce user frustration and increase sales. Recent studies on these recommendation systems utilize GCN to improve their performance, and subsequent studies often use the LightGCN model[1], and improvement of the LightGCN model[1] is equivalent to improvement of the recommendation system method. Therefore, in this paper, we actually evaluated the performance of LightGCN model to improve LightGCN model. Specifically, we experimented to see if LightGCN actually suffers from over-smoothing when stacking more than 3-layers.

2. Related Work

2.1 LightGCN[1]

LightGCN can only learn the embedding parameters of the first layer. It then combines the representations from the k-layers into a simple weighted sum. In the LightGCN paper, they said that as the number of layers increases, the over-smoothing problem occurs, so they use

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layer combinations. Therefore, in this paper, we increased the number of layers to 10 and performed a performance evaluation to see if the over-smoothing problem was significant in practice.

3. Results

The experimental datasets use commonly used Last.fm[2] Datasets. We also experimented with stacking up to 10 layers of LightGCN to see how performance changes, as shown in Table 1.

Table. 1. Experiments data

Last.fm			
	Epoch	**recall**	**NDCG**
LightGCN_L1	500	0.0517	0.0357
LightGCN_L2	500	0.0451	0.0348
LightGCN_L3	500	0.0992	0.0812
LightGCN_L4	500	0.1039	0.0866
LightGCN_L5	500	0.0932	0.0812
LightGCN_L6	500	0.1205	0.1003
LightGCN_L7	500	0.111	0.0913
LightGCN_L8	500	0.1156	0.0964
LightGCN_L9	500	0.1061	0.0853
LightGCN_L10	500	0.1147	0.091

In Table 1, you can see that there is not much performance difference beyond layer 3.

4. Conclusions

In this paper, we experimented with LightGCN by stacking up to 10 layers to see if there is an over-smoothing problem. As a results of the experiment, we found that the over-smoothing problem is not so big even if we stack more than 3 layers. Therefore, in future research, we plan to use the fact that the over-smoothing problem is not so big to improve the performance of LightGCN.

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