Internet College Education Based on Artificial Intelligence and Social Computing

Liming Jiang[1] and Zhilin Zheng[2](✉)

[1] Student Affairs Office, Chengdu Neusoft University, Chengdu, China
[2] School of Electronic Engineering, Chengdu Technological University, Chengdu, China
3235464105@qq.com

Abstract. Internet education in colleges and universities is the inevitable result of the high popularization of college students' network use, and it is an important strategy for colleges and universities to actively adapt to the networked education environment. With the rapid development of artificial intelligence, traditional Internet education technology is no longer suitable for the increasingly large information scale of the modern education system, and new computer technologies need to be assisted in the completion of Internet education. To solve this challenge, we propose a novel internet education platform based on artificial intelligence and social computing, which can be utilized to mine students' interaction information and predict their future evolutions. In particular, we introduce the state-of-the-art graph learning models as the pre-training model in our platform. Such models can generate node embeddings in the student social graph, and these embeddings usually contain important information for future prediction. In the experiments, we demonstrate the models' performance and effectiveness. In addition, we also discuss what datasets can be used in our platform pre-training.

Keywords: Internet education · Artificial intelligence · Social computing · Graph learning

1 Introduction

Internet education (also called network education) management in colleges and universities Construction can grasp the law of students using the network, refine management and scientific design. The main body of education stands firmly in the network voice position, stimulates the emotional attribution of the campus network organization of young college students, and cultivates students' subject consciousness. Promote Online education management Demand-side experience. Move, work together Network Wound Education management. Excellent content, scientific response to the concerns of teachers and students, timely attention to campus network public opinion, and maintenance of campus harmony and stability. At the same time, colleges and universities should be on the Internet. Education management Work hard on communication channels to establish a multi-organization resonance system inside and outside the school, focus on promoting the linkage of new media matrices, form cluster resonance, conduction resonance, collaborative diffusion effects, and make every effort to improve Network Education management Imitate Force.

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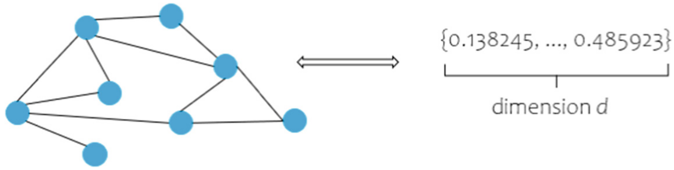

Fig. 1. From graph data to node embeddings [self-drawing]

With the rapid development of artificial intelligence, many novel technologies can be used for internet education. We propose a novel internet education platform based on artificial intelligence and social computing, which can be utilized to mining students' interaction information and predict their future evolutions. As shown in Fig. 1, graph learning models can extract important information from social networks.

In particular, we introduce the state-of-the-art graph learning model as the pretrain model in our platform. Such model can generate node embeddings for each student, and these embeddings contain important information for future prediction. In the experiments, we demonstrate the model's performance and discuss what datasets can be used in our platform pretraining.

2 Related Work

2.1 Internet Education

In China, in the exploration of the topic of online education management, scholars regard online education as an educational form, just like the concept of distance education. Most scholars believe that online education also has management problems as traditional education methods [1]. In addition, some scholars proposed from the perspective of education quality that the quality management system of online teaching, the construction of an online teaching management model that guides students to learn independently, and the management mode of online education to build an online education evaluation system, some scholars explore from three perspectives: teaching service quality, resource construction and internal organization management, and use system theory, synergy theory and educational technology theory to build a modern online education management model guided by education quality, there are also scholars from the online education management system in colleges and universities Policy and regulation Expand the conversation.

It is also discussed from the perspective of how the Internet plays a role in education [2]. Based on the negative impact of the Internet on students, it is proposed that colleges and universities strengthen the management of online education, " advocate the wind of civilized Internet access on campus", "strengthen the value education with personality education as the core", "conduct colorful, healthy and beneficial campus cultural activities", "strengthen the construction of campus websites, occupy the position of online ideological and political education", and "comprehensively improve the comprehensive quality of network administrators and block vulgar in-formation".

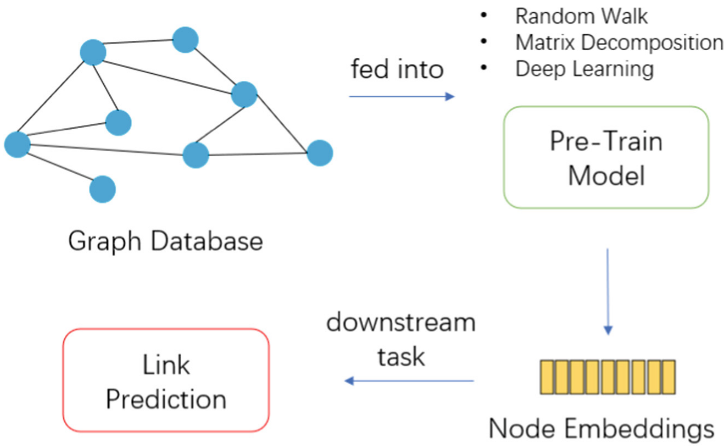

Fig. 2. Overall Framework [self-drawing]

2.2 Graph Learning

Graph Learning plays an important role in artificial intelligence and social computing [3], researchers use graph learning to mine the relationship between different nodes [4]. They usually generate node embeddings for each node, and these embed-dings can be used for downstream tasks, such as node classification and link prediction [5].

Nowadays, graph learning obtains more and more attention from both academia and industry. Many graph learning methods aims to utilize deep learning technology to mine the important information in real-world social networks [6]. Note that inter-net education is also an important social network, thus graph learning methods can be effectively used in internet education management [7].

3 Internet Education Platform with Graph Learning

3.1 Overall Framework

In this paper, we propose a novel internet education platform, which utilizes SOTA graph learning models to mine students' interaction patterns and active influence. First, we introduce the overall framework, and then propose the graph learning paradigm used in our platform.

As shown in Fig. 2, the platform can be divided into three parts: the student graph database, the pretrain model, and the downstream task prediction module. We first pre-train the classic graph learning model as our basic, and feed the graph data in the database into the pretrain model. Finally, the prediction results can be calculated by the downstream task module [8].

3.2 Graph Database Definition

Students' interactions can be seen as the relation graph (also called social network), which can be used for mining important information from their daily interactions. In particular, the student graph can be defined as follows.

Given a graph G = (V, E), where V is the node set includes students and courses, E is the edge set contains the learning records. In the student Graph, students can be seen as nodes and their relationships or interactions can be seen as edges. The graph database can be stored into the adjacency matrix or interaction sequence log for different pre-train models.

3.3 Pretrain Model Paradigm

In fact, graph learning models have different technologies. Our platform design aims to aggregate multiple models for future prediction, thus we should conduct a general framework for many graph learning models. Here we discuss the general paradigm in different graph models, and then adjust the framework based on different model in real training process.

Given a graph, the graph learning models aims to generate node embeddings for each node in the graph, which can be divide into three parts: random walk models, matrix decomposition models, and deep learning models. All these three models can map a graph into node embeddings as follows.

$$Z = \{Model(G)|random, matrix, deep\} \tag{1}$$

Random walk models
These models usually construct multiple random walks in the graph and then generate node embeddings from these random walks. In particular, a node selects the next hop node with the probability of p, and p is the reciprocal of the degree of the node.

After multiple walks have generated, each node embedding can be optimized by the loss function as follows.

$$-\log Pr(\{v_{i-w}, \ldots, v_{i-1}, v_{i+1}, \ldots, v_{i+w}\}|\varphi(v_i)) \tag{2}$$

Matrix decomposition models
Matrix decomposition is a common learning technology in the early stage of graph learning. By using singular value decomposition and other operations, the adjacency matrix of graph is split to get node embedding and representative values.

$$SVD(A) = M^{-1}KN^{-1} \tag{3}$$

Here M and N are two embedding matrices of source nodes and target nodes, respectively. K is the top-K value matrix of this graph adjacency matrix, which denotes the most representative results of this graph.

Deep learning models
Deep learning technologies are usually used in graph learning models. These models stack multiple neural network layers to learning the graph information deeply [9]. In particular, the paradigm of deep learning models can be defined as follows.

$$Z^l = GNN\left(Z^{l-1}, W^l H^l\right) \tag{4}$$

After l layer calculation, the final layer's output can be used as final node embeddings. In addition, the GNN module is a general module which has different variants, such as graph convolutional network, graph cyclic network, graph generation network, and graph space-time network, etc.

$$Z = \{Model(G)|GCN, RNN, GRU, LSTM, Attention\} \tag{5}$$

3.4 Downstream Task Module

After obtain the final node embeddings Z, we can feed them into the downstream task module for future prediction. The classic task is link prediction.

$$Result = 1\Big(-\log\sigma(-||z_x - z_y||^2)\Big) \tag{6}$$

The prediction module includes Softmax function, Relu function, or MLP function. All these functions aim to calculate a final result to show the edge (x, y) is positive pair or negative pair.

In the real-world student social graphs, two students may have new relationship in future, and this relationship may also damage in future. If we can utilize the platform to predict their future relationship, thus we can take measures to observe and solve the bad relationship between students as early as possible.

4 Experiments

In this part, we first show the SOTA graph learning methods' performance in common graph real-world datasets. Such method can be utilized as our platform's pretrain models. Then we discuss what graph datasets we can introduce for pretraining.

4.1 State-Of-The-Art Baselines

According the work [10], we introduce the performance of SOTA baselines on multiple datasets. Such datasets are all real-world datasets, include different domains, such as citation graph (cit-HepTh), social graph (CollegeMsg), and web graph (Wikipedia). Note that the CollegeMsg graph dataset is the interactive graph data of college students, which is very helpful for our research on internet college education.

In Table 1, we give several models' performance on graph data, which contain random walk model, matrix decomposition model, and deep learning model. Different models can help our platform to capture different evolution patterns, thus all of these models are effective for internet education.

Table 1. Link prediction performance [data from reference [10]]

	CollegeMsg		Cit-HepTh		Wikipedia	
	ACC	F1	ACC	F1	ACC	F1
DeepWalk	**66.54**	67.86	51.55	50.39	65.12	64.25
Node2vec	65.82	**69.10**	65.68	66.13	**75.52**	**75.61**
VGAE	65.82	68.73	66.79	67.27	66.35	68.04
GAE	62.54	66.97	69.52	70.28	68.70	69.74
GraphSAGE	58.91	60.45	**70.72**	**71.27**	72.32	73.39
EvolveGN	63.27	65.44	61.57	62.42	71.20	73.43

Table 2. Statistics of social graph datasets [self-drawing]

Dataset	CollegeMsg	School	High
Event	59,835	188,508	14,296
Node	1,899	327	4,268
Multi-edge	Yes	No	No

4.2 Pretrain Datasets

The above models can be utilized as the pretrain models, but what graph datasets shall we introduce for the internet education? The CollegeMsg [10] mentioned above is a good choice. Such dataset is an online social education graph in which an event is a student sending another student a private message.

In addition, there are many other graph data we can use. Such as School [11], a social graph of teacher-student interaction between multiple classes in middle school. High [11], an another social graph dataset correspond to the contacts and friendship relations between students in a high school in Marseilles, France, in December 2013, as measured through several techniques. In Table 2, we present information about these data sets.

These social graph datasets are closely related to internet education and can be used as pre-training data for our platform model. After the pre-training of the model is completed, it can be formally used for the relationship prediction of the platform.

5 Conclusion

In this paper, we discuss the importance of internet education, and introduce artificial intelligence and social computing technology to design an internet education platform. Through the use of pre-trained graph learning model, it can effectively predict the future relationship between students, so as to realize the management of internet education. In the future, we will further consider the pre-training of large-scale models.

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