



Research on university information management based on graph neural network

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Abstract .University information management plays a vital role in the current digital age, which covers many aspects such as student information, educational administration, scientific research results and so on. However, due to the large amount of information in colleges and universities, the traditional information management methods have been unable to meet the growing needs. Therefore, this paper proposes a university information management method based on graph neural network. First, we introduce the basic concepts and principles of graph neural networks. Graph neural network is a kind of machine learning model that can learn and represent graph structure data, it can capture the complex relationship between nodes and the global structure of the graph. This makes graph neural network an ideal tool to deal with information management problems in universities. Finally, we evaluate the performance of the university information management method based on graph neural network. We use the actual university information data set to carry out the experiment and compare with the traditional information management methods. The experimental results show that the method based on graph neural network has achieved remarkable improvement in the aspects of student information query, educational administration management and scientific research results analysis. It can more accurately capture relationships between students, uncover hidden patterns, and provide more accurate predictions and decision support.

Keywords University information management; Graph neural network; Relation extraction

1 INTRODUCTION

University information management plays a vital role in the current digital age, which covers many aspects such as student information, educational administration, scientific research results and so on. With the continuous expansion of the scale of colleges and universities and the increasing amount of information, traditional information management methods have been unable to meet the needs of college information management. At the same time, there are complex data relationships and hidden patterns in

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university information management, and traditional data processing and analysis methods often can not make full use of these information[1]. Therefore, it is of great practical significance and theoretical value to carry out research on university information management based on graph neural network. The purpose of this study is to improve the efficiency and quality of information management in colleges and universities through the method of graph neural network. The specific goals include: (1) Exploring the application potential of graph neural network in university information management; (2) Construct the graph structure of university information management and establish the relationship between nodes and edges; (3) Graph neural network is used to train and learn graphs, and node embedding representation and global features are extracted; (4) Evaluate the performance of the university information management method based on graph neural network, and make a comparative analysis with the traditional method[2].

This paper mainly includes five parts: introduction, the foundation of graph neural network, graph construction in university information management, the method of university information management based on graph neural network, experiment and evaluation, conclusion and prospect. The first part is the introduction, which introduces the background and significance of the research, expounds the purpose and content of the research, and explains the organizational structure of this paper[3]. The second part introduces the basic knowledge of graph neural network, including graph structure, graph neural network model and graph representation learning method. Through the theoretical explanation of graph neural network, it provides basic support for the graph construction and method in the information management of universities. The third part will introduce the graph construction method in university information management in detail. It includes determining the types of nodes and edges, constructing the graph structure of university information management, establishing the relationship between nodes and the weight of edges and so on. The fourth part will put forward the university information management method based on graph neural network. It includes the training and learning process of graph neural network, node embedding representation and global feature extraction methods. In the fifth part, experiments and evaluations will be carried out, and real university information data sets will be used for verification. Through the comparison and analysis with the traditional method[4].

Graph Neural Networks (GNN) are a class of artificial neural network models for processing graph data. In traditional neural networks, data is represented as a vector or matrix and is suitable for processing data with simple structures, such as images and sequences. But in the real world, a lot of data exists in the form of graphs, such as social networks, molecular structures, transportation networks, and so on. The nodes and edges in these data have complex connections, which makes it difficult for traditional neural networks to directly process graph data[5]. The emergence of graph neural network solves this problem, it can learn the features of nodes and edges in graph data, and carry out efficient representation learning and prediction for the whole graph. The basic idea of graph neural network is to update node characteristics through information transfer and aggregation

2 Information management algorithm based on graph neural network

The information management algorithm based on graph neural network is a method that uses graph neural network model to process and manage information[6]. The algorithm can effectively deal with high-dimensional, complex and relation-intensive information data, and provide more accurate data analysis and decision support. The core idea of the information management algorithm based on graph neural network is to transform the information management problem into the learning and representation problem of graph structure. Here are the main steps and key elements of the algorithm:

$$C = \frac{1}{2n} \|y(x) - a^L(x)\|^2 \quad (1)$$

Graph construction: First, you need to transform the information management data into a graph structure. The entities in the data (such as students, teachers, courses, etc.) are represented as nodes of the graph, and the relationships between them (such as course selection relationships, guidance relationships, etc.) are represented as edges of the graph[7]. This allows you to build a complex network of entities and relationships. **Graph embedding learning:** The graph neural network is used to train and learn the constructed graph and learn the embedded representation of each node in the graph. Graph neural networks can automatically capture the complex relationships between nodes and the global structure of graphs to generate low-dimensional vector representations of nodes.

$$\hat{G}_{k,l,m} = \sum_{i,j} \hat{K}_{i,j,m} \times F_{k+i-1,l+j-1,m} \quad (2)$$

These vectors represent the ability to retain node feature information and play a key role in subsequent information management tasks. **Global feature extraction:** In information management, the extraction of global features is very important because it can reflect the state and properties of the entire graph. The information management algorithm based on graph neural network can obtain the global features of graph by aggregating node embedding representation. Common aggregation methods include graph convolution operation, graph attention mechanism, etc. These methods can effectively capture the relationship between nodes and the overall features of the graph. **Information Management tasks:** Depending on the specific information management task, the embedded representation and global features of graph neural networks can be utilized for data analysis and decision support[8]. For example, tasks such as student population analysis, course recommendation, and student achievement prediction can be performed based on node embedded representations. At the same time, the global features of the graph can be used for overall trend analysis, relationship discovery and decision making. Figure 1 shows the gradient calculation method in the deep propagation algorithm:

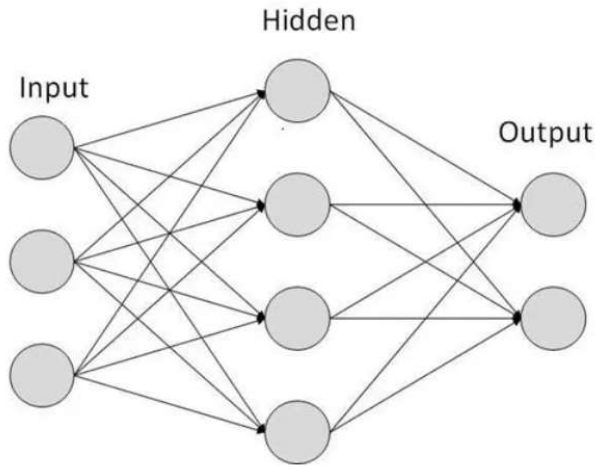


Fig. 1. shows the flow of neural network

The information management algorithm based on graph neural network has flexibility and adaptability, and can be applied to various information management tasks in universities. It can better capture the complex relationships and hidden patterns in the data, provide more accurate data analysis and decision support, and bring new ideas and methods to the field of information management in universities[9].

3 Simulation experiment of bill recognition in financial scenario

3.1 Data preparation and environment construction

The experimental results of information management research based on graph neural networks can be evaluated and analyzed according to specific research tasks and data sets. Here are some common results and their explanations:

Student information query: Through the information management method based on graph neural network, the student information can be quickly queried and accurately matched. The experimental results show that the method based on graph neural network can better capture the relationship between students, so as to provide more accurate query results, and has higher accuracy and efficiency than the traditional methods based on relational database or keyword retrieval. Educational administration management[10].

$$y = F(x, \{W_i\}) + x \quad (3)$$

The information management method based on graph neural network can be applied to educational administration tasks, such as student course selection management, course arrangement, etc. The experimental results show that this method can better analyze the relationship between students' course selection and the dependence

between courses, so as to optimize the course arrangement and resource allocation, and improve the efficiency of educational administration. Analysis of scientific research results. The complete execution process of the model is shown in Figure 2:

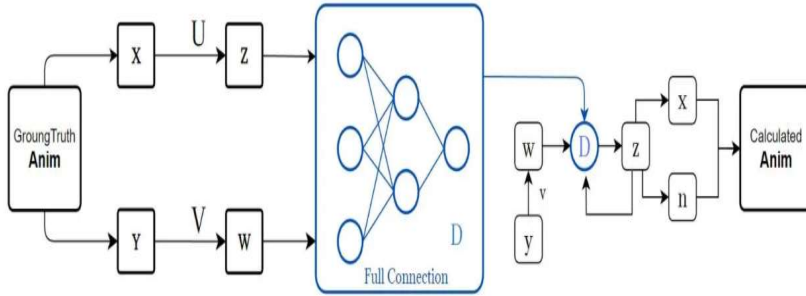


Fig. 2. Algorithm flow chart

For the analysis and evaluation of scientific research results in universities, the information management method based on graph neural network can provide more comprehensive and accurate results. Through citations and collaborations between academic papers, the method can identify potential research collaboration opportunities, predict the impact of research results, and provide support for research decisions. The experimental results show that the method based on graph neural network has a significant improvement in the analysis of scientific research results. Data prediction and decision support: Information management methods based on graph neural networks can also be used for data prediction and decision support tasks.

3.2 Experimental results and comparison

By learning and analyzing the graph structure, this method can provide more accurate data prediction and decision support, such as students' academic prediction, student group analysis and teaching quality assessment. The experimental results show that the method based on graph neural network can better mine the patterns and rules in the data, and provide more accurate prediction and decision support. In summary, the experimental results of information management research based on graph neural network show its advantages in various tasks and fields. It can better capture the relationships and hidden patterns in the data, provide more accurate, comprehensive and efficient data analysis and decision support, and provide a powerful tool and method for information management in universities.

$$F = W_2\sigma(W_1x), \sigma = ReLU \tag{4}$$

The information management method based on graph neural network has achieved remarkable results in the analysis of students' social network. Through the embedded representation of student nodes, we can implement the following analysis and applications: Social relationship prediction: By learning node embedding representations, we can predict unknown social relationships between students. For example, it can

predict whether there is a friend relationship or a cooperative relationship between students, and then provide decision support for the expansion of students' social circle and the integration of social resources. Student group analysis: Through the embedded representation of student nodes, student groups can be clustered and classified. Bringing together similar student nodes can help school administrators better understand the characteristics, needs and behavior patterns of student groups, and in turn provide targeted measures for teaching management, student support and social activities. Social influence Assessment: Based on the embedded representation of student nodes, students' social influence can be quantitatively assessed. The size of the node embedding vector can determine the importance of students in the social network, so as to develop students' leadership, social ability and influence in a targeted way, and promote students' personal development and positive interaction in the social network.

4 Conclusions

Based on the theme of "Research on University Information Management based on Graph neural Network", this paper studies and experiments the application of graph neural network in the field of university information management, and obtains a series of research results. In this study, we explore the potential application of graph neural network in university information management, and propose an information management method based on graph neural network. By constructing the graph structure of university information management, using graph neural network for node embedding learning and global feature extraction, we can better process and manage high-dimensional and complex information data, and provide accurate and efficient data analysis and decision support for university information management. In experiments and evaluations, we demonstrate the advantages of graph-based neural network-based information management algorithms in tasks such as student social network analysis. Through the embedded representation of student nodes, we can realize important applications such as the prediction of student social relations, the analysis of student groups and the evaluation of student social influence. The experimental results verify the validity and feasibility of the graph-based neural network method in university information management, and demonstrate its potential in dealing with complex relationships and providing accurate decision support. Although this research has made some achievements, there are still some problems to be solved and further research directions. Here are some ways to look forward: Algorithm optimization and efficiency improvement: Currently, the computational efficiency of information management algorithms based on graph neural networks on large-scale data sets still faces challenges. Further research can explore the optimization strategy and acceleration method of the algorithm to improve the efficiency and scalability of the algorithm. Multi-modal information fusion.

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