Curriculum Evaluation of Internet of Vehicles Converted from Electronic Information Engineering

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Abstract. Internet of vehicles is a new professional, involving real-time access to vehicle data, car road and shore information exchange, traffic data analysis and processing of key technologies and public transport information services, big data and cloud computing. In this paper, we analyze the curriculum structure of internet of vehicles which transition from the electronic information engineering based on complex network theory. We construct the complex network models of electronic information engineering and internet of vehicles. And then we analyze the topology structure of network after replace the main course. The results show that the proposed network model can accurately assess the impact of curriculum changes on the curriculum system.

Introduction

The transformation and development of local undergraduate colleges is the basic requirement of the society to cultivate the talents of higher education. Internet of vehicles as a new professional, including car network application system design, vehicle network communications, modern sensors, information processing, automotive embedded and other technical content. The aim is to cultivate high-quality applied compound talents who can work in scientific research, system integration, equipment manufacturing, key technology research and development and extension, network operation and management in various industries related to internet of vehicles industry. Electronic Information Engineering is a professional in electronics and information engineering. The professional students mainly learn the signal acquisition and processing, power plant equipment information systems and other aspects of professional knowledge. By the electronic information engineering professional transformation and upgrading into a car network professional is a direct and effective professional transformation model. In this paper, we constructs the network model of electronic information engineering and internet of vehicles curriculum system based on the theory of complex network, which nodes in the network represent the courses and links are the relationship between the courses. And then accurate evaluation of internet of vehicles professional courses on the curriculum system by the analysis of the network topology, which are "Introduction to internet of vehicles ", "Linux operating system", "Linux C programming", "Java SE programming", "Oracle Database Development" and "Android programming" and "Development Technology and Practice of Vehicle Mobile Application".

Construction of Curriculum Relationship Network

The curriculum is an organic whole that has a specific direction that consists of a multitude of courses that interact with each other. The complex network model consists of nodes and edges. The nodes in the network represent the courses in the course system, and the links between the nodes represent the interrelationships between the courses. Using the complex network model to describe the curriculum system could fully express the relationship between the curriculum structure [1-4].

Construction of Courses Relationship Network Model of Electronic Information Engineering.

The main research direction of electronic information engineering is the acquisition and processing of information, including the transmission, processing and storage of information. The application of

electronic information engineering in modern society is very extensive, such as mobile Internet, Internet of things, internet of vehicles, multimedia information processing and application, intelligent transportation and navigation, underwater submarines, lunar robots, ultra-high-definition television, , Radar, military and military communications. The professional has a total of more than 70 courses, including circuit theory, information theory and coding, signal and system, digital signal processing, electromagnetic theory, automatic control principle. We chose 66 important courses as shown in Table 1 to build a curriculum relationship network.

We build a curriculum relationship network based on the interdisciplinary relationship of the curriculum. The network is a directed and weighted network. The nodes in the network are the courses in Table 1. The edge of the network is the relationship between the courses. The weight of a course is the size of a course that affects another course. For example, the Advanced Mathematics course is the basic course for signal and system courses. More than 50% of the signal and system course knowledge is related to higher mathematical knowledge. Thus, there is a slight difference between the higher mathematics and the two nodes of the signal and the system, with an edge weight of 0.5. Electronic information engineering courses network as shown in Fig. 1. The network contains 66 nodes, 620 links, the average degree is 1.3338, the average out-closeness is 5.7023, the average in-closeness is 4.6657, global clustering coefficient is 0.793[5-9].

Figure 1. Courses Relationship Network Model of Electronic information engineering

Internet of Vehicles Professional Curriculum Network. Internet of vehicles increased "Introduction to internet of vehicles ", "Linux operating system", "Linux C programming", "Java SE programming", "Oracle Database Development" and "Android programming" and "Development Technology and Practice of Vehicle Mobile Application" Curriculum based on electronic information engineering. The curriculum network as shown in Fig. 2. The network contains 73 nodes, 692 links, the average degree is 2.7233, the average out-closeness is 5.5972, the average in-closeness is 4.9983, the global clustering coefficient is 0.7688.

Table 1 Courses of electronic information engineering

No.	Course name	No.	Course name	No.	Course name
1	Basic manufacturing technology practice	23	Linear Algebra	45	Industrial field bus control technology
2	VC++ practice	24	Probability and Statistics	46	Knowledge extension of signal and system theory
3	Electronic technology practice	25	Complex Analysis and Integral Transformation	47	Electronic System Design
4	EDA practice	26	Physics of college	48	DSP Technology and Application
5	Production practice	27	Physics of college experiment	49	Image Processing Technique
6	MCU interface practice	28	Analog Electronic Technique	50	Electromagnetic Field Theory
7	ARM information system practice	29	Circuit Theory	51	Electronic Measurement
8	DSP practice	30	Digital Electronic Technique	52	Television technique
9	Image processing practice	31	Analog Electronic Technique experiment	53	DSP Engineering Case Analysis
10	Electronic system engineering practice	32	Digital Electronic Technique experiment	54	Technology of Information and Coding
11	Graduation practice	33	The Professional Introduction	55	Digital Speech Processing Technique
12	Graduation design	34	Micro-Computer Principle And Application	56	Pattern Identification and Application
13	Circuit CAD practice	35	The Special English	57	Multimedia technique
14	Electronic circuit practice	36	Sensors Technology	58	Digital communication system
15	Digital electronic practice	37	Java Program Designing	59	Optical Fiber Communication Techniques
16	Electronic CAD practice	38	VC++ Programing	60	The New technology of electronic information
17	DSP Comprehensive Practice	39	Single-chip Micro-computer And Interface Technology	61	Application Technology of Database
18	College Chinese	40	Mechanical Drawing and CAD	62	Microwave Technique
19	College Foreign Language	41	Signal and System	63	Computer Networks
20	University Computer Foundation	42	The Principle of Communication	64	Embedded Systems and Application
21	Computer programming (C language)	43	High frequency electronics Technology	65	EDA Technology and Application
22	Advanced Mathematics	44	Digital Signal Processing	66	Automatic Control Theory

Figure 2. Courses Relationship Network Model of Internet of Vehicles

Curriculum Evaluation of Degree Distribution Based on Degree Distribution

Degree is also called connectivity. It is one of the simplest and most important attributes of a network node [10, 11]. The degree of the node is the number of all edges connected to it. In the directional network, the degree of the node is divided into in-degree and out-degree. In the network with adjacency matrix $A(n \times n)$, if there is an edge from node i to node j , then $A_{ij} = 1$, then the out-degree k^{out} and in-degree k^{in} of nodes are respectively.

$$k_i^{out} = \sum_{j=1}^n A_{ij}, \quad k_j^{in} = \sum_{i=1}^n A_{ij} \quad (1)$$

The distribution of nodes in the network is one of the most important attributes. It can be described by the distribution function $P(k)$ and the cumulative distribution function $P_c(k)$. $P(k)$ represents the proportion of nodes with degrees k in all nodes, and $P_c(k)$ represents the proportion of nodes with degrees greater than or equal to k in all nodes. The degree and degree cumulative distribution of electronic information engineering as shown in Fig. 3. The degree and degree cumulative distribution of intelligent hardware and product design as shown in Fig. 4. We replace Automatic Control Theory, Embedded Systems and Application, VC++ Programing, Java Program Designing, Micro-Computer Principle and Application, Multimedia technique, EDA Technology and Application rapid Introduction to internet of vehicles, Linux operating system, Linux C programming, Java SE programming, Oracle Database Development and Android programming, Development Technology and Practice of Vehicle Mobile Application, respectively. The degree and degree cumulative distribution of intelligent hardware and product design as shown in Fig. 5.

Figure 3. Degree and cumulative degree distribution of electronic information engineering

Figure 4. Degree and cumulative degree distribution of internet of vehicles

Figure 5. Degree and cumulative degree distribution of internet of vehicles after the replacement of courses

Summary

Internet of vehicles is the inevitable product of social development. In this paper we analyzes the curriculum system of electronic information engineering and internet of vehicles based on the theory of complex network. Firstly, the network models of electronic information engineering and internet of vehicles are constructed. And then we replace the main course, and once again on the network topology analysis. The results show that the model can accurately evaluate the influence of curriculum changes on the professional curriculum system.

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