Construction of Online Learner Model Based on Situational Awareness

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Abstract. With the rapid development of mobile Internet technology, the emergence of the Internet and big data as well as mobile terminals with mobile computer functions. Promoted the transformation of mobile learning personalized services. At the same time, however, in the mobile learning environment with complex online educational resources, the number of learning resources and learning services has increased dramatically, and it has continuously increased the time and effort spent by students on the acquisition and selection of resources. "The problem has greatly affected the efficiency of online learning and the utilization of learning resources. How to effectively use context-aware technology and build a personalized recommendation system is the key to solving the problem of learning resource overload. This has become a research hotspot in the future development of mobile learning. Therefore, this paper introduces context-aware technology, combined with the characteristics of the adaptive learning path recommendation system, from the learner's scenario elements, environmental context elements and application scenarios. Analyze the scenarios that influence the recommendations of the adaptive learning path. The selected scene elements are screened by Delphi method and mathematical statistics method to construct a learner model based on context perception.

Keywords: Situational Awareness, Online Learning, Adaptive Recommendation, Model Building

1. Introduction

With the deepening of information technology, online learning has gradually developed. Researchers in the learning community are gradually realizing the guiding role of constructivist learning theory in the construction of online learning. Online learning to carry out personalized education to help learners build knowledge effectively has become the ultimate goal of online learning establishment [1-3]. The constructivist learning theory holds that the learning environment consists of four factors: “context”, “cooperation”, “dialogue” and “meaning construction”. In the online learning process of online learning, the online learning autonomous learning environment can provide learning elements [4, 5]. Online discussion or publishing communication behaviors constitute "collaboration" and "session." The process of learning online and providing intelligent services provides a process of “meaning building” [6-10]. Context-aware services are the ultimate form of context-aware systems. The service collects the results of contextual awareness information collection and analysis to the user so that the computer or mobile application can be applied to the user's life. Although both service forms have their own advantages and disadvantages, push-based services are still the trend of service [11-14]. Due to the rapid development of computer technology, the number of various applications on various platforms has proliferated. In today's massive amount of information, premium context-aware push services are emerging to provide users with high quality and accurate services based on an improved user experience. The main purpose of solving the information overload problem in the online learning platform is to solve the main reasons for the high frequency dropout rate of the online learning platform

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and the high pass rate of the low frequency course. The selected scene elements are filtered by Delphi method and mathematical statistics method to establish a context-aware learner model.

2. Situational Awareness Service

Context-aware services primarily refer to changes in the user's contextual information that the computer or mobile phone sensor "perceives". And provide the process of appropriate context-aware services based on changes in context-aware information. Essentially, this is the process of automatically providing the services that the user currently needs based on the user's environmental information. The context aware service has the following four characteristics. Situational awareness services are "transparent". In the process of context-aware services, the device's sensors replace the user's activity input process. Context aware services are transparent to users. In the process that the user does not need to provide the service, the device does not feel the presence of the device. Situation information alerts the user only when the user needs service. This method is more suitable for nighttime, sleep, when the user has many things, etc. Situational awareness services are full-time and comprehensive. The context-aware service provides users with all-day monitoring and service based on information. Situational awareness services are instant. For the user, what is needed is an instant service. The context aware service can provide context aware services to users with very low latency based on changes in user context information. Situational awareness services are personalized to the user. The context-aware service provides services based on contextual data, and each user's context data is different. Therefore, different context-aware services must be provided based on different scenario data. In addition, data collection and service rules can be tailored to user needs.

The scene-aware sensor acquisition layer mainly collects and captures the environment around the user in the smart space. This layer consists primarily of sensors and context-aware preprocessors. Among them, the sensors mainly include navigators, gravity sensors, light sensors, distance sensors and gyroscopes in smart mobile devices. The context-aware preprocessor is pre-processed by the ambient data captured by the sensor, processed into a data format that can be identified by the upper layer, and provides support for the upper-level processing data. The context-aware database is mainly composed of an abstract database, a rule base, and a service database used by the context-aware inference engine. The inference rules used by the system and service databases when the service is provided are stored here. A relational database is a mapping table used to convert specific values into abstract data. In this platform, an abstract database can be stored in it, and the inference rules and service database are integrated in it, which is equivalent to a configuration file. This benefit can be used to better modify and add configuration files and service databases. Users, mobile devices and the environment are independent and interconnected, they are a whole. The environmental information describes the user's activity status, the user is in a specific environment and provides environmental information to the mobile device, the sensor of the mobile device senses the user's environment and changes, and provides services to the user, and the three cannot be separated separately.

3. Experiments

The context information is introduced into the recommendation system in the learning service adaptive recommendation system. Therefore, it is necessary to consider the learner's learning needs situation information, and also consider the learning resources and learning service context information to match the two situations. Personalized mobile learning service recommendations. The key issue involved in this process is the acquisition and perception of contextual information. Modeling and representation of contextual information and reasoning and application of contextual information. An effective solution to these problems is the key to implementing adaptive mobile learning resource recommendations. The scenario reasoning process is shown in Figure 1.

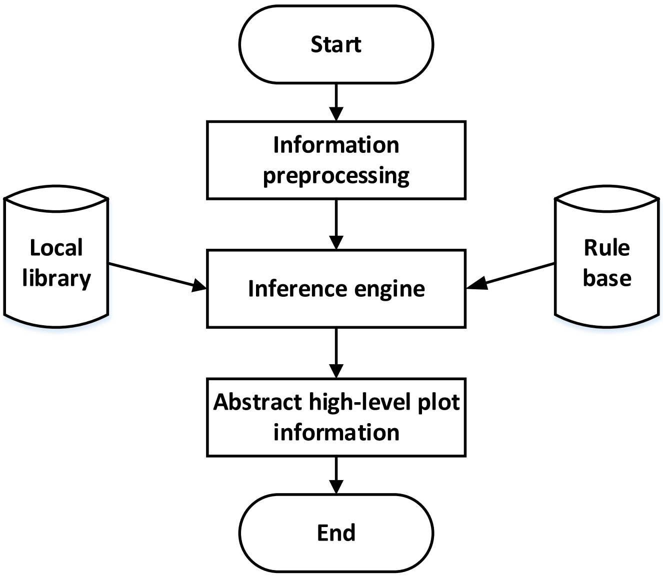

Figure 1. Situational reasoning process

3.1 Acquisition and Perception of Context Information

Context awareness is considered an enabling technique for ubiquitous computing systems. Context awareness is used to design innovative user interfaces and is often used as part of ubiquitous and wearable computing. With the advent of hybrid search engines, it has also begun to be applied on the Internet. This article has also done a lot of work to reduce the distribution of situational information and design a transparent middleware solution. These solutions are designed to enable situation management and discovery in mobile systems. By analyzing the methods and practical choices in the development process of the main stage of the situational awareness process, several situation-based location-based service system evaluation systems are provided, which utilize the situational reasoning and utilization of big data. The acquisition and perception of context information is mainly the perception and capture of the environment information of the learners in the mobile learning space. Perceived learner context information mainly includes two types of advanced context information and low level context information. Among them, the underlying scene information is mainly through various sensors on the smart mobile terminal. Such as GPS, ultrasound and infrared to perform a series of original scene information. Such as the current study time, the location of the learner and other information. The advanced context information refers to the current learner's learning activity information, learning history information, and learning preferences and learning habits. The acquisition of advanced context information is more difficult and more complex than the acquisition of low-level context information. It needs to be obtained indirectly through computer video tools, data analysis tools, image processing tools, and so on. And low-level situational awareness information can be interpreted by artificial intelligence tools to be converted into advanced context information.

3.2 Reasoning and Utilization of Situational Information

Scenario modeling is at the heart of building a situational awareness system. It defines the learner's contextual information in a systematically identifiable form of processing. Its purpose is mainly to make the device understand the current situation of the user. Effective use of context information by the system is the ultimate goal of situational awareness. Contextual reasoning and utilization mainly refers to finding the association of these situational information from multiple contexts, making reasonable reasoning, thus combining multiple contextual information, and finally providing the learner with composite contextual information. At the same time, scene reasoning and utilization also includes explicit context information from sensor acquisition or learner input to derive more implicit context information. The reasoning of the scene data mainly realizes the separation of the inference layer code from the database. The reasoning of the perception scenario analyzes the pre-processed scene data of the sensor acquisition layer. The rules of the perceptual context database are then invoked to derive the learner's existing state or the state that is about to occur. Declare the state, and finally provide the learner with the most appropriate learning service by calling the controller. Scenario-aware reasoning theory is often used in context-aware reasoning, that is, using the IF-THEN theory. The statement in the IF is taken as a condition, and the statement in the EHRN is the conclusion. The value of the object is defined as a triple in contextual reasoning in the corresponding context:

$$CV = \langle O, C, V \rangle \tag{1}$$

Where C refers to context information for an object typically containing one or more contextual information for an object. The set of context information is:

$$C = \{cxt_1, cxt_2, \cdots, cxt_n\}(n \geq 1) \tag{2}$$

The user-based collaborative filtering algorithm is based on the assumption of the relationship between users. If a group of users makes a similar assessment of a product or service, their assessment of other products or services should be similar. With this assumption, after obtaining a similar evaluation of some users of the same product, it can be inferred that some users in the group also like products that other users like. User-based collaborative filtering algorithms are usually divided into two steps to implement recommendations. The first step is to find a group of users who have similar interests to the recommended users. If the positive feedback product sets for users U and V are N(u) and N(v), then the interest similarity is marked as:

$$\omega_{u,v} = \frac{|N(u) \cap N(v)|}{|N(u) \cup N(v)|} \tag{3}$$

The second step is to find the products that the user likes in this collection and recommend products or services that the referee cannot find. The number of target customer segments in the algorithm should be considered experimentally. If the user group is too small, there will be a problem that the information accuracy is low. If the user base is too large, it is easy to produce recommended hot products. The recommended coverage is reduced and it is easy to cause personality.

4. Context-Aware Online Learning System Model Construction

The online learning path planning method proposed in this paper aims to plan an effective learning path that suits the user's learning style and conforms to the actual learning process. Help users achieve their career goals effectively, thereby increasing user satisfaction and addressing online learning. Therefore, the verification of the online learning path planning method mainly includes two parts of the learning path that conform to the user learning style and user satisfaction. The experiment has been tested on the experimental user. It can be clearly seen that as the number of iterations increases, these three methods will continue to draw a higher learning path with higher user satisfaction and gradually stabilize after reaching a certain height. It can be seen that for users with different learning styles, these three methods can plan online learning paths for users. However, it can be seen from the experimental results of the user that after 50 iterations, the result of the scene information method proposed in this paper is better than the other two. In other words, the learning path planning method proposed in this paper can obtain higher users. Satisfy. Secondly, compare the learning paths obtained by the three methods, and take the user as an example to evaluate the matching degree between the learning path and the user learning style. As shown in Table 1, the similarity between the learning path and the learning style is the average of the similarities of the five nodes. It can be seen from the results that the learning path of the situation information method planning is more in line with the user's learning style.

Table 1. Similarities between learning paths and learning styles

Method	Learning path					Suitability
	Node 1	Node 2	Node 3	Node 4	Node 5	
Situational information	0.72	0.72	0.78	0.74	0.83	0.75
GA	0.60	0.89	0.71	0.68	0.78	0.71
ACO	0.72	0.83	0.80	0.61	0.85	0.73

In order to further verify the validity of learning style-based context information in solving online learning path planning problems, the experimental results are compared with the results of GA and ACO algorithms. For the objectivity of the experiment, the experiment still uses the experimental user in Figure 2 as the test object, and tests the effectiveness of the method. All experimental results were obtained after 75 iterations.

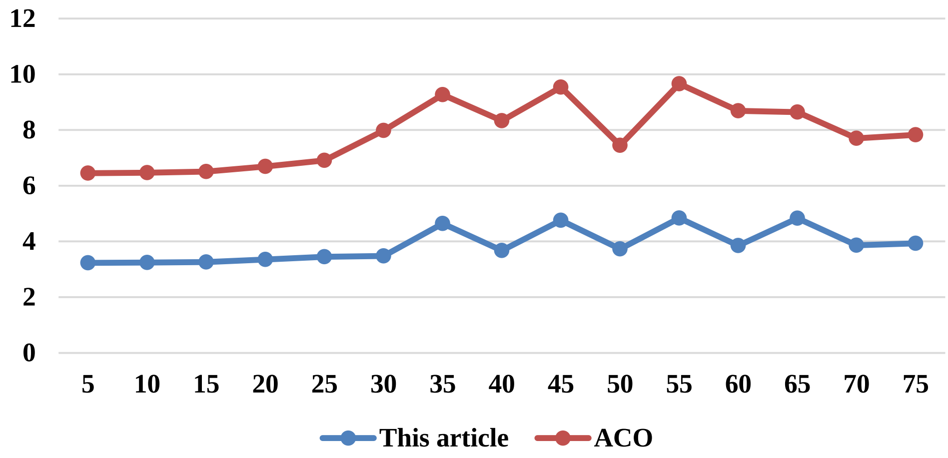

Figure 2. Experimental results of three methods for users from 1 to 75 iterations

The user selects the recommended knowledge point from the recommendation list, and then selects the function of generating the learning path, and the system generates a prior knowledge of the knowledge point and a learning path composed of the knowledge. This requires recursive addition of senior knowledge to the learning path until all senior knowledge has been added. Pioneer knowledge points can be found by learning the pioneering relationships between content. The learning path is usually a directed acyclic graph, so the loops in the graph are detected and eliminated when the learning path is generated.

5.Conclusion

Situational awareness is an important part of the concept of smart space and has become the core technology for personalization and automated learning services. The application of context-aware technology in the mobile learning resource recommendation system can not only extend the personalized learning service model of mobile learning, but also effectively improve the personalized learning experience, enhance the teaching and service capabilities of the distance education platform, and promote mobile learning. Personalized learning services. Based on the structure of adaptive learning path recommendation system and the steps of context awareness, this paper expounds the design ideas of context-aware application and adaptive learning recommendation system, and proposes that context awareness is the basis of adaptive recommendation. Only the learner's situational awareness learning is fully understood. In order to better recommend learning paths and resources for them. Adhering to the idea of situational awareness and learning process, the learner model and knowledge model are designed based on the user model reference specification.

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