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Ubiquitous Learning Logs Analytics

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Abstract: This paper describes a system that can be used to visualize and analyze some ubiquitous learning logs to discover several learning patterns and trends. Visualization and analysis of the system are based on vast amount of learning data in ubiquitous learning environment. Ubiquitous Learning Log (ULL) is defined as a digital record of what learners have learned in the daily life using ubiquitous technologies. It allows learners to log their learning experiences with photos, audios, videos, location, RFID tag and sensor data, and to share and to reuse ULL with others. This paper will reveal about the relationship between the ubiquitous learning logs and learners by using network graph.

Keywords: ubiquitous learning, network graph, time-map, information visualization

1. Introduction

Recently, researchers in the educational engineering area have been studying focusing on ubiquitous themes. For example, CSUL (Computer Supported Ubiquitous Learning) or context aware ubiquitous learning (u-Learning) have been constructed using computing technologies such as mobile devices, QR-code, RFID tag and wireless sensor networks (Hwang et al., 2008; Ogata & Yano, 2004). These learnings take place in a variety of learning space such as classroom, home and museum.

Also, these learning dataset include spatiotemporal data. Spatiotemporal data usually contain the states of an object, an event or a position in space over a period of time. These datasets might be collected at different locations, various time points in different formats. It poses many challenges in representing, processing, analysis and mining of dataset due to complex structure of spatiotemporal objects and the relationships among them in both spatial and temporal dimensions (K.Venkateswara Rao et al., 2011, 2012).

Similarly, it poses many issues about relationship between the learners and the ubiquitous learning logs due to complex structure of the ubiquitous learning logs in SCROLL. In addition, it is important for learners to recognize what and how they have learned by analyzing and visualizing the past ULLs, so that they can improve what and how to learn in future (Ogata et al., 2011). To tackle these issues, it is necessary to reveal relationships between the learners and the ubiquitous learning logs.

Therefore, this paper proposes a method to visualize and analyze relationships between the learners and the ubiquitous learning logs using Time-map and network graph.

2. Related Works

2.1 Learning Analytics and Knowledge

In recent years, Learning Analytics and Knowledge (LAK) has been drawing an attention from researchers of such fields as educational engineering, information science and network science. To date, Course Management System (CMS) and Learning Management System (LMS) enabled us to record learners' access logs onto server. The Learning Analytics (LA) aims for practical use based on learning mechanisms revealed by visualizing, mining and analyzing vast amount of learning data (Ferguson 2012). This paper focuses on the Social Learning Analytics (SLA), a subset of the LAK (Buckingham 2012). The SLA puts forward presenting appropriate information to learners at the appropriate timing

through the Dashboard in real time. As a new challenge, this paper aims to reveal about relationships between learners and learning logs on spatiotemporal fields.

2.2 Time-map

Time-map is a library of javascript, which collaborated with Google maps and SIMILE (Semantic Interoperability of Metadata and Information in unLike Environments) TimeLine (SIMILE project). SIMILE focuses on developing robust, open source tools that empower users to access, manage, visualize and reuse digital assets. The time-map function means that the user can scroll the timeline and then the Google maps will display the learning logs recorded during learners' selected period. It is designed to help learners to reflect what they have learned. For example, if a learner clicks his learning logs on timeline, Google maps will display their positions as shown in Figure 1.

Figure 1. Time-map

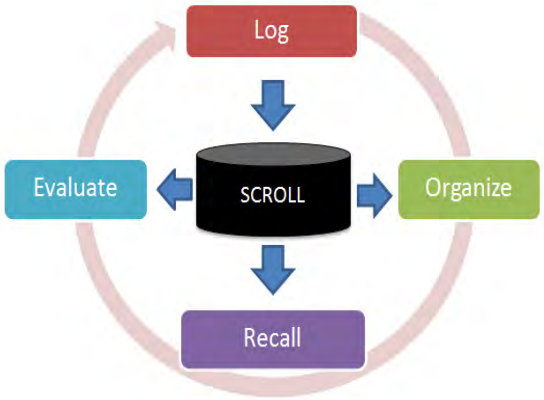

Figure 2. LORE model in SCROLL

3. Design of the system

3.1 SCROLL

One of the objectives of SCROLL is to support international students in Japan to learn Japanese language from what they have learned formal and informal setting. It adopts an approach of sharing user created contents among users and is constructed based on a LORE (Log-Organize-Recall-Evaluate) model which is shown in Figure 2 (Ogata et al., 2011).

3.2 Collecting a ubiquitous learning log on SCROLL

The learners can record some learning language such as English, Japanese and Chinese with a photo using android device and SCROLL as shown in Figure 3.

Figure 3. An example of adding a ULLO

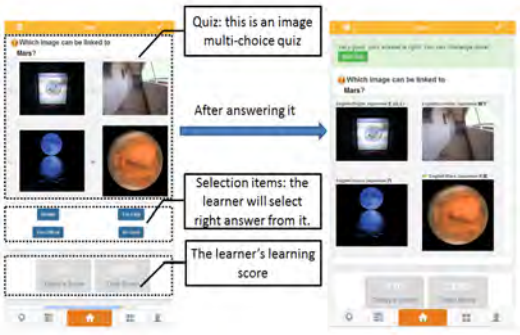

Figure 4. Quiz function

The learning log includes meta-data such as author, language, created time, location (latitude and longitude) and tag. The learners will record or review a learning log using these functions on

android device. Such iterative learning is supported by our quiz function on SCROLL. There are three types of quizzes generated automatically by the system, which are yes/no quiz, text multiple-choice quiz and image multiple-choice quiz. Figure 4 shows an image multiple-choice quiz interface generated automatically based on the meta-data of ULLs.

3.3 Structure based on network graph in SCROLL

To reveal several relationships between the learners and knowledge or knowledge and location, we have uniquely defined them as three-layers structures as shown in Figure 5.

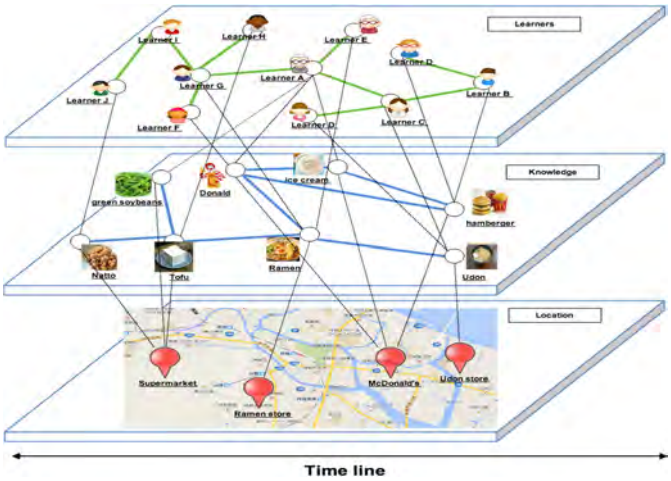

Figure 5. Three-layer structure in SCROLL

The upper layer contains each author in order to confirm position of own or other learners.

The intermediate layer contains the knowledge that learners learned. Also, some fields of learning tasks can be included in this layer. For example, some task-based learning in ubiquitous learning environment can be carried out using knowledge and event. The scalability of the layers can be enhanced and the field of visualization can be widened by linking one's own learning logs to the knowledge learned by doing tasks.

The lowest layer contains data such as location and time. In order to realize spatiotemporal visualization of our learning logs, nodes on the intermediate layer are linked to the nodes on the lowest layer using Time-map.

4. Implementation

This section describes ways of the implementation of the system for visualizing the three-layer structure using network graph using Time-map.

4.1 System for visualizing network graph in SCROLL

The interface of the network graph on web browser is shown as Figure 6. The learners can recognize relationships between own/others author and knowledge by using the network graph interface. The learners' node (green or blue node) on the network graph is connected to many knowledge (yellow node) in accordance with node color.

Recommendation objects in Figure 6 are shown rankings in the learning trends in order to expand a field of their view from visualized ubiquitous learning logs on the network graph. By arranging the in-degree centrality in the high order from the ubiquitous learning logs that they might study in the next learning session, the learners are able to recognize famous or representative learners and important knowledge.

Time-map function in Figure 6 consists of the timeline and Google maps. It represents the shift of learning history in accordance with lapse of time. The learners might forget the learning logs when and where they have learned before. Therefore, the system can remind the learners of them by combining timeline with map. The system will remind them of their learning logs recorded during the specified period of time by showing them on the timeline (default: two month before and after the

setting time). Besides, the system will lead them to be aware of knowledge recorded right before or after the knowledge of their interest which was recorded by other learners. Therefore, it will give them a hint on what to learn in the next learning session.

Figure 6. System interface

5. Conclusion and Future work

This paper described the system for visualizing relationships between the learners and the learning logs. International students can add their knowledge as the learning log in SCROLL, and then SCROLL can provide learning contents to recall what they learned based on their learning contexts.

In the future, we will develop a new function so that the system can analyze various situations focusing learning analytics such as network analysis, decision tree and association rule.

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