Ogata, H. et al. (Eds.) (2015). Proceedings of the 23rd International Conference on Computers in Education. China: Asia-Pacific Society for Computers in Education

Supporting Real-world Language Learning Based on Ubiquitous Learning Analytics

Kousuke Mouri [1], Hiroaki Ogata[2] , Noriko Uosaki[3]
[1,2]*Faculty of Arts and Science and the Graduate School of Information Science and Electrical Engineering, University of Kyushu, Japan*
[3]*Center for International Education and Exchange, Osaka University, Japan*
*{mourikousuke, hiroaki.ogata, n.uosaki}@gmail.com

Abstract: This paper proposes a visualization and analysis system called VASCORLL (Visualization and Analysis system for COnnecting Relationships of Learning Logs) in order to link learners in the real world and learning logs that are accumulated in a cyber space by a ubiquitous learning system called SCROLL (System for Capturing and Reminding of Learning Log). Learning materials provided by ubiquitous learning systems are in most cases, prepared by teachers or instructional designers. It makes it difficult to find relationships between a learner and other learners in different contexts. Using VASCORLL, learners can find other contexts where can be applied to their own learning experiences. This paper describes the design, the implementation of VASCORLL.

Keywords: ubiquitous learning log, network graph, time-map, social network analysis

1. Introduction

Ubiquitous learning has been paid attentions in educational research over the world. For example, CSUL or u-learning has been constructed using ubiquitous technologies such as mobile devices, RFID tags, QR codes and wireless networks (Yin et al., 2004, 2010). These types of learning takes place not only in-class learning but also in a variety of out-class learning space such as homes, libraries and museums (Uosaki et al., 2013).

Mouri et al. (2014, 2015) proposed an innovative visualization system for analyzing learning logs in order to reveal relationships between learners in the real world and learning logs in the cyber space. However, their idea was visualization of the collected data and they did not analyze nor mine their data. In addition, it is difficult to find relationships between a learner and other learners in different contexts.

Therefore, this paper proposes a visualization and analysis system called VASCORLL (Visualization and Analysis system for Connecting Relationships of Learning Log). VASCORLL works in a cyber-physical setting to link learners in the real world and learning logs that are accumulated in cyber spaces by using a ubiquitous learning system called SCROLL (Ogata et al., 2011). This paper describes the design and the implementation of VASCORLL

2. Related Works

2.1 Collocational Network

Collocational networks are two-dimensional networks that contain interlinked collocation, i.e. words that occur together in a text. For example, Willaims et al. (1998) use the network as a corpus linguistic tool in order to create specialized dictionaries. For linguists, the relationships between words are important information. However, for learners in an informal setting it is also important to grasp information such as other learners' nationalities, age, gender, learning places and time connected to what they have learned. VASCORLL could link learners' contexts in real world and past learners' contexts that are accumulated in cyber space.

2.2 Geographical information system and Time-map

A geographic information system (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present all types of spatial or geographical data. By mapping learning information on the map on the system, learners can easily reflect on what and where they have learned. However, previous GIS did not take time line into consideration when learners reflect on what they have learned. To tackle these issues, Johnson and Wilson (2009) developed a visualization tool of handling temporal data within a GIS framework called Time-map. Time-map consists of the time line and Google Maps. It represents the shift of learning history in accordance with the lapse of time.

This visualization method can find individual learning information on the spatio-temporal dimensions, but VASCORLL can find relationships in different contexts among learners by combining Time-map with network graph.

3. System Design

Figure 1 shows the workflow to feedback them after visualizing and analyzing ULLs by VASCORLL in a cyber-physical setting.

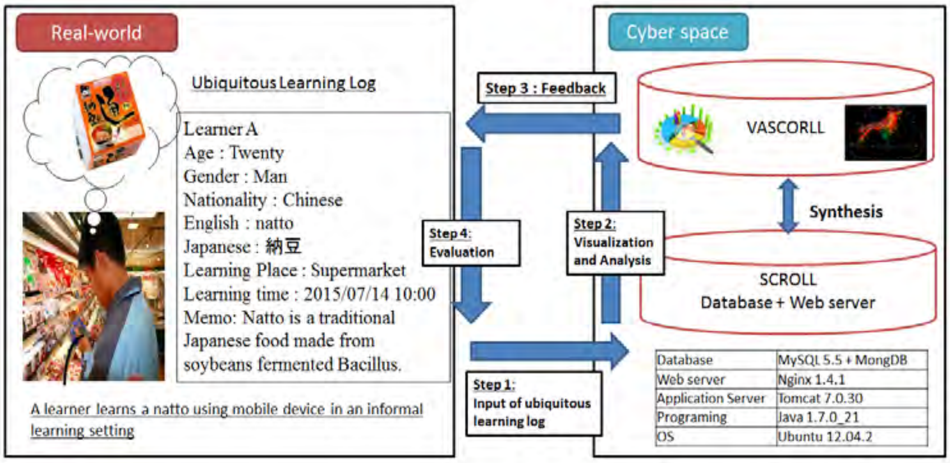


Figure 1. How SCROLL and VASCORLL works

The workflow shows the following four steps:

Step1. Learners can save their experiences as ULLs with photos and videos using mobile device or desktop PC and SCROLL. The ULL includes the author name, language, time of creation, location (latitude and longitude), learning place and tags. For example, if a learner learns a natto at the supermarket, the saved ULL will be accumulated into the cyber space.

Step2. Learners do not have means to know whether their knowledge can be applied to other learning environments or not. VASCORLL allows learners to find knowledge that can be applied into different contexts, by visualizing and analyzing a large amount of ULLs that are accumulated in the cyber space.

Step3. VASCORLL feedbacks important relationships such as the most frequently learned place and time zone from the results of step 2.

Step4. It is important to recognize who is learning what, and when, where and how, so that learners can understand how their own knowledge is used in other contexts. Therefore, VASCORLL supports learners to apply their own experiences to other contexts, and directly learn more information from there (Mouri et al., 2012, 2013).

All the above workflow can be supported by SCROLL and VASCORLL.

4. Implementation

4.1 Visualization system

The interface combining network graph and time-map for visualizing complex relationships among ULLs is shown in Figure 2 (left). It contains of the following components:

- Network graph: The layout in Figure 2 (left) shows a sample of the original layout. Figure 2 (right) shows the enlarged network graph. In the case of this figure, learners can grasp that the target word (natto) is the most similar to tofu by calculating based on cosine similarity. Similarly, learners can grasp that the natto is the most similar to some contexts such as Supermarket (the place where they frequently learns about natto) and night (the time zone when they frequently learns about natto).
- Time-Map: Learners might forget their learning logs when and where they have learned before. Therefore, the system will remind them of their learning logs recorded during the specified period of time by showing them on the timeline. Also, the network graph and time map functions are linked each other. For example, if a learner clicks a certain node on the network graph, the time map will show the location and time corresponding to it. Therefore, learners can obtain its location and time information.

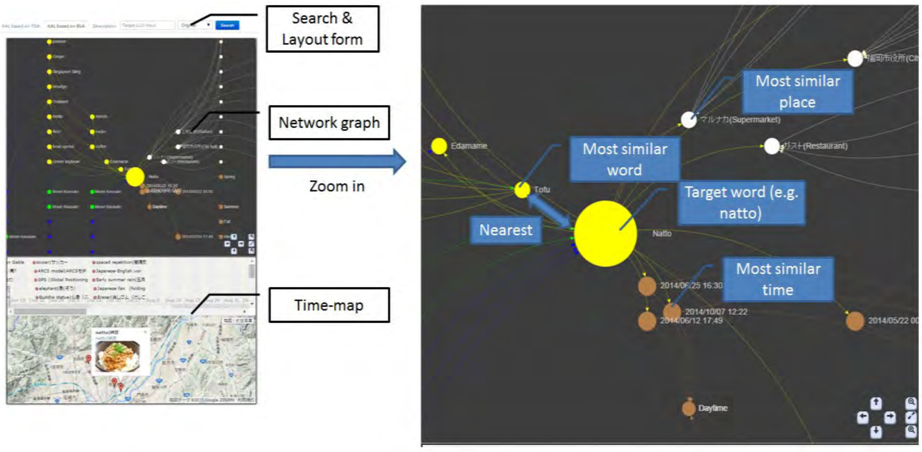
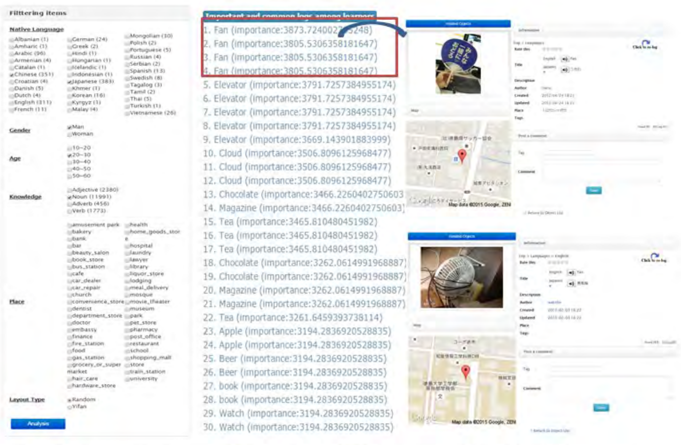


Figure 2. Visualization interface

4.2 Analysis interface

Figure 3 shows the analysis interface of VASCORLL. Firstly, learners will conduct some filtering works in order to find relationships between themselves and other learners as shown in Figure 3(1). For example, if learners want to find relationships among learners whose native language is Japanese, they will check "Japanese" in checkbox on Filtering item. Hereby, VASCORLL will be set to find ULLs of learners whose native language is Japanese. Similarly, VASCORLL allows them to set filtering according to such parameters as gender, age, knowledge (e.g. noun, verb, adverb and adjective) and learning place (e.g. University and Supermarket).



(1) Filtering setting (2) Recommended logs (3) ULLs among learners

Figure 3. Analysis interface

After filtering, VASCORLL provides relationships among ULLs to learners as shown in Figure 3(2). Figure 3(3) shows relationships among international students whose native language is Chinese. The recommended ULLs are calculated based on social network analysis such as degree centrality, closeness centrality and betweenness centrality. By learning these ULLs, learners can grasp relationships of knowledge in different contexts. For example, there is a ULL where an international student learned "fan" at the university in the past. It means “扇風機” (mechanical fan) in Japanese. There is another ULL where another international student learned the same word, "fan" in a different context in the past. In this case it means “うちわ” (Uchiwa is a round, flat paper fan with a wooden or plastic handle.)" in Japanese. Even if the English word is the same, the meaning might be different if the context is different. By using VASCORLL, they can learn such relationships that they cannot obtain from textbook-learning.

5. Conclusion

In order to link learners in the real world and learning logs accumulated in cyber space by a ubiquitous learning system called SCROLL, this paper proposes a visualization and analysis system called VASCORLL. VASCORLL will find relationships between learners' contexts in real world and past learners' contexts in cyber space, and then recommend knowledge that can be applied into other contexts to learners in the real world.

In the future, we will consider evaluating whether how much learning opportunities affect by using VASCROLL and whether learning logs that are recommended by VASCORLL is appropriate for learners.

Acknowledgements

This part of this research work was supported by the Grant-in-Aid for Scientific Research No.25282059, No.26560122, No.25540091 and No.26350319 from the Ministry of Education, Culture, Sports, Science and Technology (MEXT) in Japan. The research results have been partly achieved by “Research and Development on Fundamental and Utilization Technologies for Social Big Data” (178A03), the Commissioned Research of National Institute of Information and Communications Technology (NICT), Japan.

References

Ogata, H., Li, M., Bin, H., Uosaki, N., El-Bishoutly, M., & Yano, Y. (2011). SCROLL: Supporting to share and reuse ubiquitous learning logs in the context of language learning, *Research and Practice on Technology Enhanced Learning,* 6(3), 69-82.

Ogata, H., Hou, B., Li, M., Uosaki, N., Mouri, K & Liu, S. (2014). Ubiquitous Learning Project Using Life-logging Technology in Japan, *Educational Technology and Society Journal*, 17(2), 85-100.

Williams, G. (1998). Collocational Networks: Interlocking Pattern of Lexis in a Corpus of Plant Biology Research Articles, *International Journal of Corpus Linguistics 3*, 151-171.

Johnson I. and Wilson A (2009). The TimeMap Project: Developing Time-Based GIS Display for Cultural data, *Journal of GIS in Archaeology 1*, 123-135.

Mouri, K., Ogata, H., Li, M., Hou, B. and Uosaki, N. (2012). Learning Log Navigator: Augmented awareness past learning experiences, *proceedings of 2012 IIAI International Conference*, 159-162.

Mouri, K., Ogata, H., Li, M., Hou, B., Uosaki, N., & Liu, S. (2013). Learning Log Navigator: Supporting Task-based Learning Using Ubiquitous Learning Logs, *Journal of Research and Practice on Technology Enhanced Learning (RPTEL)*, 8(1), 117－128.

Mouri, K., Ogata, H., Uosaki, N. and Liu, S. (2014). Visualizaiton for analyzing Ubiquitous Learning Logs, *Proceedings of the 22nd International Conference on Computers in Education (ICCE 2014)*, 461-470.

Mouri, K., Ogata, H. and Uosaki, N. (2015). Ubiquitous Learning Analytics in the Context of Real-world Language Learning, *International conference on Learning Analytics and Knowledge (LAK 2015) ACM*, 378-382.

Yin, C., Ogata, H. and Yano, Y. (2004). JAPELAS: Supporting Japanese polite expressions learning using PDA(s) towards ubiquitous learning, *The Journal of Information and Systems in Education*, 3(1), 33-39.

Yin, C., Ogata H., Tabata, Y. and Yano, Y. (2010). Supporting the acquisition of Japanese polite expressions in context-aware ubiquitous learning, *Internationl Journal of Mobile Learning and Organisation*, 4(2), 214-234.

Uosaki, N., Ogata, H., Li, M., Hou, B. and Mouri, K. (2013). Guidelines on Implementing Successful Seamless Learning Environments, *International Journal of Interactive Mobile Technologie*s, 7(2), 44-53.