INNOVATION IN LANGUAGE LEARNING International Conference

Development of a Recommendation Panel for Wordhyve Language Learning App

Mohammad Nehal Hasnine[1], Junji Wu[3], Masatoshi Ishikawa[2], Hiroshi Ueda[1]

[1]Research Center for Computing and Multimedia Studies, Hosei University, Japan
[2]Faculty of Business Administration Tokyo Seitoku University, Japan
[3]Communication Engineering Department, Waseda University, Japan

Abstract

To language learners, vocabulary is an inseparable component of a foreign language as, without significant vocabularies, it is rather difficult to read, write, and communicate. Wordhyve is a ubiquitous language learning app that assists foreign language learners in enhancing foreign vocabulary using various authentic informal learning contexts. Wordhyve allows the users to capture and record information linked with each learning activity as the learning log using its ubiquitous functions. Later, the analytics of the Wordhyve app analyzes the logs for generating incidental vocabularies for broadening vocabulary learning opportunities. In this paper, a new feature for the app, namely Wordhyve Recommendation Panel, is developed to recommend incidental vocabularies and smartly-generated learning contexts. In the app, incidental vocabularies and smartly-generated learning contexts are generated by detecting the objects found and analyzing the scenes of an image that a learner uploaded to memorize an intentional vocabulary. The recommendation panel lets the learner choose which incidental vocabularies to put aside for study next and which of the smartly-generated learning contexts to use for memorizing a word. The image analytics of Wordhyve relies on object detection and automatic image captioning technologies. The strategy used to build Wordhyve's analytical functions is to use an intentional learning log as the trigger to generate multiple incidental vocabularies that a learner could learn in the future.

Keywords: *Context-aware application, Image analytics, Incidental vocabulary, Language learning, Learning contexts, Wordhyve.*

1. Introduction

Vocabulary or word learning is an important aspect of language learning. Obtaining a significant amount is necessary to become a master in a language. However, vocabulary learning is very challenging to language learners because vocabulary is often not taught in the classroom; rather, it is given as homework to learn using informal learning strategies. Also, newly learned words are easy to forget. Therefore, many strategies, including multimedia effect [1], spacing effect, concept map [2], picture superiority effect, and interactive imagery, are used in mobile-assisted and ubiquitous learning apps. Images are used as a multimedia annotation to create word learning materials in mobile-assisted and ubiquitous learning apps. One key reason is that an image conveys its meaning or essence more effectively than verbal descriptions. Due to this, images could trigger learners on a cognitive level. In this regard, scholars found that word memorization with both labels and pictures is beneficial and more effective than vocabulary acquisition with labels only [3]. The dual-coding theory introduced by Paivio [4] also suggests that visual and verbal information are processed in different parts of the brain. Hence, it is necessary to analyze the contents of the images, particularly the images taken from various authentic informal learning contexts such as while studying abroad, traveling to a foreign county, encountering interesting objects, and meaningful contexts that involve real-world problems. With the popularity of smartphones, capturing and recording these authentic informal learning contexts has become easier than ever. Language learners often store this contextual information in mobile-assisted and ubiquitous learning apps as intentional vocabulary learning logs. Wordhyve is a language learning app that allows language learners to capture their incidental vocabulary learning logs [5]. The analytics of the Wordhyve app uses that log information for understanding learners learning behaviour and feedback at the right time and right place to facilitate vocabulary learning [5].

1.2 Contribution of this paper

This project aims to facilitate language learners in learning foreign vocabularies using multimedia annotations (such as images, translation, pronunciation) and contextual clues (including learning contexts). In this regard, we developed Wordhyve app, a native android app for language learners. In this paper, we improved the existing analytics of the Wordhyve app by newly adding a recommendation panel. In this recommendation panel, we recommend incidental vocabularies (refer to 3.2) and smartly-generated learning contexts (refer to 3.2).

2. Wordhyve language learning app

2.1 Profile creation

The first step to use this language learning app is to create a profile in the app (UIs shown in Fig.1.). At present, a profile can be created for free. For creating a profile, a user needs to input standard user information such as name, email address, gender, DOB, etc. In addition, it is required to input native language, target language(s), places that a learner often uses to study a foreign language, and location information (automatically detected using Google Place API). The apps analytics uses that information to analyze a learner's learning behaviours for feedbacking in the right time and right place.

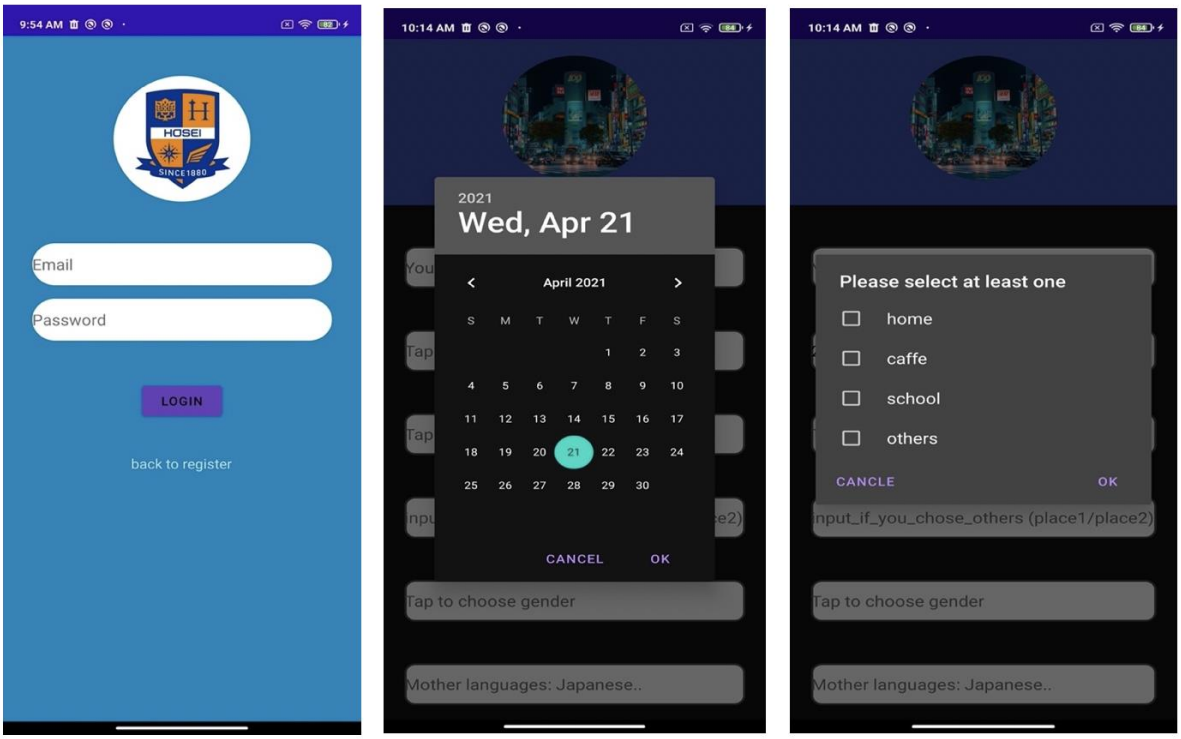

Fig.1. Profile creation in Wordhyve

2.2 Creating an intentional vocabulary learning log in Wordhyve

After creating an account and logging in, the app will direct the user to the log creation UI (refer to Fig.2.). In this UI, a learner can create an intentional vocabulary learning log by inputting the word to memorize, an image to represent the word, and the context information where the learning has taken place.

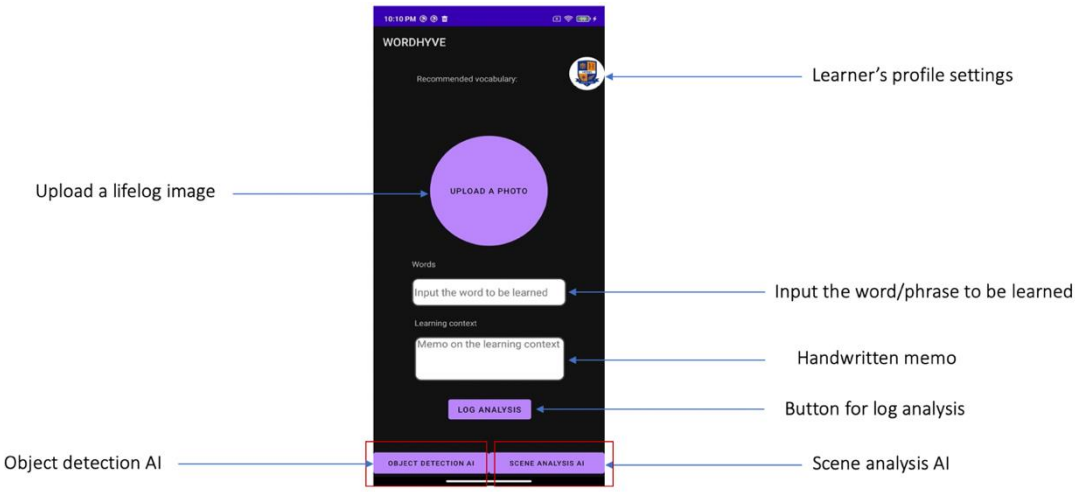

Fig.2. Log creation UI

3. Concept and methodologies

3.1 Incidental vocabularies

In this study, incidental vocabularies refer to objects found in the image uploaded in creating an intentional vocabulary learning log. For example (referring to the log presented in Figure 3), a learner wants to learn 'train' in a foreign language as the intentional vocabulary. When creating a log in the Wordhyve app for the word 'train', s/he requires uploading a lifelog image captured using his/her smartphone. Once the log is created, the app's analytics uses image understanding mechanisms to extract those objects by scene analysis method. In this case, the analytics detects and recommends the objects such as 'track', 'outdoor', 'transport', 'engine', 'traveling', and 'railroad'. This research addresses words such as 'track', 'outdoor', 'transport', 'engine', 'traveling', and 'railroad' as the incidental vocabulary. From a list of words, the learner decides which vocabularies to be saved for memorizing in the future.

3.2 Smartly-generated learning contexts

In this study, Smartly-generated Learning Contexts (SLC) are those that our SLC generation model generates. The SLC model employs automatic image captioning technology on the image that was uploaded in creating an intentional vocabulary learning log. For example (taken Figure 3 into account), when the learner wants to memorize the word 'train' using the app, the app asks the learner to describe the learning context when the learning takes place (in this case, the dark color train in very classy). At present, to recommend smartly-generated learning contexts, the app analyses the scene of the image used to create the learning log. In the case of Figure 3, the app generates 'a train on the railway tracks' as the smartly-generated learning context. Depending on the scenes, the app may suggest up to three SLCs as alternatives to the handwritten description of the learning context. Then, the learner decides which of the smartly-generated learning contexts to use.

3.3 Development of the Wordhyve's Recommendation Panel

Table 2 shows the technical details of the recommendation panel.

Table 2. Underlying technologies

Spec.	Details
Image analysis model 1	Microsoft cognitive vision services
Image analysis model 2	Megvi's deep learning APIs
Platform (OS)	Android
Programming language	Kotlin
Database	Firebase
Location services	Google Place APIs

Fig.3. shows the way incidental vocabularies and smartly-generated learning contexts are recommended. In this recommendation panel, for example, when a learner creates a log for an

intentional vocabulary ‘train’, the system analyzes the image using image analytics and generates multiple new vocabularies such as ‘track’, ‘engine’, ‘railroad’, which we refer to as the incidental vocabularies. Wordhyve recommends such incidental vocabularies instantly to the learner and lets a learner decide to be learned those incidental vocabularies or not. The system stores all the incidental vocabularies as learning records for the words to be learned in the future.

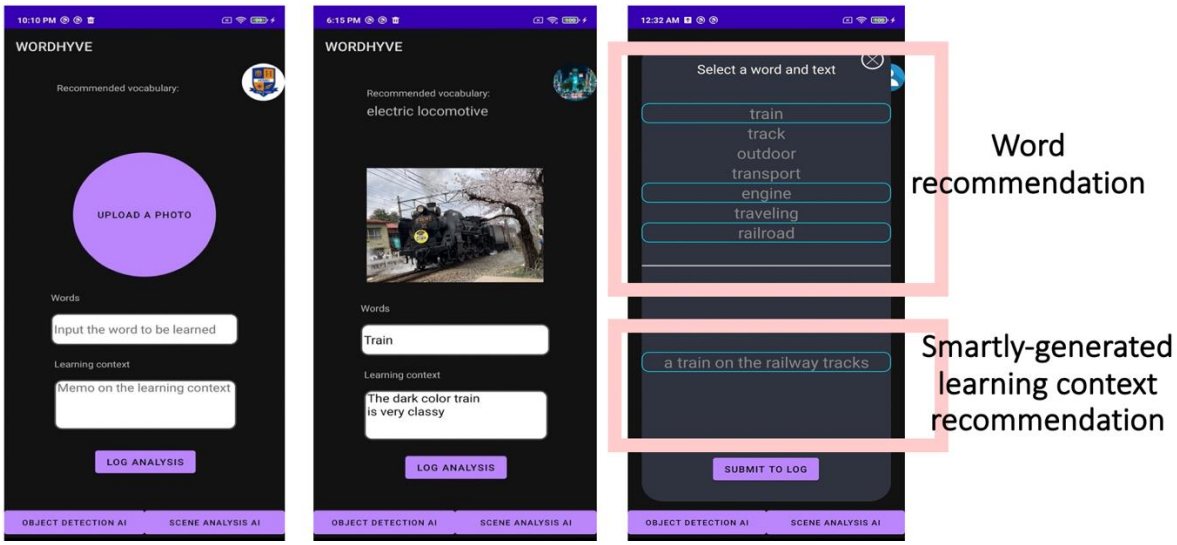

Fig.3. The Wordhyve recommendation panel

4. Summary

Incidental vocabulary learning involves a foreign language learner learning new words from various learning contexts and contextual clues. The research aims to understand noun learning through incidental means, the relationship of objects found in lifelog images and incidental vocabulary learning, and the strategies that could promote the incidental learning of vocabulary along with intentional vocabulary learning. As of now, many theories and strategies, including extensive reading, television watching, retention from captioned audio-visual input, etc., have tried to account for the specific way that this type of acquisition takes place. However, learning incidental vocabulary depends on the type of cognitive process in which the learner is engaged. Conventional language learning apps such as Appropriate Image-based Vocabulary Acquisition System [6], Image Understanding Ecosystem [7], and Incidental Vocabulary Learning System [8] have massive limitations in supporting incidental vocabulary learning and describing learning contexts. Most of the existing apps are developed to support intentional vocabulary learning. In addition, to describe a learning context for each vocabulary to learn, conventional apps require the learner to type each learning context in the system. To solve these limitations, we developed a context-aware language learning app called Wordhyve. This paper developed a recommendation panel that relies on cutting-edge image analytics to generate and recommend multiple incidental vocabularies and several smartly-generated learning contexts. At present, the Wordhyve app uses Microsoft cognitive vision services and Megvi’s deep learning APIs for image-to-object detection and scene description tasks. Also, the app uses Google place APIs to detect a learner's learning locations. To measure the recommendation panel’s efficacy, i) short-term and long-term memory retention and ii) the acceptance ratio of the Wordhyve recommended incidental vocabularies by the learner will be assessed in the future.

References

[1] Y. Yeh and C. Wang, “Effects of multimedia vocabulary annotations and learning styles on vocabulary learning,” Calico Journal, pp. 131–144, 2003.
[2] C.-C. Chiou, L.-C. Tien, and L.-T. Lee, “Effects on learning of multimedia animation combined with multidimensional concept maps,” Computers & Education, vol. 80, pp. 211–223, 2015.
[3] C.-C. Lin and Y.-C. Yu, “Effects of presentation modes on mobile-assisted vocabulary learning and cognitive load,” Interactive Learning Environments, vol. 25, no. 4, pp. 528–542, 2017.
[4] A. Paivio, Mental representations: A dual coding approach. Oxford University Press, 1990.
[5] M. N. Hasnine and J. Wu, “Wordhyve: A context-aware language learning app for vocabulary enhancement through images and learning contexts”, In the Proceedings of 25th International Conference on Knowledge-Based and Intelligent Information & Engineering Systems, Procedia Computer Science, vol. 192, pp. 3432-3439, 2021.
[6] M. N. Hasnine, Y. Hirai, M. Ishikawa, H. Miyakoda, and K. Kaneko, “A vocabulary learning system by on-demand creation of multilinguistic materials based on appropriate images,” Proceedings of the 2014 e-Case & e-Tech, pp. 343–356, 2014.
[7] M. N. Hasnine, G. Akçapınar, K. Mouri, and H. Ueda, “An Intelligent Ubiquitous Learning Environment and Analytics on Images for Contextual Factors Analysis,” Applied Sciences, vol. 10, no. 24, p. 8996, 2020.
[8] M. N. Hasnine, K. Mouri, G. Akcapinar, M. M. H. Ahmed, and H. Ueda, “A New Technology Design for Personalized Incidental Vocabulary Learning using Lifelog Image Analysis,” Proceedings of the 28th International Conference on Computers in Education (ICCE2020), pp.516-521, 2020

Acknowledgement

This project is supported by Japan Society for the Promotion of Science (JSPS) Grant-in-Aid for Young Scientists 21K13651.