CS486C – Senior Capstone Design in Computer Science

Project Description

Project Title: AR Object Detection and Text Recognition for Language Learning	
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Project Overview:

Imagine you want to learn a new language. You've seen the different online systems that show the English and the other language word, and you may have even been provided a voice/verbal presentation of the word. However, what if you could see the item, or select it from a virtual reality "shelf", hear its word or view its spelling in the other language and then try it for yourself. Or better, look around yourself in augmented reality, point at or refer to some object, and then hear its name in the language you are learning.

Computers and computing systems can take us there but it hasn't really happened yet. Consider the following.

1. **Vocabulary learning technology**

Online and mobile applications for vocabulary learning such as Quizlet and Memrise, are increasingly popular tools for language learners who wish to broaden their lexicon. However, these applications focus on the textual form and meaning relationship, leaving out the audible and physical realms. Such tools may work well for some learners, but pose problems for very beginners who might not have the ability to navigate in a foreign language or for individuals who have difficulties with text. For example, if a person is learning a new alphabet such as Korean, finding the right word for "lamp" instead of "light" might be quite difficult unless they can connect the written form to the exact meaning visually.

To this end, this project proposal aims to leverage computational advances in object detection and optical character recognition (OCR) and Augmented Reality to allow language learners to identify objects and text in their surroundings in order to learn its meaning and use in both textual and audible forms.

2. **Our team**

Our team has been working in Computer-Assisted Language Learning (CALL) for several years and has noticed the lack of mobile tools for foreign language learners that both focuses recent advances in AR and sound pedagogy in language learning. We have experience researching second language acquisition in computerized contexts and developing internet-based language learning applications for a wide variety of learners.

3. **Current solutions for object detection and OCR learning**

- They are either cumbersome applications for OCR or object detection, rarely combining both.
- Widely available apps and tools that focus on language learning do not incorporate OCR or object detection technology.
- Few vocabulary learning resources focus on all key elements of word learning (meaning, use, and form).

4. **Solution overview**

We envision a web app optimized for mobile devices that allows a simple interface for:

- Opening the user's camera, perhaps in live / video mode for full AR implementation
- The ability to scan objects or text in the user's surroundings
- Trigger an object detection or OCR library (could be toggled between two modes)
- Identify the object / word on their screen
- Link to a word learning page with a web-sources definition, image, and audio example. The language learning resources will be supplied by us and include an open-source dictionary, a word in use guide, and pronunciation link
- The user should then be able to return to the scanning screen and start again

We can also envision two stretch goals:

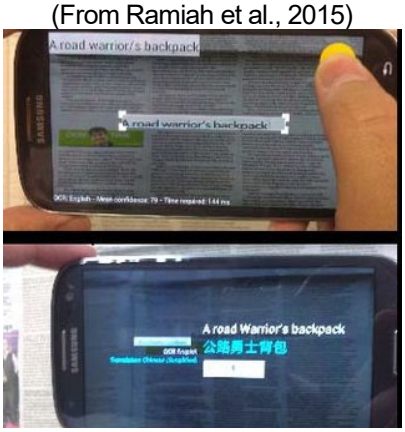
- A method for users to save a list of the words they looked up and return to the word learning page for each
- A language selector to choose the target language (English, Korean, Spanish, and French would be our first target languages)

5. **Impact of successful product**

The project would allow us to distribute this as a learning tool to learners, teachers, and researchers as a free and beneficial tool for beginning learners and those who have challenges in working with text. We would be able to distribute it to language learning students at NAU and other institutions globally.

Object Detection Sample
(From Kozik & Marchewka, 2013)

OCR Sample
(From Ramiah et al., 2015)



Knowledge, skills, and expertise required for this project:

- Familiarity with object detection and/or optical character recognition programming libraries
- Experience in building a mobile-friendly multimedia web app
- Experience in programming for content in other languages

Equipment Requirements:

- There should be no equipment or software required other than a development platform and software/tools freely available online.
- As we would like the web app to be mobile-friendly, no app store developer accounts will be necessary.

Software and other Deliverables:

- An AR web app that is mobile-compatible and has object detection and text recognition (could be two different modes).
- A click or tappable link for object / text identified that leads to a learning resource page.
- A strong as-built report detailing the design and implementation of the product in a complete, clear and professional manner. This document should provide a strong basis for future development of the product.
- Complete professionally-documented codebase, delivered both as a repository in GitHub, BitBucket, or some other version control repository; and as a physical archive on a USB drive.