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An Environment-Triggered Augmented-Reality Application for Learning Case Grammar

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Abstract: We present a handheld Augmented-Reality app that enables learners of German to study case grammar using real objects in their surroundings. The system can easily be integrated into the everyday life of busy learners and provides them with a means to study on their own. Specifically, the app detects objects in the learners' surroundings and determines their spatial relationship. It then automatically generates quizzes to test dative and accusative cases. The app provides an example of how structural concepts of languages can be taught with AR.

Keywords: Augmented Reality; Case Grammar; Language Learning; Ubiquitous Learning

1 Introduction

Augmented Reality (AR) is considered a promising technology for supporting learning because AR learning systems can provide timely context-relevant content in a real-world setting [SK18]. Moreover, AR is suitable for visualizing spatial or temporal concepts and for learners to actively engage with learning content [BD12]. For example, in language learning, ARbis Pictus used AR goggles to show foreign-language labels [Ib18]. This led to more successful learning than a flashcard-based learning approach. Grammatical aspects of language were enhanced in a previous project of ours [Dr20]: we introduced a handheld AR app for studying grammatical gender and the dative case in German. We used markers to detect objects and their spatial relationship in the learners' surroundings to construct sentence quizzes. In the current project, we extend this approach with automated object detection and additional variation in quizzes.

2 Concept and Implementation

In this demo, we utilize the affordance of AR for visualizing spatial relationships and apply it to challenging aspects of the German language: grammatical gender and case grammar. Specifically, we automatically identify objects in the learners' surroundings and use them to create multiple-choice quizzes: we build a sentence describing the relative position of two objects where learners need to select the article that (1) has the grammatical gender of the second object and (2) is correctly inflected in dative or accusative case. The interaction with the learners' surroundings increases contextual relevance and most likely also the motivation for learning.

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The app was built for Android devices in order to reach a wide audience. It uses the back camera to continuously scan and identify objects learners point the device at. It shows a live camera preview and augments it with labels of detected objects (see Figure 1). The camera image is processed in a Tensorflow Lite Object detection[2] workflow using a model trained on the Common Objects in Context (COCO) data set[3], which contains 80 object classes. Labels are shown when the confidence threshold for a detected object is reached. As soon as a learner has selected two labels (i.e., objects) on the screen, their relative position is computed and a quiz is shown at the bottom of the screen (see Figure 2).

Thus, to summarize, with our novel app, learners can practice challenging aspects of the German language whenever and wherever it suits them. With slight changes, such an app would also be suitable for studying similar problems, such as cases in other languages.

Fig. 1: Screenshot AR Case Grammar Learner

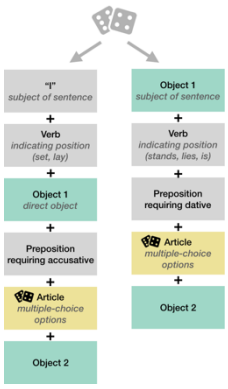

Fig. 2: Quiz Generation Process

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