
Graduate School of Science and Engineering, Aoyama Gakuin University

Title: Validity verification as an evaluation index of thought time in voice dialogue car navigation system

Student Name: Yuki Shida

ID Number: 35616156

Degree: Master of Engineering

Course: Intelligence Information

Thesis Advisor: Guillaume Lopez

Abstract

In recent years, vehicles equipped with in-vehicle infotainment system are popular. These systems are particularly attractive because voice-activated systems provide key information to the users without requiring distractive manual interactions with the system. In research on in-car speech recognition systems, the speech recognition time is used as an important parameter to compare the performance of two different car navigation systems. Normally, this is done by evaluating their performances when the users are actually driving. In reality, however, the recognition time of the task may fluctuate due to external factors such as the driving situation or speech misrecognition. Thus, it is not fair to compare the performances of two systems unless these discrepancies are resolved.

In this research, we aim to clarify whether it could be possible to solve this problem by taking into consideration the time a user spends thinking about tasks he/she is considering performing and to evaluate the effectiveness of this approach. We attempt to estimate the user's thinking time by comparing the response of the cerebral blood flow while thinking to that of the cerebral blood flow while thinking about car navigation. We define that section as thinking time and we use it to compare the performance of speech-controlled car navigation systems.

To estimate the user's thinking time, we use a One-Class Support Vector Machine (OC-SVM) for error value estimation. The OC-SVM can calculate scores using a classifier and detect abnormal data. In this experiment, abnormal value data was added to the data at the time of thinking, and the boundary between the thought and the abnormal value score was determined. In the car navigation operation task with a driving simulator, subjects set the destination according to the tasks that were asked. Then, we conducted a questionnaire survey.

The result of this study shows that, by applying OC-SVM to the thinking section, about 79% was considered as thinking time. Moreover, when applied to the thought time during the car navigation operation task, about 81% was classified as thinking time. By compared this thinking time for each car navigation system, we found relationships between car navigation systems and questionnaire results. This suggests that including thinking time improves the accuracy in comparing two voice-controlled navigation systems.