

MERIT Internship Report

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Outline

- Period

November 6 - December 8, 2023

- Place

Minato MIRAI Innovation Center, Murata Manufacturing Co., Ltd.

- Theme

Research on extraction of desired signals in biological signals

Background

Driver monitoring systems (DMS) are becoming important to consider for the full automation of automobiles. If the driver's health disorder is affected based on biometric signals, it is necessary to immediately issue an alert and stop the car. Since delays in alerting can lead to delays in saving lives, the system must be able to always monitor the driver's health status. However, when driving a car, noises caused by road conditions, weather, and use of the car are mixed in. There is a need to study methodologies that enable the monitoring of biometric information even in such harsh measurement environments.

The technique to analyze and process the obtained signals is called signal processing. The removal of noise mixed with the above-mentioned signals is one of the important themes in the field of signal processing. When the noise varies greatly from situation to situation, its removal is difficult because the nature of the noise cannot be assumed. An adaptive noise canceller is a noise reduction configuration that can be used in such cases. Adaptive noise cancellers are widely applicable to realistic situations because they work without making any assumptions about the nature of the noise and can follow the nature of the noise even if it changes during the process.

Research Details

Since the specific results of this research are confidential, this section provides an overview of the research process.

In this study, we aimed to improve the noise reduction capability of adaptive noise cancellers in more realistic situations by theoretically investigating the methodological aspects of adaptive noise cancellers. For this purpose, we examined whether noise reduction can be achieved by applying a novel algorithm that has already been proposed for the adaptive noise

canceller. Based on this examination, we went on to propose a method that could potentially improve the noise reduction capability. In the final week of the month-long internship, I gave a presentation summarizing my research, reported the results to the people in the company, and received feedback on my research.

Impressions

The most important purpose of this internship for me personally was to experience how I could apply the abilities that I had developed through my research to a research project at a company such as a manufacturer. At university, I researched the basic theory of quantum thermodynamics, and I suppose that I would have to deal with themes different from my current core area of expertise in my research at a company. In fact, during this internship, I spent a month conducting research in signal processing, an area that I had never studied before. In the process, I was able to create and evaluate a program based on an existing algorithm, and based on the results, I was even able to propose an improved method. Through this experience, I was able to realize that the mathematical skills that I had cultivated, as well as the ability to examine themes and come up with ideas, could be utilized in other fields as well.

In addition, the Minato MIRAI Innovation Center, which hosted me, provided an excellent environment for conducting research work, so I was able to devote myself to my research in almost the same way that I normally do. In this respect, as far as theoretical research is concerned, I felt that there is not much difference in ease of research between a company and a university institution if the facilities and a research leader who can be present are in place.

Acknowledgments

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