Title of Project： Restructuring human sciences based on decoding of emotional information

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Number of Research Area：21B101　Researcher Number：40456108

【Purpose of the Research Project】

In humanities disciplines such as psychology, linguistics, economics, and aesthetics, models of mental processes are created from human behavior and their records. In such models, it is important to understand how emotions affect human behavior, but it has not been easy to directly measure how individuals "feel" and thus to directly incorporate the function of emotions into models.

Functional MRI is a method that can measure brain activity of a living person, and is known to be a safe method with no concerns about radiation exposure. In recent years, advances in analysis techniques using machine learning have made it possible to estimate an individual's emotional state from brain activity (Chikazoe et al., 2014; Pham et al., 2021), but the technical hurdles to analysis are high.

In this research area, Dr. Chikazoe, an expert in functional MRI research using machine learning, will take the lead in creating a new academic framework for understanding language, economics, and art from emotion, in cooperation with Dr. Mochihashi, an expert in natural language processing, Dr. Watanabe, an expert in microeconomics, and Dr. Ishizu, an expert in aesthetics.

【Content of the Research Project】

The goal of this Research Area is to reconstruct humanities disciplines with a focus on emotional information. In order to achieve this goal, this area is divided into four Research Areas: "Elucidation of the integrated processing process of ambivalent value information using functional MRI (A01)," "Brain science of language and art that brings about emotion (A02)," "Estimation of a lightweight economic structural model of emotional influence (A03)," and "Cognitive Neuroscience Examination of Aesthetic Experiences Beyond Pleasure and Displeasure and Their Psychological Effects (A04). Based on the hypothesis that affective values, i.e., pleasant and unpleasant emotions, are diverted to economic judgments of gain and loss, Dr. Chikazoe (A01) uses stimuli that simultaneously induce pleasant and unpleasant emotions (ambivalent values) to clarify the universality of the integrated processing process of value information in eating, economic, and moral judgments. Dr. Mochihashi (A02) focuses on language arts as a subjective expression of emotions, and clarifies the emotional functions of language by using natural language processing and brain imaging in a complementary manner. Dr. Watanabe (A03) measures the brain activity of two subjects during an economic game such as an auction using a two-individual simultaneous measurement MRI system, and uses an econometric approach to model the influence of emotional states estimated from brain activity on decision making. Dr. Ishizu (A04) will focus on "sadness and beauty," a mixed aesthetic experience, and clarify the emotions that constitute sadness and beauty. Furthermore, he will elucidate the neural basis of grief and sorrow and its impact on human-like altruistic and self-defeating decision-making. What is common to all planned research is that emotional information, which has been difficult to observe directly in the humanities, is decoded from brain activity and incorporated into the model as a variable (Fig. 1). The visualization of emotional information is made possible by advanced measurement equipment and state-of-the-art brain function image analysis technology that makes full use of machine learning.
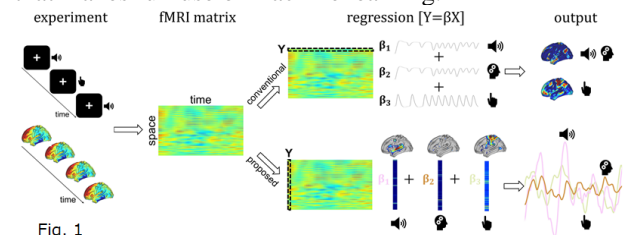

Fig. 1

【Expected Research Achievements and Scientific Significance】

Up to now, brain research in the humanities has aimed to find brain regions that function in correspondence with concepts proposed in the respective fields (ethical conflicts, economic rationality, etc.). In the end, however, it was a matter of translating abstract concepts into concrete structures such as the brain, and while this was interesting research, it did not have the impact that would significantly advance the discipline itself. In this research area, we aim to present a new model and a new concept in the humanities based on emotional information decoded from brain activity. This approach will enable us to design economic systems, such as auctions, that are optimized for human emotional responses, and we will promote research with an awareness of feedback to the real world.

【Key Words】

Machine learning: The use of computer systems that are able to learn and adapt without following explicit instructions, by using algorithms and statistical models to analyze and draw inferences from patterns in data.

【Term of Project】FY2021-2023
【Budget Allocation】103,900 Thousand Yen
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