

## Analysis of Brain Activities due to Differences in Running Shoe Properties

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**Abstract :** Many of the ever-growing elderly population require exercise, such as running, for health management. One important element of a runner's training is the choice of shoes for exercise; shoes are important because they provide the interface between the feet and road. When we purchase shoes, we may instinctively choose a pair after trying on many different pairs of shoes. Selecting the shoes instinctively may work, but it does not guarantee a suitable fit for running activities. Therefore, if we could select suitable shoes for each runner from the viewpoint of brain activities, it would be helpful for validating shoe selection. In this paper, we describe how brain activities show different characteristics during particular task, corresponding to different properties of shoes. Using five subjects, we performed a verification experiment, applying weight, softness, and flexibility as shoe properties. In order to affect the shoe property's differences to the brain, subjects run for ten min. Before and after running, subjects conducted a paced auditory serial addition task (PASAT) as the particular task; and the subjects' brain activities during the PASAT are evaluated based on oxyhemoglobin and deoxyhemoglobin relative concentration changes, measured by near-infrared spectroscopy (NIRS). When the brain works actively, oxihemoglobin and deoxyhemoglobin concentration drastically changes; therefore, we calculate the maximum values of concentration changes. In order to normalize relative concentration changes after running, the maximum value are divided by before running maximum value as evaluation parameters. The classification of the groups of shoes is expressed on a self-organizing map (SOM). As a result, deoxyhemoglobin can make clusters for two of the three types of shoes.

**Keywords :** brain activities, NIRS, PASAT, running shoes

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