Brain Activity Measurement by fMRI and NIRS at the Rehabilitation Training

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Abstract
Recently, the number of stroke patient has been increasing in many countries including Japan according to aging of population. Besides the number of physical therapist (PT) has not increased despite of the aging of society and the absence of PT is one of the social problem. Therefore an own forcing training is required on behalf of externally forcing training by PT. Biophilia institute made some devices for rehabilitation, which device called “Pata-Koro”, and it is reported that the devices are valid for own forcing training. In this study the purpose is to measure brain activity by fMRI and NIRS at the rehabilitation training. First, we perform image processing MRI image and NIRS image at the rehabilitation training. Next, the correspondence relation of fMRI image and NIRS image is discussed and the feature of rehabilitation score of fMRI and NIRS. Since fMRI is ill-suited for fMRI inspection because we cannot bring the devices of rehabilitation at the inspection, and we decide the use of NIRS for measurement at rehabilitation. Final goal of this study is to analyze the time-dependent change of brain function by rehabilitation effect using NIRS.

Method
In this research, we perform image processing for fMRI images. The MRI images of healthy persons are used for the image processing in this paper. The image is saved as BMP file with 24 bit RGB format. Three images are taken from one person; one is the image at the rest, one is the image at external forcing training and another is the image at own forcing training. In fMRI some colors are superimposed on the brain image according to the activation level of each part of brain. The inactivated regions are not colored, the slightly activated region is colored by green, and the strongly activated region is colored by red. First, we extract a brain shape from the original image at the rest. Next, green regions of the image are extracted from G component image in the original image, and red regions are extracted from R component image. Finally, we superimpose the extracted G and R image onto the MRI image without color function.

Result
Figure 1 shows one of the results of this study. Figure 1 (a) shows fMRI image, (b) shows only green parts of the original image, (c) shows only red part, and (d) shows that the extracted green and red parts are superimposed onto the brain image. At the external forcing training to left leg, we find that a part of the right side of brain is activated. Besides at the own forcing training, we confirmed that a part near the center was activated.

Future Work
In the further work we perform the image processing of NIRS image and compare the results of NIRS with ones of fMRI. Moreover we will try to discuss about time-dependent change according to difference of rehabilitation methods.

![Fig.1: Extraction result of each region from fMRI image](image-url)