Human 3D Visual Perception

Project Leader

SHIGEMASU Hiroaki, Ph.D.

Associate Professor, Information Systems Engineering

1. Objective

This project aims to investigate how humans perceive the three-dimensional world, using psychophysical and functional brain imaging methods. The findings from this project will be applicable to the effective and efficient creation of 3D presentations of virtual and augmented reality environments; such presentations which will not cause uncomfortable effects such as 3D sickness. As this project also investigates the functions of cortical areas regarding depth perception, this project can contribute to the intelligent, efficient sensing of human brain activity for the construction of brain-computer interface systems.

2. Project Outline

(a) Psychophysical study of human vision

Perceptual characteristics of 3D vision, especially for depth order between multiple objects and for the 3D shape of objects, will be investigated to reveal how two dimensional retinal images are converted into 3D perception. Depth cue interaction, stereo scaling problem (inversed square law), and depth contrast effects will be investigated using a 3D projector, an electromagnetic tracking system (Polhemus Fastrak), and an eye tracker (SR Research Eye Link 2).

(b) Study of functional brain imaging in humans

Using multi voxel pattern analysis (MVPA), decoding of relatively higher level of visual perception will be investigated, regarding issues such as depth perception and heading perception, in terms of cortical activity measured by 3T fMRI. EEG may also be used to investigate human depth perception.

3. Expected Performance

In this project, the successful candidate would be expected to:

(a) Work independently on a research topic and develop program for experiments.

(b) Contribute to both behavioral and neuroscience study.

(c) Assist the lab members with the development of programs for experiments.

4. Required Skills and Knowledge

The successful candidate for this project will have the following knowledge and skills:

(a) Programming (Matlab, C/C++, R)

(b) Statistical data analysis

(c) Excellent writing skills

References

(1) Shigemasu, H., and Sato, T. (2012) Effects of the amount of monocular shape information on stereo scaling problem. Japanese Psychological Research, 54(1), 27-37.

(2) Shigemasu, H., Miyawaki, Y., Kamitani, Y. and Kitazaki, M. (2008) Decoding heading directions from human brain activity. The Japanese Journal of Psychonomic Science, 27(9), 121-122.

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https://www.kochi-tech.ac.jp/english/admission/ssp/guideline.html

Contact

E-mail: shigemasu.hiroaki@kochi-tech.ac.jp