

# Applications of Wavelets to the Perception of Visual Information

Hitoshi Arai

The University of Tokyo, Japan

In this lecture we talk about mathematical analysis of information processing in the human visual system. In particular, we describe by means of wavelets how visual illusions related to brightness or color are produced.

The study of visual illusions is an important topic for vision science and psychology, and over the past 100 years, many studies of visual illusions have been made. However, as for several visual illusions, their mechanisms are not yet well understood. So far, in order to study visual illusions, many researchers used psychological methods, neuroscience, neural networks, filtering etc.

In this talk we propose a new computational system modeled after the function of the striate cortex, the so-called "V1", in human's brain. In order to design the system we construct a filter bank by using both a maximal overlapping bi-orthogonal wavelet and some nonlinear processing motivated by visual information processing. By this system we can do several computer simulations which indicate how our visual system produces visual illusions. This mathematical model simulates in a unified way several visual illusions which are produced by information processing in the striate cortex. From these simulations we can describe the mechanism of such visual illusions by using mathematical language.

We also give an application to the digital image processing.

The University of Tokyo

3-8-1 Komaba, Tokyo 153-8914, JAPAN

E-mail address: h-arai@ms.u-tokyo.ac.jp