

Brain-inspired systems & Wireless electronics

Attractive Information Processing in the Brain

Wonder in our brain: Even a newborn baby tracks the mother with his/her eyes. This action occurs unconsciously, and is indispensable for him/her to live in the real world. This type of reaction is categorized into pattern processing, which is observed at various levels in our life related to intuition. At the same time, we can also conduct logic thinking such as arithmetic calculation, which is categorized into symbol processing. The brain performs both of them easily.

Utilizing Brain Principle

Brain-based Engineering: We investigate the principles and mechanisms in a constructive manner to open new engineering by designing and creating useful systems and



Fig.1 : Brain-based radar system and the

devices based on possible brain principles. A system example is an antipersonnel plastic-landmine visualization radar system (Fig.1) consisting of phase-sensitive eyes, using a newly developed wideband and small aperture antenna elements, and a new *brain* specifically suitable for processing complex amplitude.

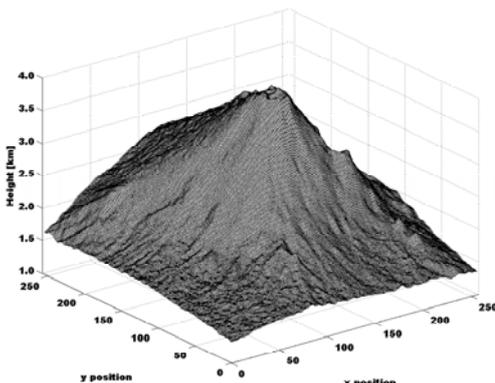
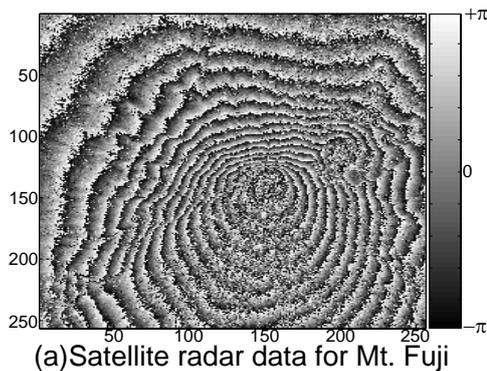
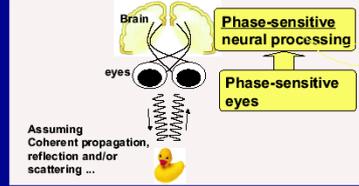
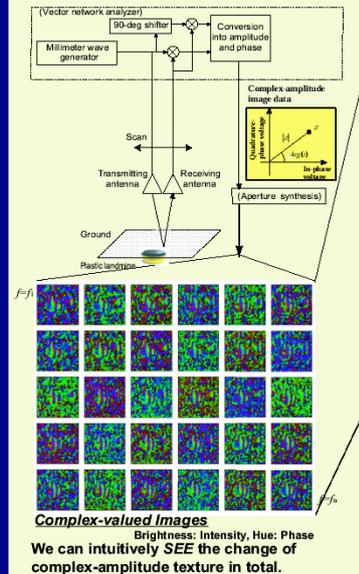


Fig.2 Geoscience with brain processing

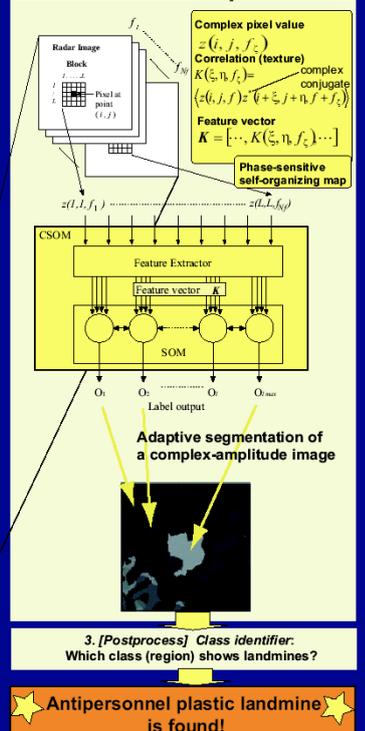
Basic idea: If we had phase-sensitive eyes, in what way would our brain develop?



1. Phase-sensitive Front-end



2. CSOM (Complex-Valued Self-Organizing Map) --- "The Super Brain"



Reference: T.Hara, A.Hirose, Neural Netw., 17, 8-9 (2004) 1201-1210

From Robot to Space

Intelligent eyes useful from local sensing to space / earth observation:

Such extended brain functions are promising in a wide range of engineering fields, e.g., in robot vision and geoscience observation. Figure 2(a) shows fringes obtained by a satellite interferometric radar for Mt. Fuji. Though each fringe looks like a contour, the image contains height-undeterminable points very densely because of unavoidable observation distortion. But you realize that you can catch the rough shape of Mt. Fuji at a glance. We elucidate the "mind's eye" principle and utilize the mechanism to compensate for the distortion and, finally, construct the Mt. Fuji shape in 3 dimension as shown in Fig.2(b). It is useful for disaster prevention. We aim to contribute to the society by creating new adaptive, distributed, and robust systems and devices based on the brain mechanisms so that the people in the world enjoy their safe and secure lives.

Subjects: Intelligent antenna Adaptive antenna and system, Sensing and imaging Security system using millimeter wave and microwave, Antipersonnel plastic landmine radar, Digital elevation map, Text extraction in general scene image, Adaptive processing in optics Dispersion compensation in optical communications, 3D movie generation, Brain processing principles Concept generation, Integration of multimodal information, New brain-like functions apart from flesh-and-blood human being.