A Model of Consciousness and Self Based on Simple Abstracted Brain-Like Neural Network System

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Introduction

From the viewpoint of information processing system design, a model of consciousness and self with simple abstracted brain-like structure using neural network is investigated.
Methods

**First step:** An information processing system that adapts to the environment autonomously is designed. In this design, restraint conditions and basic structure similar to brain are set to the system.

**Second step:** Applying a logical operation based on “what we feel or not” to the system, “self and consciousness” are clearly defined as logical substances that control the system efficiently.

Design conditions

♦ The system must adapt autonomously to a complex environment without a teacher.

♦ When adaptation operation begins, the system has only basic minimum functions corresponding to the instincts of animals. For example, pleasant and unpleasant experiences can be distinguished.

♦ The system must quickly decide upon an action in accordance with the system’s current situation and previous experiences.

♦ The system must use the experienced content as effectively as possible.

♦ Only a minimum amount of resources and energy can be used by the system to adapt.
Fig. 1 Basic configuration of the system
Main functions

♦ The system tries to take actions that again result in a pleasant feeling and to avoid actions that again result in an unpleasant feeling. The system does these actions faster and more adequately through learning.

♦ The system is mainly composed of several functional modules: a concept module, an declarative memory module with associative memory function, and an integration and core control module that connects these modules. The integration part of this module selects the most important combination of concepts in the system at the time on the basis of a mutual vote. This function corresponds to GWT. The core control part of this module only has an active control function and decides whether to act as a system.
Mutual voting (Top level-selection)

Core control

Action planning / Reward prediction

Reward

Explicit memory

Long term memory

Short term memory

Generalized rule memory

Main Body

Fig. 2 Configuration of the system
Consciousness and self in this model

Consciousness and self are useful and logical substances to decide action of the overall system quickly and efficiently. These are logically defined as higher level functions which only use restricted information. Information restriction is executed based on the similar way depending on “what we feel or not”

(Though there is massive information in our brain, we usually feel few restricted information only. Similarly, center operator of a complex computer system uses restricted information to act quickly and efficiently.)

Self is defined as a control function with real world images as input, recollected images and emotional state as own states. This means that “to feel” or “to be conscious” in this model is restricted above input and states.

These input and states are necessary and approximately minimum information to act.
Fig. 3 A skeleton of self and consciousness as logical substances
Recursive self

♦ As direct perception of the own state of the core control module is restricted to emotion, then perception of the declarative content of the own state of the core control module has to go around the other modules. This means that the core control module can only see itself through a mirror and so experiences a recursive self. In addition, the operation of working memories is described as a memory control method applied by the core control module.

Conclusion

♦ A model of consciousness and self is proposed after investigating a neural network system with a simple abstracted brain-like structure that autonomously adapts to its environment. In this model, “self and consciousness” are clearly defined as logical substances that control the system efficiently.