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L-SYSTEM IN CELLULAR AUTOMATA DESIGN OF ARTIFICIAL NEURAL DECISION SYSTEMS

Masanori Sugisaka[1], Mayumi Sato[1], Yong-guang Zhang[2], and John Casti[3]
[1]Oita University, Oita 870-11 Japan
Tel:+81-975-69-3311; Fax:+81-975-69-7035; E-mail:msugi@cc.oita-u.ac.jp
[2]Institute of System Science, Academia Sinica, Beijing, China
Tel:+86-1-255-7250; Fax:+86-1-256-8364; E-mail:yzhang%iss01@iss01.iss.ac.cn
[3]Santa Fe Institute, Santa Fe, New Mexico, USA
Tel:+1-505-983-5044; Fax:+1-505-982-0565; E-mail:casti@santafe.edu

Abstracts This paper considers the applications of cellular automata in order to design self-organizing artificial neural decision systems such as self-organizing neurocomputer circuit, machines, and artificial life VLSI circuits for controlling mechanical systems. We consider the L-system and show the results of growth of plants in artificial life.

Keywords L-system, Artificial neural decision systems, Artificial life

1. INTRODUCTION

We have developed recently a hardware based neural identification method [1],[2],[3] for constructing an artificial neural decision system(AN DS) [4],[5] which performs processing different kinds of information from sensors and make decisions based on internal criteria simultaneously in parallel, with the aid of VLSI neural chips hardware. The configulation of such an ANDS is shown in Fig.1. In this figure, self-organizer decides the structure of the neurocomputers network system and its size, etc., by the criterion generated from the internal crriteria generator according to the sensory inputs received from the surrounding. Based on the results obtained from the neurocomputers network system, the decision maker produces several decisions in parallel.

In our previous papers [4],[5], we discussed briefly how to construct the self-organizer, which generates an appropriate structure of the neurocomputers network system, in order to make decisions. Therefore, in this paper we mainly show the simulation results of L-system and show an application of the results for growing and organizing the neurocomputers network system.

2. SIMULATION OF L-SYSTEM

Let us consider the state-transition rule such that four symbols always tranform in the following manner:

$$0 \longrightarrow 1[0]1[0]0$$

$$1 \longrightarrow 11$$

$$[\longrightarrow [$$

$$] \longrightarrow]$$

we can convert this type of string into a tree-like structure by treating the symbols 0 and 1 as line segments, while regarding the two brackets [and] as branch points. Figure 2 shows the first six generation of such a "plant" obtained by using the L-system grammer given above.

3. APPLICATION OF L-SYSTEM FOR ANDS

In this section, we briefly discuss the application of the L-system for growing or organizing the neurocomputers network system. The simple model shown in Section 2 contains the novel feature that the number of cells in the automaton is allowed to increase with time according to a recipe laid down by the state-transition rule.

In this way the model grows in a manner mimicking the growth of a filamentous plant like the blue-green algae [6]. We can apply a rule, which grows the artificial plant, for designing the self-organizer in order to construct an appropriate neurocomputers network system in the ANDS.

4. CONCLUSIONS

We showed the simulation result of L-system, namely, artificial plant in this paper. Also brief discussions concerning the application of L-system are given for constructing the ANDS. We are now involved in the researches how to apply the cellular automata theory for constructing the self-organizer in both software and hardware.

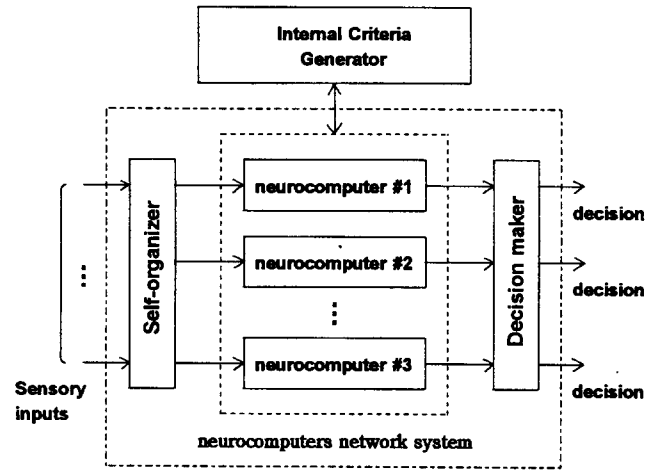

Fig.1 Configulation of an ANDS

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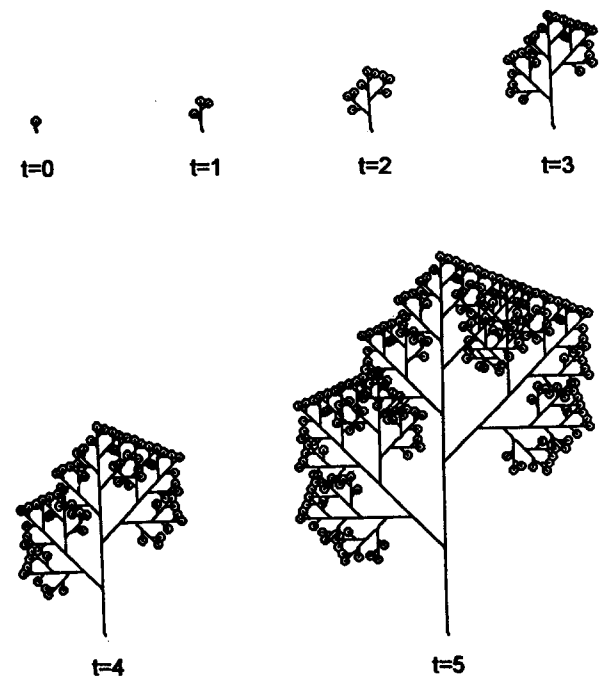

Fig.2 First six generation of plant.