Estimation of Neural Network in Silk Moth

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When a male silk moth senses sexual pheromone of a female partner by using its antenna, it repeats certain series of walking pattern and arrives to the partner (Fig. 1). This walking pattern is generated in lateral accessory lobe (LAL) domain which controls physical exercise. The LAL domain is consist of about 400 neurons and this neural network is transmitting information. Therefore, in this study, we elucidate the process of this behavior by constructing a neural network model of the LAL domain.

If we estimate every individual neural connection, it will be too huge and complex to solve. Therefore, i) we build a model that treats some numbers of neurons as one neuron and ii) estimate strength of each connection between 2 neuron representatives of neuron groups. Concretely, at i), we divide the LAL domain into 10 sub domains (Fig. 2) and at ii), Genetic algorithm (GA) is applied to solve the large-scale problem estimating 45 connection values. We also use the sequence of zigzag walking pattern as an evaluation function. Figure 3 is one example of estimation results. The arrows mean strong connections; the blue allows are excitatory connections and the white ones are inhibitory. In conclusion, it is shown that this approach is appropriate to estimate the neural network which generates zigzag pattern.

Keywords: Mobiligence, neural network

References

1) Sunao Hashimoto, Ryosuke Chiba, Tomoki Kazawa, Ryohei Kanzaki, Jun Ota, "Estimation of LAL Neural Network of Silkworm by Evolutionally Consumption," 20th SICE Symposium on Decentralized Autonomous Systems , p349-p352, 2008 (*in Japanese*).

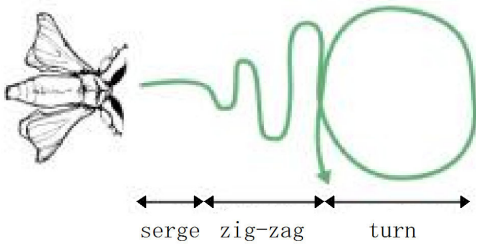

Fig. 1 Walking pattern of silk moth
(Provided by Prof. Kanzaki)

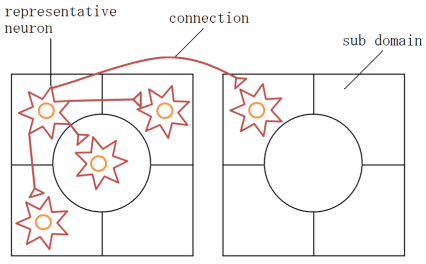

Fig. 2 Model of LAL domain

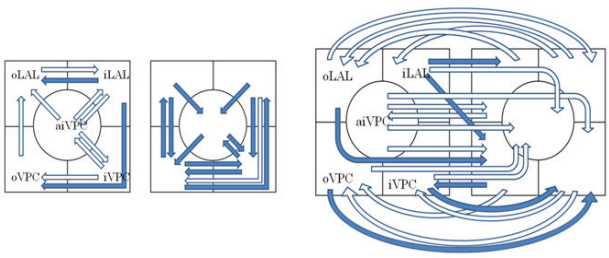

Fig. 3 Estimation result of neural network