Computational Complexity Theory for Neural Networks

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Illustration

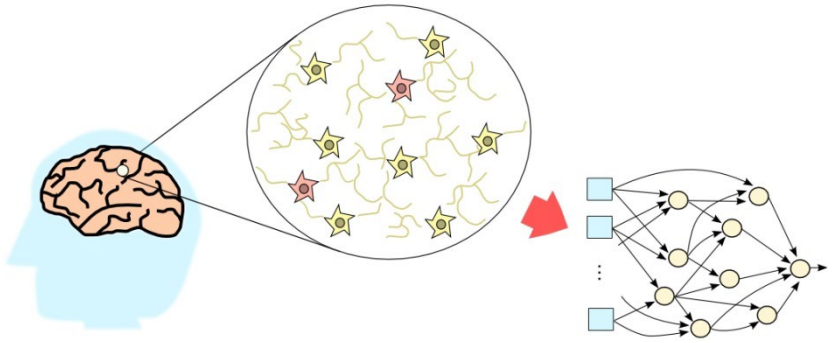

Fig. 1 Modeling a neural circuit as a logic circuit

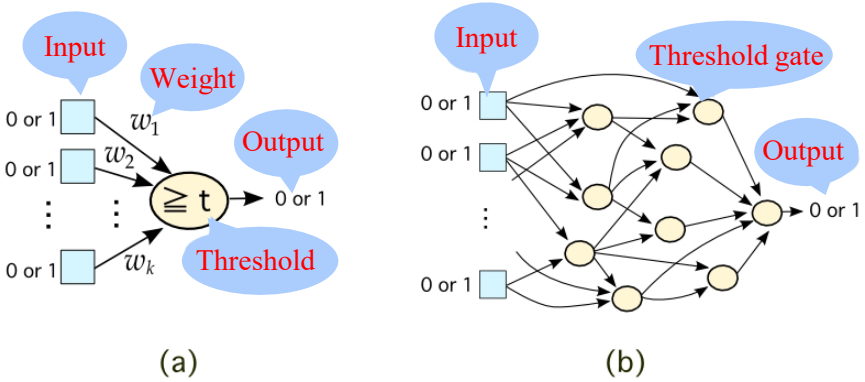

Fig. 2. (a) Threshold gate; and (b) Threshold circuit

Content:

A logic circuit is a computational model, and consists of basic elements called logic gates which output one or zero. While a logic circuit plays central role in standard computers, we can also model a neural network in the brain as a logic circuit, since it also consists of basic elements called neurons which transmits a spike or not (Fig. 1). We can thus investigate neural networks in terms of computational complexity theory. A threshold logic circuit is a simple theoretical model of a neural network, and consists of threshold gates computing linear threshold functions (Fig. 2).

We are interested in the computational power of threshold circuits. In particular, we study what types of information processing is efficiently carried out by threshold circuits, where the efficiency is measured by the number of gates, computation time, energy consumption, etc.

Appealing point:

Our research aim is to understand information processing in the brain from the viewpoint of theoretical computer science.

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Research Interest : Computational complexity

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