Towards a Qualitative Evaluation of Biological Plausibility for Brain-inspired Software

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Challenges for establishing a quantitative evaluation of the biological plausibility of brain-inspired software will be summarized.

In recent years, attempts to learn from the brain and approach general-purpose artificial intelligence have increased. To continue improvements in brain-inspired software, we crave a quantitative index that evaluates whether all or part of the software is appropriate as a brain computation mechanism.

It is reasonable to focus on the level of architecture, which is a neural circuit that produces various computational functions in the brain.

The index of biological plausibility will be calculated through matching between the artificial information flow (AIF) diagram converted from the software and the brain information flow (BIF) diagram converted from the brain architecture. One main challenge is searching for associations between the BIF diagram and the AIF diagram and calculate their similarity.

The ideal BIF diagram is a knowledge base that stores neuroscience findings related to intelligent ability without excess or deficiency. Challenges in BIF diagram construction include addressing insufficiencies in the current neuroscience knowledge and identifying the scope of neuroscience knowledge related to the manifestation of intelligence. For example, structures that change during learning or structures that are too detailed are not very important.

An AIF diagram is obtained by expressing software algorithms as information flowing in the network structure. In general, converting hand-crafted algorithms to a network structure is not easy. It is difficult to add comments of the human-understandable functionality to the structure obtained by learning from data.

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