Commentary

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Applications of Brain-Inspired Computers and Large-Scale Brain Computing Systems Based on Brain-Inspired Chip Development

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Description

The term "brain-inspired computing" refers to computational models and techniques that, as opposed to completely imitating the brain, are primarily based on the mechanism of the brain. The objective is for the machine to be able to mimic human cognitive abilities and coordination mechanisms in a way that is brain-inspired, eventually reaching or exceeding human intelligence. Researchers in artificial intelligence are now aware of the advantages of learning from the information processing mechanism in the brain. Artificial intelligence can learn from the brain's information processing mechanism thanks to advances in neuroscience and brain science. Researchers in the brain and neuroscience are also attempting to apply their knowledge of brain information processing to a wider range of scientific fields.

Information Technology

The push of information technology and smart technology benefits the field's development, and the brain and neuroscience will also inspire the next generation of information technology transformation. Researchers are attempting to reveal the structure of bio-intelligence from various aspects and functional basis thanks to advancements in brain and neuroscience, particularly with the assistance of new technologies and equipment, which enable them to obtain multi-scale, multi-type biological evidence of the brain through a variety of experimental methods. The multi-scale structure and functional mechanisms of brains derived from these experimental and mechanistic studies will provide important inspiration for building a future brain-inspired computing model. These multi-scale structure and functional mechanisms of brains will include everything from the mesoscopic network connection model to the links in the macroscopic brain interval and their synergistic characteristics.

Brain-Inspired Chip

In a broad sense, a brain-inspired chip is one that was designed with the structure and cognitive mode of the human brain in mind. Clearly, the "neuromorphic chip" is a brain-inspired chip that focuses on designing the structure of the chip with the human brain neuron model and its tissue structure in mind. This is a major area of research into brain-inspired chips. Numerous research findings on neuromorphic chips have emerged in tandem with the rise and development of "brain plans" in various nations. These findings have attracted significant international attention and are well-known to academia and the industry. Spinnaker and Brain Scales, supported by the EU, Stanford's Neuroglia, IBM's True North, and Qualcomm's Zeroth, among others IBM has been working on true north, a brain-inspired chip, for nearly ten years. Since 2008, IBM has received funding from the US DARPA program to develop intelligent processing pulsed neural network chips. By simulating brain structures that could learn and process information like the brain, IBM first developed two cognitive silicon prototypes in 2011. Every neuron of a mind motivated chip is cross-associated with gigantic parallelism. "True North," a second-generation brain-inspired chip from IBM, was made available in 2014.

The True North chip's performance has significantly improved over the previous generation of brain-inspired chips, and the number of neurons has increased from 256 to 1 million from 262,144 to 256 million, the number of programmable synapses has increased. Sub synaptic operation with a power consumption of 20 mW per square centimetre and a total power consumption of 70. In the meantime, true north can only handle one-fifth of the nuclear volume of the first generation of brain chips. A neuron computer with 16 true North chips and real-time video processing capabilities is currently being developed by IBM. Since its initial release, the true North chip's exceptionally high indicators and quality have sparked a lot of interest in the academic community. The first chip in the world to support the deep neural network processor architecture chip "Cambrian" was developed in 2012 by the Institute of Computing Technology of the Chinese Academy of Sciences (CAS) and the French Irina. The technology has won the best international conferences in the field of computer architecture, ASPLOS and MICRO, and its design method and performance have been recognized internationally.

The chip can serve as an excellent example of the direction of brain-inspired chip research. Evolution has produced the human brain. Compromises are inevitable during the evolution process,

despite constant optimization of its structure and information processing mechanism. The structure of the cranial nervous system is multi-scale. The mechanism of brain-scale feedback and the fine connection structure of neuron scales are two important issues that remain in the mechanism of information processing at each scale. As a result, it is still extremely challenging to study at the current level of scientific research even if a comprehensive calculation of the number of neurons and synapses is made, which is only one thousandth of the size of the human brain. The research on von Neumann architecture is still the foundation for the majority of the brain-inspired chips that are currently in use, and traditional semiconductor materials are still used for the majority of the chip manufacturing materials. The neural chip is merely borrowing the most fundamental information processing unit in the brain.

The most fundamental computer system, such as the storage and computational fusion mechanism, pulse discharge mechanism, and neuron connection mechanism, Furthermore, the mechanism that connects various scales of information processing units has not been studied in relation to brain-inspired computing architecture. New materials like nanometres are being used to develop neural computing components like brain mersisters, memory containers, and sensory sensors, supporting the construction of more complex brain-inspired computing architectures. This is now a significant international trend. A software environment is also needed to support the wide range of applications of brain-inspired computers and large-scale brain computing systems based on brain-inspired chip development. By using biological systems as a model, behaviour based robotics differentiates itself from conventional AI.

In contrast to the behaviour based approach, classic artificial intelligence typically follows a path based on internal representations of events to solve problems. Behaviour based robotics relies on adaptability rather than utilizing predetermined calculations to deal with a situation. Behaviour based robotics have become commonplace in research and data collection as a result of this development. The majority of behaviour based systems are also reactive, which means that they don't need to be programmed to know what kind of surface the robot is moving on or how a chair looks. All things considered, all the data is gathered from the contribution of the robot's sensors. The robot utilizes that data to bit by bit address its activities as per the progressions in quick climate. Behaviour-based robots (BBRs) typically exhibit more deliberate, biological like actions than their computing-intensive counterparts. A BBR can exhibit the anthropomorphic quality of tenacity while also frequently making mistakes, repeating actions, and appearing confused. Examinations among BBRs and bugs are incessant in light of these activities. Although some have claimed that BBRs are models of all intelligence, they are sometimes regarded as examples of weak artificial intelligence.