Fusing Brain-Inspired Computing and Sensing Devices for Enhanced Intelligent Robotics

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Brain-inspired intelligence, by leveraging the information acquisition and processing mechanisms of biological nervous systems, has emerged as a pivotal technological avenue for advancing artificial intelligence. Within the technical framework of brain-inspired intelligence, brain-inspired computing and brain-inspired sensing technologies constitute two core pillars: Brain-inspired computing devices overcome the inherent memory wall bottleneck of the traditional von Neumann architecture, providing efficient hardware platform for neural network operation with high computational density and low power consumption. Brain-inspired vision chips, on the other hand, deeply emulate the hierarchical processing mechanisms of the human visual system, enabling precise capture of transient information and spatial correlation features in dynamic scenes, thereby significantly enhancing perceptual robustness under complex environmental conditions such as illumination change. Their synergistic integration forms an efficient closed loop from environmental information acquisition to intelligent decision-making, establishing unique advantages for fundamentally elevating the autonomous intelligence of robots.

In this research, we elaborate on the core technical characteristics of the brain-inspired computing chip "Tianjic" [1] and the brain-inspired vision chip "Tianmouc" [2], independently developed by the Center of Brain-inspired Computing Research in Tsinghua University. Leveraging their respective strengths, we constructed a lightweight edge intelligence system, forming a collaborative "Sensing-computing" processing chain [3]. Experiment results demonstrate that this system achieves more robust state estimation and autonomous navigation performance, thereby, enhancing robots' perceptual and adaptive capabilities in complex open environments.

References

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