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# ROBUST EFFICIENT HARDWARE ACCELERATOR FOR NEURAL NETWORK ON EMBEDDED SYSTEM

**Abstract**

The future of spacecraft missions will be populated with intelligent devices that require low-power hardware and a fault-tolerant platform. Deep neural networks are the state-of-the-art technique for machine learning tasks, which can be applied to large areas of application. For example, object detection and classification are mainly based on neural networks. However, these algorithms are both computationally intensive and radiation sensitive, which makes them difficult to deploy on spacecraft missions and also has reliability problems. The effect of radiation caused by a mixture of protons and heavy ions from galactic cosmic rays and solar particle events is responsible for the single bit upset or multiple bit upset which usually occurs in the secondary storage. This effect causes the neural network system to make an incorrect decision because its parameters are stored in secondary storage, which can be avoided by using an error correction algorithm. Unfortunately, this comes at a cost that we need to decode before computation can begin. Therefore, we proposed a system that stores the data in terms of Hadamard code and implements the specialized hardware accelerator to decode this scheme of code and fetch it to the deep neural network engine while maintaining power and time constraints. The Hadamard code, which can correct up to 7 bits per word, is used to send photos of Mars back to Earth from NASA's space probe Mariner 9. By using this, we claim that we have a robust deep neural network system. This paper aims to contribute to maintaining the efficiency of artificial intelligence in space while developing an efficient error-correction decoding system. Specifically, the reliability of the data when performing the machine learning algorithm is evaluated on an embedded system, which is considered the heart of the space missions.

Keyword: Hardware Accelerator, Efficient Decode System, Robust Computation