

EDGE INTELLIGENCE BASED COLLABORATIVE LEARNING APPROACH FOR IOT EDGE

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Abstract

Edge Intelligence based collaborative learning has been recognized as a trending research area. It was noted that the majority of existing collaborative learning approaches were designed in the context of servers or resources with relatively high computational power. Therefore, it was identified that the design and implementation of a system was required to utilize collaborative learning in resource constrained IoT edge.

The existing collaborative learning approaches were critically reviewed and analyzed in order to identify the most ideal collaborative learning approach for the resource constrained IoT edge. The partitioned model training (DNN partitioning) approach was identified as the most ideal collaborative learning approach for the IoT edge. Two training architectures based on the partitioned model training approach were introduced for the resource constrained IoT edge to facilitate collaborative learning in environments with limited and adequate access to edge infrastructure. A lightweight containerization mechanism was utilized to deploy the proposed collaborative learning system and a hybrid deep learning model was utilized to demonstrate the system. Furthermore, an iterative model training mechanism was integrated with the partitioned model training approach to reduce the iterative communication overhead.

The test results and the evaluation of the research proved that the proposed Edge Intelligence based collaborative learning system functioned efficiently with lower CPU/memory consumption, lower power and energy consumption, lower operating temperature and high model accuracy. Some of the future works identified were the integration of a headless mode to perform collaborative learning, testing the applicability of the approach in microcontrollers, testing on IoT devices with dedicated GPU and the integration of a gradient compression mechanism.

keywords: Internet of Things, Edge computing, Artificial intelligence