

Enhancing On-Device Learning in IoT Systems Through Meta-Learning Techniques: A Comprehensive Review

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The incorporation of meta-learning approaches to on-device learning for IoT systems has emerged as one of the effective ways of developing intelligent and never-stopping devices capable of learning and adapting on their own. This study examined the existing literature to highlight the progress, prospects, and potential complications prevalent in this dynamic field. The paper reviews specialized hardware architecture, meta-learning algorithms, and system modularity that support on-device learning in constrained IoT systems. This study investigated several existing methods to enhance on-device learning, such as Federated Learning (FL), Transfer Learning (TL), and Continual Learning (CL) in relation to IoT systems by using meta-learning. It also covered the predictive modeling perspectives, performance assessment, and emerging issues such as privacy, security, and professional ethics. Thus, it synthesized the latest research and current literature to identify gaps in existing knowledge to enhance on-device learning in IoT systems through meta-learning techniques. The findings may enable researchers and practitioners to get insights with a comprehensive understanding of the state-of-the-art, prospects and potential developments of on-device meta-learning in IoT systems, fostering further advancements in this rapidly evolving area of study.

Keywords: *on-device learning, IoT systems, meta-learning, edge computing, resource-constrained devices*