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Abstract: While centralized servers pose a risk of being a single point of failure, decentralized approaches like blockchain offer a compelling solution by implementing a consensus mechanism among multiple entities. Merging distributed computing with cryptographic techniques, decentralized technologies introduce a novel computing paradigm. Blockchain ensures secure, transparent, and tamper-proof data management by validating and recording transactions via consensus across network nodes. Federated Learning (FL), as a distributed machine learning framework, enables participants to collaboratively train models while safeguarding data privacy by avoiding direct raw data exchange. Despite the growing interest in decentralized methods, their application in FL remains underexplored. This paper presents a thorough investigation into blockchain-based FL (BCFL), spotlighting the synergy between blockchain’s security features and FL’s privacy-preserving model training capabilities. First, we present the taxonomy of BCFL from three aspects, including decentralized, separate networks, and reputation-based architectures. Then, we summarize the general architecture of BCFL systems, providing a comprehensive perspective on FL architectures informed by blockchain. Afterward, we analyze the application of BCFL in healthcare, IoT, and other privacy-sensitive areas. Finally, we identify future research directions of BCFL.
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