Abstract: Decentralized Finance, mushrooming in permissionless blockchains, has attracted a recent surge in popularity. Due to the transparency of permissionless blockchains, opportunistic traders can compete to earn revenue by extracting Miner Extractable Value (MEV), which undermines both the consensus security and efficiency of blockchain systems. The Flashbots bundle mechanism further aggravates the MEV competition because it empowers opportunistic traders with the capability of designing more sophisticated MEV extraction. In this paper, we conduct the first systematic study on DeFi MEV activities in Flashbots bundle by developing ActLifter, a novel automated tool for accurately identifying DeFi actions in transactions of each bundle, and ActCluster, a new approach that leverages iterative clustering to facilitate us to discover known/unknown DeFi MEV activities. Extensive experimental results show that ActLifter can achieve nearly 100% precision and recall in DeFi action identification, significantly outperforming state-of-the-art techniques. Moreover, with the help of ActCluster, we obtain many new observations and discover 17 new kinds of DeFi MEV activities, which occur in 53.12% of bundles but have not been reported in existing studies

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