Abstract: This dissertation explores the application of blockchain technology and the incentivization of behavior in emerging decentralized ecosystems. We investigate its application in the healthcare sector, with a particular focus on genomic data sharing. We also examine its potential in deterring illicit activities such as cryptocurrency fraud and explore its role in confidential tracking within decentralized delivery systems.

We propose efficient strategies for data storage and retrieval in blockchain systems, specifically targeting cross-site genomic data sharing. Our blockchain-based log system provides a lightweight and widely compatible module for existing blockchain platforms. By ensuring accountability in cross-site genomic data sharing, we demonstrate the feasibility of blockchain technology in incentivizing responsible behavior and enhancing collaboration across different healthcare entities.

In addressing the issue of illicit activities in the blockchain ecosystem, we design a virtual taint system that marks cryptocurrency transactions as "tainted" if they are known to be involved in crime, fraud, or other illicit activities. This system serves to disincentivize such activities, revitalizing integrity within the cryptocurrency ecosystem.

Furthermore, we present a blockchain-based system for the confidential tracking of routes in decentralized delivery systems. By leveraging the transparency of blockchain while preserving business confidentiality, this system reveals necessary information only when fraud occurs, thereby incentivizing honest behavior and enhancing trust within the network. Our research contributes significantly to both the understanding and incentivization of behavior in emerging decentralized ecosystems, particularly within the context of blockchain technology. The findings pave the way for secure and efficient data management solutions across various sectors and contribute to the creation of a safer and more secure digital environment.

Wednesday, August 30, 2023, 11:30 am
https://emory.zoom.us/j/4122982383

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