

AI-Driven Financial Market Surveillance

Detecting and Preventing Misconduct in Decentralized Systems

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Abstract

This doctoral dissertation explores the application of Artificial Intelligence (AI) to enhance financial market surveillance, particularly within decentralized financial systems, such as those powered by blockchain and cryptocurrency technologies. As financial markets increasingly transition from traditional centralized models to decentralized platforms, existing regulatory frameworks face significant challenges in monitoring activities that are characterized by pseudonymity, cross-border transactions, and privacy-enhancing technologies. This research aims to address these challenges by proposing an AI-driven regulatory framework that adapts to the distinct complexities of cryptocurrency markets.

The study focuses on four core areas: the development of advanced transaction traceability methodologies for Distributed Ledger Technologies (DLTs), the detection of illicit activities in cryptocurrency wallets using machine learning, the automation of investor complaint validation through Natural Language Processing (NLP), and the creation of a hybrid AI system that proactively identifies fraudulent investment schemes. By integrating rule-based approaches with machine learning models, this research emphasizes the explainability of AI decisions, ensuring that regulatory authorities can interpret and act upon AI-generated outcomes.

Through empirical analysis, this work introduces novel methodologies aimed at enhancing the transparency, adaptability, and overall effectiveness of financial supervision in decentralized environments. The findings underscore the potential of AI to transform market surveillance, offering regulatory bodies the tools necessary to detect, prevent, and mitigate misconduct in emerging digital markets. Furthermore, the dissertation addresses the ethical and legal considerations in deploying AI for regulatory purposes, ensuring that these technologies not only protect investors and maintain market integrity but also uphold privacy rights and due process.

By bridging the gap between AI technologies and the evolving regulatory needs of cryptocurrency markets, this research contributes both theoretically and practically to the development of more effective, transparent, and adaptive financial oversight mechanisms.