Detection of Cyberattacks on the Metaverse Based on First-Order Logic

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Abstract : There are currently considerable challenges concerning data security and privacy, particularly in relation to modern technologies. This includes the virtual world known as the Metaverse, which consists of a virtual space that integrates various technologies and is therefore susceptible to cyber threats such as malware, phishing, and identity theft. This has led recent studies to propose the development of Metaverse forensic frameworks and the integration of advanced technologies, including machine learning for intrusion detection and security. In this context, the application of first-order logic offers a formal and systematic approach to defining the conditions of cyberattacks, thereby contributing to the development of effective detection mechanisms. In addition, formalizing the rules and patterns of cyber threats has the potential to enhance the overall security posture of the Metaverse and, thus, the integrity and safety of this virtual environment. The current paper focuses on the primary actions employed by avatars for potential attacks, including Interval Temporal Logic (ITL) and behavior-based detection to detect an avatar's abnormal activities within the Metaverse. The research established that the proposed framework attained an accuracy of 92.307%, resulting in the experimental results demonstrating the efficacy of ITL, including its superior performance in addressing the threats posed by avatars within the Metaverse domain.

Keywords : security, privacy, metaverse, cyberattacks, detection, first-order logic

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