When Big Data Meets NFT:
Challenges, Impacts, and Opportunities

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ABSTRACT

Non-fungible tokens (NFTs) are unique digital assets that are based on smart contracts of blockchain technology and traded via cryptocurrencies. They became known to the public in 2021 and kept growing rapidly. Until the second quarter of 2022, the total volume of NFTs has reached $12.22 billion. However, since the NFT market is still in its early stage, there are limited studies on this topic. In this paper, the first purpose is to analyze the overall market structure and volatility, characteristics of top NFTs on famous marketplaces, and future trends of NFTs. The next focus is to summarize current research trends about the concept of NFT, investigate the challenges faced by researchers, and provide current data collection or feature extraction techniques that are frequently utilized to solve those challenges.

KEYWORDS

Artificial Intelligence, Big Data Analytics, Blockchain, Cryptocurrency, Decision-Making Science, Deep Learning, Machine Learning, Metaverse, NFT

INTRODUCTION

On March 11, 2021, NFT artwork "Everydays: The first 5000 Days" by digital artist Beeple was sold for $69 million in the auction at Christie's. This work is the collage of all the works done and published by Beeple in the past 5000 days, and its final auction price made it become the most popular NFT with the highest value (Kapoor et al., 2022). After that, NFT market started to be known to the general public, and people began to discuss "What is NFT, and why it has such a high value?" NFT, also known as Non-fungible token, is the ID or certification of a digital asset in metaverse. Unlike the currencies people use to trade, NFT is not interchangeable, and every token is unique. Its uniqueness shows its scarcity as well as explaining why it has potential to appreciate. Also, NFT is traded via

cryptocurrencies such as Ethereum. Through blockchain technology, its ownership will be certified to make sure that the process is decentralized and transparent; everyone will know who owns which NFTs at what time and the price of each resell (Wang et al., 2021). Until the second quarter of 2022, the total volume of NFTs has reached $12.22 billion (Akamo, 2022). However, since NFT market is nascent, there are only limited amount of researches. Therefore, having a comprehensive and deep market analysis is critical and helpful to fully unveil the mask of NFT market. Certain challenges include NFT's relative nature of unpredictability and irregular volatilities.

However, with the help of technologies and big data, many current challenges can be effectively solved. Big data represents velocity (the high speed of data collecting and processing), volume (the large amount of data), and variety (different types of data such as image, text, and gif etc) (Laborde, 2020). Two challenges described above: the high volatility and limited research of NFT market, can be solved, or at least mitigated, by big data. Through big data, researchers are able to build a comprehensive database that is powerful enough to be used to as the basic of the following analytical tasks, such as training models and performing sentimental analysis via machine learning and deep learning and making predictions based on the results. The predictive analysis aims to solve the challenge of the relatively unpredictable nature. By finding out patterns of the price flow, trading frequency, as well as social media hypes, researchers can gain a more exhaustive understanding of the market structure as well as the insights behind the irregular changes.

This paper aims to analyze both the current and future NFT market structure and trend as well as the motivations, rationales, methods, and challenges in current research that have been done. The first focus will be the overall analysis of NFT market, including characteristics of top NFTs on OpenSea, noticeable market volatilities, and future market trends. The second part will be the summary of current research trends, investigation of why these trends prevail, and potential challenges involved. Finally, the paper will discuss the data collection and integration methods, bid data analytics, as well as decision-making and predictive models and analysis by machine learning and deep learning to further investigate the NFT market and solve significant challenges.

BACKGROUND

The concept of Metaverse was suggested in the science fiction "Snow Crash" by Neal Stephenson approximately 30 years ago, and it has become more and more widespread in the field of technology as the rise of Blockchain, Artificial Intelligence, and Cloud Computing (Yang et al.,2020). Since blockchain technology provides the Metaverse with the chance to and associates the economic system in the physical world people live in with the virtual world, it triggers the interest of many famous companies. For instance, Facebook, the company that later renamed as Meta, opened up their own virtual reality world of avatars "Horizon Worlds" in the United States and Canada. Also, they use "Zuck Bucks" as their own currency in the virtual world (Nambiampurath, 2022). NFTs, are also one of the rapid-developing in the world of metaverse, and it is the representative of asset ownership. It is based on blockchain technology and traded through cryptocurrency such as Ethereum and Solana. Zhang et al. (2021) suggests that NFTs are minted via smart contracts, which are digital contracts stored on a blockchain, to certify asset ownership and manage the transferability. This process is completely decentralized without the participation of the third-party agency. Its mechanism is similar to that of the vending machine. Customers choose which product they want to buy on the machine and pay the money. The whole transaction process is based only on some computer codes rather than other agencies. As a result, the trading process of NFTs are inseparable from the concept of blockchain technology, cryptocurrency, and Metaverse.

In the last decades, the main investment people know is stocks or bonds. As the field of digital art develops and the rise of one of the earliest NFT collection "CryptoPunks" by Larva Lab, people start to be attracted by a nascent market: NFTs. Since it is not a mature market that investors are familiar with, its market value has been largely debated. White et al. (2022) proposes that media can

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