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Human beings tend to make predictions about future events irrespective of probability of occurrence. We are fascinated to solve puzzles and patterns. One such area which intrigues many, full of complexity and unpredicted behavior, is the stock market. For the last decade or so, we have been trying to find patterns and understand the behavior of the stock market with the help of robust computation systems and new approaches to extract and analyze the huge amount of data. In this chapter, the authors have tried to understand stock price movement using a long short-term memory (LSTM) network and predict future behavior of stock price.

Connected devices have access to every part of our lives with the increasing implementation of the internet of things (IoT), from home automation, health and fitness, automobile, logistics, to smart cities, and industrial IoT. Therefore, it is only natural that IoT, connected devices, and automation find their application in agriculture, and as such, greatly enhance almost every facet of it. In recent decades, farming has undergone a variety of technological changes, becoming more industrialized and powered by technology. Farmers have gained effective control and efficiency over the process of raising livestock and growing crops through the use of various smart farming devices. Within this chapter, the authors discuss and analyze the advantages of using IoT within agriculture. They present the IoT system architecture to allow smart farming. This chapter also covers the advantages of integrating the blockchain into the agricultural field. Case studies are included in the end for your reference.

Conventional machine learning (ML) needs centralized training data to be present on a given machine or datacenter. The healthcare, finance, and other institutions where data sharing is prohibited require an approach for training ML models in secured architecture. Recently, techniques such as federated learning (FL), MIT Media Lab's Split Neural networks, blockchain, aim to address privacy and regulation of data. However, there are difference between the design principles of FL and the requirements of Institutions like healthcare, finance, etc., which needs blockchain-orchestrated FL having the following features: clients with their local data can define access policies to their data and define how updated weights are to be encrypted between the workers and the aggregator using blockchain technology and also prepares audit trail logs undertaken within network and it keeps actual list of participants hidden. This is expected to remove barriers in a range of sectors including healthcare, finance, security, logistics, governance, operations, and manufacturing.

Presently, machine learning (ML) techniques have gained considerable attention, with growing interest in various areas and applications. Healthcare, agriculture, and bioinformatics are the most identified areas to study with the help of ML. This chapter introduces about the basic principle of ML such as data, model, basic mathematical details of ML, and types of learning. The important aspect of ML is "how to teach a machine." This chapter focuses on the types of learning: supervised, unsupervised, semi-supervised, and reinforcement learning. Some commonly used ML algorithms such as decision tree (DT), k-nearest neighbor (KNN), support vector machine

Chapter 1
Integrating Blockchain With AI

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ABSTRACT

The advancement in AI and blockchain can fundamentally reshape our way of working, learning, and almost our way of living. Though the research in both areas helps us in advancing our knowledge, it is even more advantageous by converging concepts of blockchain and AI (i.e., developing the thinking through blockchain). Blockchain is decentralized, distributed, and often a public system. Thinking, fundamentally defined as rationally concluding something, with a few known premises, is the fundamental concept behind AI and implementing the AI to become as close to human intelligence as possible; therefore, improvements in thinking are always welcomed. Both being incomplete, AI suffers from issues with trustworthiness, explainability, and privacy, while blockchain suffers in case of security, scalability, and efficiency. Bringing these two together can complement each other and make the system efficient. The chapter deals with various uses of integrating blockchain with AI. It also gives a brief on the uses of blockchain for improving both human and machine thinking.

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1. INTRODUCTION

Inventions of Blockchain and Artificial Intelligence brought many revelations in technology. While automation of payments in cryptocurrency was made possible by Blockchain (Morris, 2016), decision making and intelligence are given to machines using AI. Blockchain also made it possible for governing interactions by introducing smart contracts (Morris, 2014), with no longer a requirement of a trusted third party. Both these technologies are advancing at a wonderful pace along with helping innovations in other fields and bringing out more possibilities in every industry. We cannot deny that both technologies have a different amount of technological complexities. Also, the idea about blockchain being decentralized and under no one's control might be a bit of exaggeration as it still has to be *developed* by many *developers* and thus makes it prone to errors.

Analysis of data through various methods like Deep Learning and Machine learning led to the development of present-day AI. To this day, most of the methods and algorithms of deep learning and machine learning for AI follow a centralized model. In such centralized models, the machine is trained by a group of servers that validate and organize the data by training through different datasets. These datasets and chunks of data are managed by various organizations to make decisions. These third-party organizations might be the cause of a variety of problems. The centralized nature of AI leads the data to be tampered with or the parties getting hacked. Either of these can lead the decisions of AI to be highly erroneous.

This led to the research of a Decentralized AI. This is where the inclusion of Blockchain to AI started (Team N.A., 2018). A Blockchain though not perfectly, is a Decentralized system. A decentralized AI processes and performs decision making over data on the blockchain, which was previously transacted and stored on it, by digitally signing it and using secure sharing, and removing the requirement to use a Trusted Third Party or other intermediaries (Dinh & Thai, 2018). So, here what exactly is happening is that the AI, which can handle a lot of data and process, is using the data stored on a blockchain. The blockchain is eligible for this procedure due to the security of data on it. Use of smart contracts can further advance the usage as it can make the blockchain to be programmed in such a way that it can govern the data for decision making and also on generating and accessing the data among the participants (Wood, 2014). There a various researches going on how to improve blockchain and AI, but in an isolated manner. Recent studies show that the integration of blockchain and AI can lead to many revolutions and can also help to improve both the areas.

Another important and interesting application of integrating these two is blockchain thinking (Swan, 2015). This specifically deals with formulating thinking itself as a blockchain process. The researchers claim that this not only helps with AI but also

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