Data Analytics and Artificial Intelligence
Vol: 2(5), 2022
REST Publisher; ISBN: 978-81-948459-4-2
Website: http://restpublisher.com/book-series/data-analytics-and-artificial-intelligence/

Block chain for deep learning

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Abstract: Deep learning has grown immensely in recent years due to its capacity to make sensible conclusions. The great majority of today's deep learning systems, which are constructed on centralised servers, lack appropriate operational transparency, traceability, reliability, security, and trustworthy data provenance features. If deep learning models are trained on centralised data, the single point of failure problem may also arise. In this essay, we investigate the benefits of fusing block chain technology with deep learning. We examine the body of research on deep learning and block chain integration. By creating a theme taxonomy based on seven criteria- block chain type, deep learning models, deep learning-specific consensus protocols, application area, services, data kinds, and deployment goals-we classify and organise the literature. We outline the advantages and disadvantages of the most advanced block chain-based deep learning frameworks to give meaningful conversations. Additionally, based on four criteria— block chain type, consensus protocol, deep learning method, and dataset-we compare the current block chain-based deep learning frameworks. Finally, we outline significant research issues that must be resolved in order to create highly reliable deep learning systems.

Keywords: Deep Learning, Block chain, Smart Manufacturing, Scalability, Security, Privacy, machine learning, federated learning, Transparency

1. Introduction

Deep learning's promise has been seen in practically all industrial areas. For instance, in the healthcare industry, doctors employ deep learning models to accurately diagnose the patient's ailment based on their symptoms. Deep learning models have been used to predict the disease spread rate in a specific location during the recent pandemic brought on by the spread of corona virus illness (COVID-19), and to aid the authorities in managing the pandemic using the anticipated results [1-3]. Additionally, cutting-edge deep learning methods have helped doctors diagnose COVID-19 patients using the dataset of CT and X-ray pictures [4, 5]. In addition to healthcare applications, security personnel at airports have used deep learning to find and validate prohibited items. Data integrity, security, and secrecy can all be handled well by block chain, a decentralized system [2, 10, 11, and 11]. The combination of block chain and deep learning can provide a number of advantages, including efficient data processing and automated decision- making. A smart city is an infrastructure for the quick development of next generation sensing devices and a growing industry based networks, telecommunications, and other factors. Smart management, smart control, and smart communications are necessary for the development of the smart city and are on sensors employed in a variety of recent We explore a number of research issues Image Recognition Sensory Data Analysis OCR Intelligent Data Interpretation Voice Recognition Text Prediction Image analysis and interpretation in the form of classification, detection, and segmentation. Biometric and wearable device data is used for analyzing the health of the patients. To extract the textual data from images (scanned documents and photos). From data gathering to data comprehension, and using the data for automation. Smart voice assistants such as Alexa, Siri, and Cortana uses deep learning to ensure flawless operations. Smart text prediction to generate the message based on previous input. sophisticated applications, including smart manufacturing, smart automobiles, smart farming, and others. The following are the paper's main contributions: Based on seven key factors, we develop taxonomy to organise and classify the available research on block chain-based deep learning systems. We outline the advantages and disadvantages of the most advanced block chain-based deep learning frameworks. We contrast the deep learning frameworks for block chains based on key factors. That may have an impact on the effectiveness, precision, and predictability of current deep learning frameworks based on block chain technology. Background In this section, the main characteristics of deep learning and block chain are briefly discussed, along with the advantages of combining them in terms of data security, automated decision- making, and improved robustness.

2. Block chain technology

The manner the block chain saves data makes it very impossible for hackers to alter, corrupt, or destroy data. It is by design a decentralized system that stores and processes data and transactions using P2P architecture. There are many nodes in it, and they all work together to validate and store the transactions as blocks are A set of transactions are stored in each block of the chain, and it is assured that the blocks that already exist are correctly linked to the newly formed blocks to build the chain of blocks. The newly added block is disseminated to all participating nodes after being added to the local chain by a miner to guarantee data consistency [28, 29]. The block chain transactions verified and approved by the miner nodes thanks to the decentralized consensus mechanism. For instance, several block chain platforms implement the Proof- of-work and Proof-of-Stake consensus protocols, which can protect the block chain against any internal or external data hacking assault. Another key component of block chain technology is smart contracts, which function like an electronic programmed and only execute when certain conditions are satisfied [3, 17, 30]. The goal of smart contracts is to lower business risk and expense.

3. Federalized learning and deep learning

AI and machine learning are both included in deep learning. Existing deep learning techniques teach a model to represent the most fundamental type of data in latent space. Pictures, text, and speech signals are examples of data. The connection between deep learning, AI, and machine learning is depicted in Figure 4. Deep learning enables hardware to carry out several tasks with accuracy comparable to or sometimes even superior to that of humans. Image classification [37], object identification [38], self-driving cars [39], disease prediction [40], and voice control [41] are well-known applications of deep learning techniques that serve as examples of its extensive use in several domains. Lots of labelled data are used to train the deep learning models. 5. Block chain-based Deep learning Block chain technology can help deep learning models be reused and trustily shared, which is a crucial necessity. Similar to this, the major drivers driving the integration of block chain with deep learning are audit ability, data verification, and attestation of results, provenance, and traceability of ownership, usage, and guarantee of fairness [24]. In order to learn the features and produce an output with probability vectors in place, deep learning models are fed a huge amount of data from a variety of samples. Even while deep learning models excel at making predictions from raw data, many real-world scenarios still depend on the quality of the input. The block chain is a massive database that all network nodes may access and store data in. Block chain type Based on the block chain platforms used by the current deep learning frameworks for block chain, this parameter divides the existing studies into three groups. The time-specific modalities of the block chain help to improve many of the services and applications that the deep learning algorithms enable because they have time-related restrictions. Modern deep learning frameworks categorise can block chain platforms into public, private, and consortium/federated categories based on their design, characteristics, and policies. These categories are explained below. 6.1 Public block chain The public block chain platform leveraged by the existing block chain-assisted deep learning frameworks allows permission less or unrestricted access to the distributed ledger by the users or machine learning devices. Users access the ledger copy that is distributed among all nodes within the public block chain network and performs transactions. Public block chain platforms maintain transaction anonymity because of decentralized data storage and processing. Furthermore, public block chain platforms are secure against several types of attacks; therefore, they assist the deep learning models in coming up with the correct and trustworthy results [28, 30, 57]. 6.2 Private Block chain The block chain-assisted deep learning frameworks use private block chains that are controlled and managed by a single organization. Private platforms are permitted where the controlling entity has the necessary power [58]. Since the central authority is aware of the validators' and nodes' identities, the private network requires significantly less difficult mathematical operations to verify the transactions. Consequently, the private platform executes transactions more quickly than the public platform.

4. Deep learning models

The gathered data is processed by a deep learning model, which creates patterns that may be applied to various use cases to aid in decision-making. The deep learning models used for decision-making in many application domains are divided into five main types based on the configuration of neural network layers. An overview of deep learning models that have produced patterns and made judgments using data. From block chains is provided below. 7.1 Consortium/federated block chain Convolution Neural Network (CNN), also referred to as Conv Net, analyses an image to recognize the items, give the objects weights, and categorise them in accordance with the context. Additionally, it makes object instances in the processed image detectable [60]. CNN has been used by the deep learning frameworks built on block chain to classify photos, identify objects, and segment instances in a variety of use scenarios. Because CNN uses flexible filters to identify the qualities of the image, block chain-based studies benefit from the algorithm’s minimal pre-processing time requirement. 7.2 Recurrent neural network when given input of visual data, a CNN model performs better. However, Recurrent Neural Network (RNN) generates patterns using sequential or time- series data [61]. For block chain-based solutions, voice or speech recognition, speech-to-text conversion, voice search, and natural language processing are some of the well-known RNN uses (NLP). Additionally, in CNN models, the input data are independent of one another, whereas in RNN models, the previous inputs are linked and affect the result. 7.3 Generative networks (GAN) adversarial the generative model is able to produce original data and learns patterns in an unsupervised manner. More specifically, it is a type of deep learning modeling that makes use of convolution neural networks. The GAN model is built with a generator network and a discriminator network. The discriminator learns to distinguish between true and bogus data, whereas the generator creates fresh samples. 7.4 Deep reinforcement learning (DRL) DRL allows expert systems to more accurately analyse the data since it is inspired by ideas of human behavior that are based on behavioral ecology. DRL models make up the environment in which intelligent agents act in order to learn. Agents are also implicitly rewarded or punished based on their actions. Reinforced learning-based models are those that reward actions that result in the intended outcome [65] 7.5 Geometric deep learning It is a deep learning variation that concentrates on creating neural networks with non-Euclidean data as their foundation [66]. A particular type of non-Euclidean data is a graph. Using graph-based data allows data modeling to be completed with less time and effort. Instead of data in the conventional form to generic neural networks, the graphs are input to the geometric deep learning models. 8. Application areas This parameter identifies the primary application domains that the most advanced block chain-assisted machine learning frameworks concentrate on guarantee data integrity. Health care, IoVs, traffic control, and safety and protection are the key areas. 9. Services this parameter emphasizes the core functionality of block chain-based deep learning systems aimed towards numerous application domains, including healthcare, vehicular communication, and IoT. Anomaly detection, traffic violation prediction, privacy preservation, cellular traffic management, and forking prevention are just a few of the goals that current techniques attempt to achieve. 9.1Privacy preservation Data about an entity cannot be altered or read by unauthorized individuals thanks to privacy protection. Protection. The anonymity of the data used in deep learning models may be preserved via block chain technology [78].Proxy re-encryption and extremely complex data encryption techniques can offer privacy protection. 9.2Violation prediction in Traffic infractions come numerous forms, such as speeding, drunk driving, lane switching illegally, and failing to stop at a red light. The combination of deep learning and block chain is essential for forecasting the violations committed by drivers. For instance, the deep learning- based classifier can forecast traffic events using highly secure block chain data [79]. Such information can be immutably recorded on the block chain and used by the department of highways to develop the network of roads, insurance firms to evaluate damage, and law enforcement organizations to enact laws. 9.3Anomaly detection the discovery of data that deviates from typical behavior is the focus of anomaly detection. The encoder-decoder network in deep learning can understand the typical behavior of a real-world event based on block chain-based data and transactions [80]. Based on the examination of the data, it can recognize an anomaly right away. Additionally, the model is able to identify these 10. Data types the characteristics of this parameter specify the kinds of data that the deep learning models supported by cutting-edge block chain technology can accept and analyze Block chain-based deep learning models often accept text and visual data as input. 9. Block chain-based deep learning Modern block chain-based deep learning solutions for various application domains are covered in detail in this section. It contrasts current deep learning frameworks built on block chain based on parameters chosen from the literature. 10.1 Review of block chain-based deep learning Frameworks this section provides an overview of current deep learning frameworks built on block chains with a focus on healthcare, automotive networks, networks, cellular traffic management, and block chain security and defence against hostile attacks. Data evaluation Deep learning models' resource- friendly architecture and patient-centric data handling have become crucial components, notably in pharmacogenomics research. A decentralized approach that feeds pharmacogenomics data to deep learning models to forecast ovarian cancer has been proposed in the work reported in [85]. Comparison of existing 10.2 frameworks this section contrasts current deep learning frameworks for block chains based on a number of factors. The solution category, block chain type, consensus strategy, deep learning techniques, data set used by the deep learning model, study strengths, and study constraints are the primary parameters that are taken into account for the analysis. Table 2 contrasts the research projects outlined above in several categories where block chain and deep learning are involved.

5. Conclusion

Cutting-edge learning We have studied block chain-based deep frameworks in this article. We discussed in detail the advantages brought about by the integration of deep learning and block chain, as well as their key features. The successful integration of deep learning with block chain can improve the Quos in several applications, primarily related to healthcare, block chain security, data traffic management, and vehicular communication in urban areas. It can also facilitate existing systems in terms of data security and privacy and improve data security and privacy. Based on seven criteria, including the type of block chain, deep learning models, deep learning-specific consensus protocols, services, application domains, deployment goals, and data types, we developed taxonomy to group the reported literature into different categories.

6. References

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