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Neuroscience and Blockchain

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Abstracts

Our brain is made of thousands of neurons that create a chain of different episodes stored in the human brain in a decentralized manner that shapes human conscious experience just like blockchain technology. Although the human brain can voluntarily delete some episodes stored by the mechanism of distributed neurons, this ability is limited. Thus, each episode is open to access and saved securely so that we do not confuse our childhood memories with movie characters same as blocks in a decentralized ledger (Allegri, 2021). In this paper, it is investigated that some properties of the human brain can be to some extent analogical to blockchain and that certain blockchain concepts can be applied to the development of neuroscience as knowledge of the workings of the human brain and memories. At the same time, the latest advancements in blockchain technology can be fruitful in the development of neuroscience. To closely examine the correlation between neuroscience and blockchain, decentralized ledger technology concepts and neuroscience basics are presented [1].

Keywords: Blockchain; Neuroscience; Brain; Information; Blockchain technology

Blockchain Technology

Blockchain as a decentralized ledger technology is a secure method of storing and sharing information while all presented in the network agree on each change in information and stored information cannot be altered without the agreement of all parties (Wolfskehl, 2018). Blockchain can be considered as an open ledger that is permanently available for everyone to observe and add new information; however, no changes or distortion in the previously stored information are possible without the permission of all parties (Taherdoost, 2022). The ledger is made of many nodes. Each node is initially registered to authorize the validity of transactions (Taherdoost, 2022). In a simple analogy, the ledger is like a book with many pages same as many blocks in the ledger. To add any new block to the ledger considering that each block stores records of all transactions, a solution should be found based on the content of the previous blocks just as it is impossible to add an irrelevant page in the middle of a book without understanding the general content. Moreover, each block can be modified only in case of getting approval from all participants in the network (Taherdoost, 2022). That is the reason why decentralized ledger technology can be used to keep information trustworthy and open to access at the same time (Wolfskehl, 2018) [2-4].

Neuroscience and Blockchain

Considering the similarity between human brain functions in making memory blocks and blockchain technology, the technology can be employed to address neurology concerns and neurodegenerative disorders such as Parkinson's and Alzheimer's (Cooper, 2022). In the same way, neuroscience concepts facilitate the development of blockchain technology in many aspects.

The human brain is a distributed network of neurons in which unconscious memories and conscious experiences are stored as a chain. Unlike unconscious memories, human consciousness is coherently stored and what is entered in the conscious memory is selected under a neurological mechanism that encodes an event in consciousness. Based on the metacognitive system of the brain, neurons fire when faced with an event that should be saved in the memory through a gating mechanism (Swan, 2015). This is just like a blockchain in which all nodes of a network are involved in a process. However, the process of the human brain is not free from errors. One representation may be easily believed and trusted at first sight and mistakes may happen. However, humans can revise initially accepted beliefs and thoughts upon rechecking and make regular modifications to what is accepted by the conciseness. Making such mistakes is not favorable in blockchain technology in which the trustworthiness of input data is the main goal of the network (Swan, 2015). Based on the human brain mechanism, the same mechanism is proposed in a largely decentralized system in which transactions that are divided into small amounts can be quickly trusted and verified without necessarily achieving the consensus of all participants; however, they will be revised if any illegitimacy is witnessed. Adoption of the neuron-based consensus protocol can lead to fast and straightforward blockchain processes. Although this analogy seems to be difficult and reliant on vast amounts of data, it can be practical in blockchain since the brain as a decentralized system performs the same process well (Sh and Ca, 2018) [5,6].

Blockchain employs hash functions to ensure the security of information. The concept of the hash function in blockchain technology can be also used to understand the human brain. Based on the hash function, input data of any size will be turned into a string with a fixed length. The hash function is sensitive to minor changes in the input message that no two messages can be produced in similar output strings. In blockchain technology, the hash function is used to hash the content of each block in the network. Thus, the content of each block is unique in essence while input data may have been entirely different (Taherdoost, 2022). The same happens in the human brain when we face similar objects with different essences such as tangerine and an orange. Two fruits are similar in appearance; however, the brain stores them differently based on a similar hash function recognition pattern that prevents recalling memories of each mistakenly (Sh and Ca, 2018). Employment of hash function in blockchain technology ensures security and integrity of data in a network since any modification in data transforms the pattern and eventually protects the systems against cyber-attacks.

Conclusion

Blockchain technology has been recognized as a significant breakthrough and a solution to many problems in different industries including healthcare systems. Neuroscience, on the other hand, is study of human brain and how human cognition is raised. Blockchain technology and neuroscience can inspire each other to improve health and technology innovations. Employment of neuroscience concepts can lead to valuable benefits in addressing neurological disorders.

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Conflict of Interest

No Conflict of interest

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