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Creating an Effective Healthcare System through Lightweight Blockchain Infrastructure and Advanced Deep Learning Techniques

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Abstract

A radio communication sensor system comprises interconnected sensor modules utilizing wireless communication. Typically battery-powered, these modules interface with a central controller referred to as the base station. These modules perform basic computations and transmit data to the base station, often leading to energy depletion in resource-limited nodes, particularly those transmitting data from distant sources. Nodes proximate to the base station assume more extensive roles, encompassing data detection and transmission from distant nodes. The Improved Fuzzy Inspired Energy Effective Protocol (IFIEEP) addresses this energy disparity by employing three node categories to allocate more energy to underperforming nodes. Node viability is assessed based on factors like remaining energy, proximity to the base station, neighbor concentration, and centrality within a cluster, albeit these factors are founded on an uncertain premise. Effective implementation necessitates adaptive clustering, designating cluster leaders for data transmission to the base station and network-wide data dissemination. Heterogeneity parameters, encompassing node count and initial energy, are provided to guide the process. Smaller numbers of supernodes yield minor gains in network lifetime, while substantial gains, up to 100%, in covered area are achieved with increased supernodes.

Introduction

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Smart Healthcare System with Lightweight Blockchain Infrastructure and Advanced Deep Learning Methods: In an era characterized by rapid technological advancements, the realm of healthcare is undergoing a transformative shift towards more intelligent and efficient solutions. A crucial facet of this evolution is the integration of smart technologies that leverage lightweight blockchain systems and cutting-edge deep learning techniques. This convergence holds the promise of revolutionizing healthcare delivery, enhancing patient outcomes, and optimizing resource utilization.

A smart healthcare system, at its core, encompasses the seamless integration of data-driven technologies to enable real-time monitoring, diagnostics, and treatment. The utilization of lightweight blockchain infrastructure introduces a layer of security, transparency, and interoperability, while advanced deep learning methods empower the system to extract meaningful insights from complex medical data.

Analysis

This research embarks on a journey to design and establish an innovative smart healthcare system that harnesses the potential of both lightweight blockchain technology and sophisticated deep learning algorithms. The primary aim is to enhance healthcare services by ensuring secure data exchange, enabling efficient interoperability across disparate systems, and enabling robust analytics for informed decision-making The supplementary ledger data system, known as Distributed Ledger Technology (DLT), incorporates validating machines utilizing the Ethereum platform [1]. This framework is capable of executing operations equivalent to those performed within the Bitcoin cryptocurrency ecosystem. Leveraging the Ethereum Virtual Machine (EVM), immutable computational logic can be constructed atop the Ethereum blockchain, subsequently executed within public ledgers [2]. Introducing smart contracts and their execution entails the accumulation of Ethereum's computational resources. This is achieved through the expenditure of Ethereum cryptocurrency, also referred to as Ethereum tokens. These tokens serve as the means by which the execution of tasks, including smart contract operations, is facilitated [3]. The subsequent section outlines the fundamental steps integral to the execution of a smart contract post-registration within the ledger. Smart contracts are designed to interact with specific input data, a provision accomplished through transactions [4]. These transactions enable the propagation of data and the activation of computational logic embedded within the smart contract.The term "data" is employed to denote this specific type of information. Ensuring transparency in monetary transactions and modifications within the state of Ethereum Virtual Machines (EVMs) is achievable, enabling any involved party to scrutinize these processes [5]. This paradigm shift highlights the utilization of the sigmoid function and the tahn function, both integral tools in addressing challenges encountered by scientists and engineers throughout history. The tahn function, a soft step function, is adeptly harnessed

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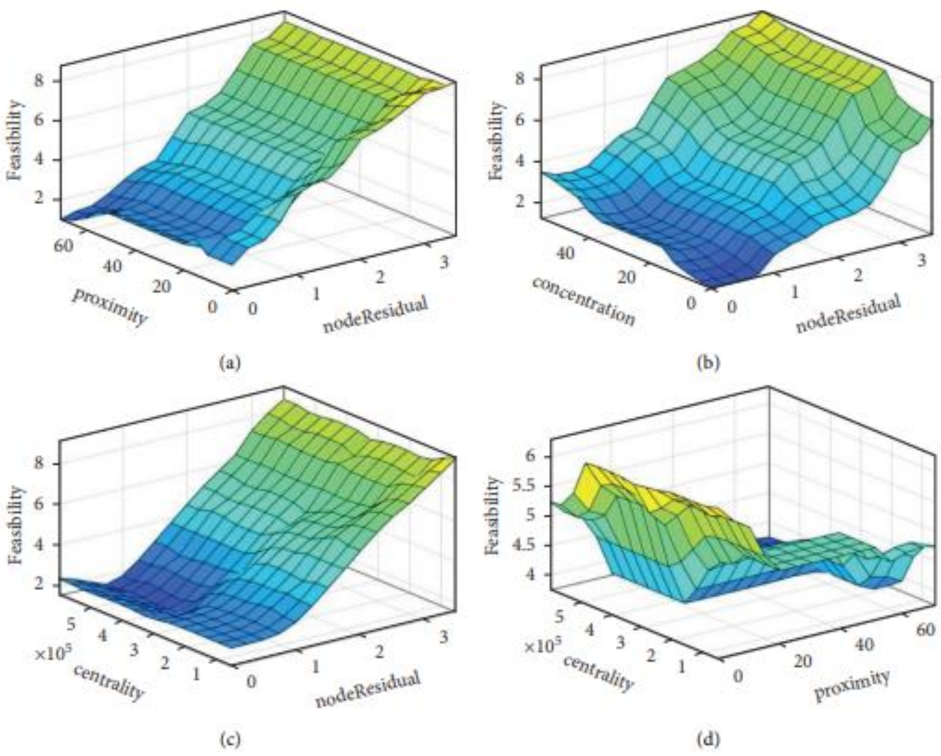
to attain objectives in lieu of conventional squashing functions [6]. It is vital to underscore that while the sigmoid function and the step function may share visual and functional similarities [7], they significantly differ in their application compared to the biological brain. The biological brain inherently requires the passage of time to function optimally [8]. In contrast, artificial neural networks (ANNs) can accept input values independently of temporal progression, with their output values predetermined. Contrary to prior perceptions that high computational prowess hindered the rapid calculations of artificial neural networks, the structural resemblance to the human brain solidifies their foundation in the realm of artificial intelligence technologies [9]. As a result, the potential obsolescence of artificial neural network models has been debunked. The artificial neural network, constructed upon the structural blueprint of the human brain, plays a pivotal role in driving advancements in artificial intelligence technologies [10]. This strategic alignment with the human brain's organization cements its status as a cornerstone for innovative artificial intelligence methodologies [11].



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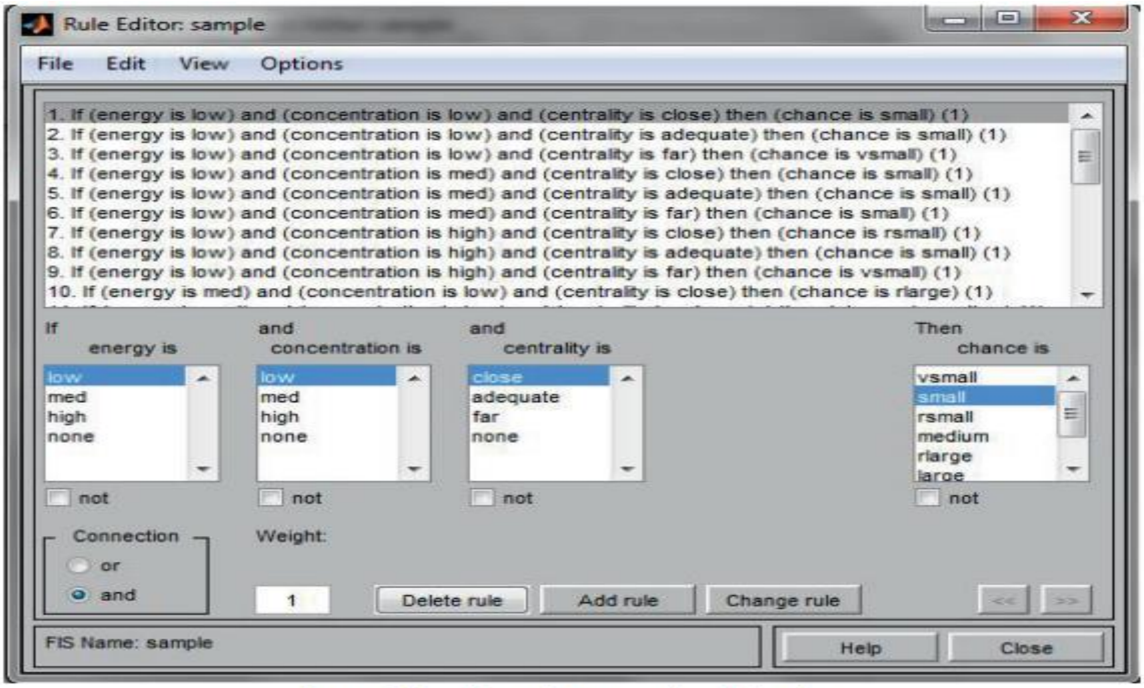

FIGURE 5: Description of output membership function.

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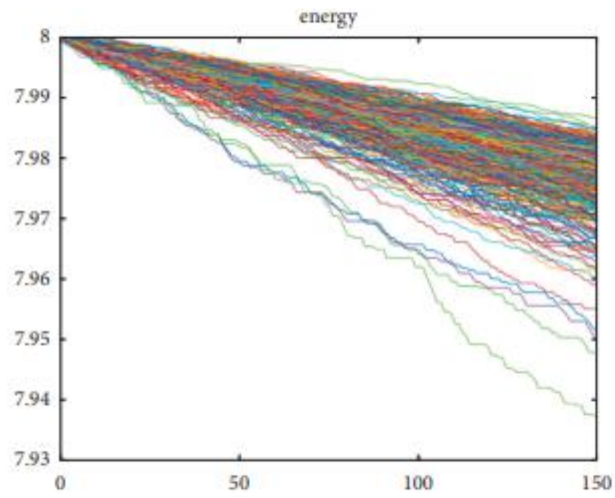

Figure 10: Assessment of improved model with 2 levels.

Table 2: Percentage gain in improved protocol, the fuzzy inspired energy-efficient protocol for heterogeneous wireless sensor network as compared to existing protocols.

Number of nodes dead	2-level SEP	3-level SEP	3-level DEEC
1% nodes dead	−11.19%	−10.07%	−50.38%
50% nodes dead	28.11%	23.89%	6.96%
80% nodes dead	27.17%	16.83%	10.32%
100% nodes dead	6.60%	1.60%	5.29%
Percentage area covered			
1% nodes dead	5.58%	1.96%	5.19%
50% nodes dead	11.97%	1.22%	1.68%
80% nodes dead	26.66%	8.86%	9.72%
100% nodes dead	100%	12.89%	100%

Conclusion

We have introduced a novel protocol to enhance the diversity of wireless device systems. Unlike conventional methods that allocate cluster heads based solely on probabilistic thresholds, our protocol considers node load, residual energy, and data redundancy as factors in the determination of cluster heads . Notably, the selection of cluster heads is guided by the evaluation of residual energy levels. Furthermore, nodes with higher responsibilities are furnished with increased energy resources, facilitating their efficient task execution. This strategic allocation of energy resources optimizes the performance of these nodes. Theoretical insights into optimal heterogeneity characteristics were then leveraged to predict the requisite additional energy for specific node types, identified through empirical experimentation . By aligning practical findings with theoretical expectations, we ensured a more

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accurate energy allocation strategy.. This advantage holds true not only in terms of improved profitability but also in terms of coverage over a larger geographic area, considering a comparable number of residual energy nodes and energy consumption cycles.

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