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Original Article

An Automatic IP Autoconfiguration Scheme using Harmony Search Algorithm Optimized Hybrid Extreme Learning Machine Model

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Abstract *- IP autoconfiguration is the process of allocating unique network settings, flows, policies, and controls. Each node in the network must be configured to connect with other nodes in the system. The centralized DHCP server can accomplish it. Meanwhile, in the mobile ad hoc network (MANET), there are no centralized servers; hence, the autoconfiguration of nodes to the network is arduous. It can be achieved by distributed address autoconfiguration approach, and we proposed a novel Harmony Search Algorithm (HSA) based hybrid structure-adaptive radial basis function-extreme learning machine (HSARBF-ELM) (HSHSAELM) approach for MANET. The proposed HSA is used to detect the duplicate address node. An HSARBF-ELM classifier effectively assigns a reserved address to the new node by classifying the nodes. The proposed HSHSAELM approach effectively achieves the address allocation and duplicate address nodes. Further, it is also used to minimize the communication overhead and ensures unique address allocation to the new nodes. Experimental analysis of our proposed method with state-of-art works shows that our proposed method outperforms all the other approaches.*

Keywords *- Harmony Search Algorithm, Autoconfiguration, IP Address, Duplicate Address, MANET, RBF and Agent.*

1. Introduction

The Wireless Sensor Network (WSN) comprises many tiny radio-equipped sensors. The WSN links autonomously to other networks via shared, received, and gathered environmental information [1]. Sensor nodes in such networks are self-configurable and ad-hoc deployed. The wireless sensor nodes, which are physically smaller, are used to form a larger-scale network with deployment goals. WSN architecture involves the creation of hundreds of thousands of nodes. Such large networks cannot be set up, operated, configured, or addressed without the aid of external [2]. Because of the repercussions of this sensor node's architectural scale, resources such as processing capacities, computation, memory storage, and energy and communication bandwidth are constrained. A great focus on resource optimization designs all network schemes to ensure longer operations of WSN. The cluster members and cluster heads are the groups of wireless sensors [3]. In accordance withtheIPv6 address structure, the generated ID performs the uniqueness verification. The new sensor node assigns the IP address. The message exchanged among the nodes in the address assignment procedure is minimized via the duplication address detection procedure [4]. This model optimizes the communication and energy cost, overhead, and packet delivery ratio; the latency is significantly improved.

The automatic configuration of network parameters is the major issue in ad hoc networks. The networks merging and the partitioning are concerned with additional questions. Similar IP addresses are obtained by two various networks [5]. Due to the size of the identifier of the node, the network merging is managed, which affects an increase in traffic for data exchange. Few distributed models address allocation in a MANET without the single point of failure problem. The major difficulties are the address's unique network guaranteeing, address pool handling, merging, and partitioning. To overcome these complexities, in this study, we proposed a novel Harmony Search Algorithm (HSA) based hybrid structure-adaptive radial basis function-extreme learning machine (HSARBF-ELM) (HSHSAELM) approach to address autoconfiguration in MANET. The major contribution of this study is delineated as follows:

The proposed method reserves the address by utilizing the HSA and HSARB-based ELM network, which reduces the time spent on address assignment and reduces communication overhead.

The address allocation is available only to three types of MANET nodes: MANET with both the reserved and own addresses, a MANET with only its address, and a new node.

The HSA algorithm improves configuration and finds duplicate nodes automatically.

The experiments show the proposed approach's effectiveness in terms of communication overhead, uniqueness, latency, and configuration time for different address ranges.

The rest of the paper is organized as section 2 describes the related works. The background of the proposed research is depicted in Section 3, along with the overall proposed architecture in section 4. The results are discussed in section 4, followed by the conclusion in section 5.

2. Relative works

Auto reconfiguration of nodes occurs when there are large-scale distributions of nodes in moving conditions. Moreover, it is the most crucial as well as challenging task that the protocol is to make. Chardet et al. [24] proposed a novel method known as Concerto to manage the lifecycle and reconfiguration operations of software components. This method follows fine-grained and parallel execution operations to perform reconfiguration actions. The efficacy of this method is high.

Korichi et al. [13] proposed a novel method to perform the auto-configuration in MANET known as Mobile Multi-Agent Systems (MMAS). The proposed method can be used to distribute the server allocated in a preferred cluster and controlled by the MMAS. It also configures the nodes to be appended to the network. One of the basic issues faced in the MANET is addressing autoconfiguration. Jiang et al. [14] stated a new generic address assignment agent to embed in the NS platform to change the node's address by dynamic generation. It also uses Passive Auto Configuration Mobile Network (PACMAN) to implement and thus provides better allocation of addresses to the nodes.

Priya et al. [15] proposed a new hierarchical topological-based auto method to reduce cost by duplicate address detection (DAD). By removing the broadcasting of DAD messages from the network, the overhead of the used DAD can be reduced. The Adaptive particle swarm optimization-based multiple velocity strategies (APSO-VMS) can be exploited to reduce the clustering issues in the network. This has been performed by choosing an optimal leader who can circumvent the frequently leaving and failing strategy. Soares et al. [25] described a novel NetService to auto-configure a predetermined MANET based on the applications. The stated approach can be used to handle IP address allocation. This is also used to exchange information from network access.

3. Background

3.1. Harmony Search algorithm

Geem et al. [6] suggested an evolutionary model of the Harmony Search (HS) algorithm. In musical performance, the improvisation of harmonies inspires the HS algorithm. The harmony memory presents each feasible solution vector. The following four major steps are used to determine the optimal possible harmony.

3.1.1. Initialization

The below equation randomly initializes the solution vector in harmony memory in the HS algorithm.

$$Y_{jk} = l_k + (u_k - l_k) \times random(0,1)$$

$$for j = (1,2,\ldots,hms) and k = (1,2,\ldots.,d) \tag{1}$$

The number of harmony variables and the number of harmonies in harmony memory are k and j. The lower and upper bound variables are l_k , and u_k that tend to be 0 to 1 interval. Evaluate all harmonies after the initialization of harmony memory.

3.1.2. Improvisation Process

The HS efficiency and convergence are improved by controlling two important parameters: pitch adjustment ratio (P_{AR}) and rate of harmony memory consideration (H_{MC}).

According to harmony memory consideration (H_{MC}), the predefined value $(0 \leq H_{MC} \leq 1)$considers the k^{th} variable of novel harmony$\left(Y_k^{`}\right)$.

$$Y_k^{`} = \begin{cases} Y_{jk} if random(0,1) \leq H_{MC} \\ l_k + (u_k - l_k) \times random(0,1) if random(0,1) > H_{MC} \end{cases} \tag{2}$$

According to equation (3), the predefined value $(0 \leq P_{AR} \leq 1)$considers the k^{th} variable of novel harmony$\left(Y_k^{`}\right)$.

$$Y_k^{`} = \begin{cases} Y_k^{`} if random(0,1) > P_{AR} \\ Y_k^{`} \pm BW \times random(0,1) if random(0,1) \leq P_{AR} \end{cases} \tag{3}$$

The pitch adjustment range improvised $Y_k^{`}$is controlled using the bandwidth BW.

3.1.3. Update the Harmony Memory

While compared to the worst harmony previous in harmony memory, evaluate the improvised new harmony$Y_k^{`}$. It is replaced by the worst one if it is better [23].

3.1.4. Termination

Repeat the updating and improvisation process of HS at the end of the stopping criterion met. Finally, the optimal solution is obtained.

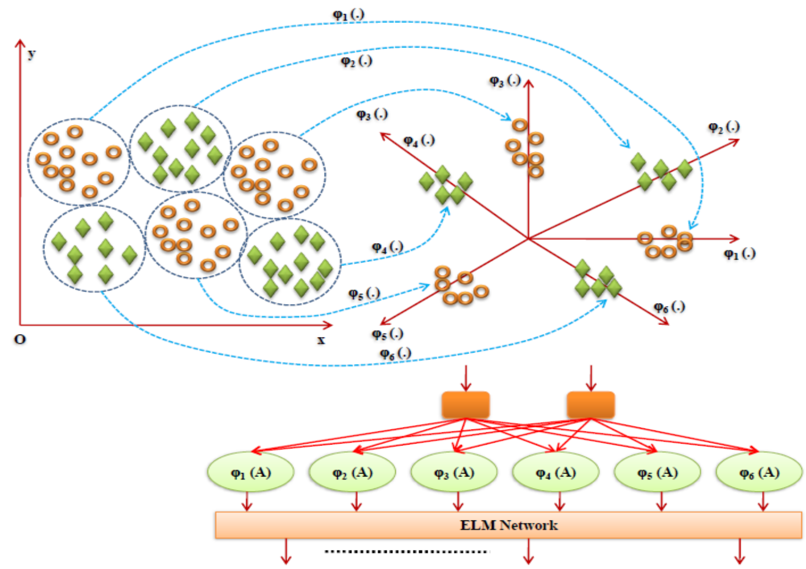


Fig. 1 Mechanism involved in HSARBF-ELM network

3.2 HSARBF-ELM

3.2.1. Network Framework of HSARBF-ELM

The hybrid SARBF-ELM [17] is composed of a cascaded connection of the SARBF network and ELM network. The hidden output layer of SARBF is linked to the input of the ELM network. The input vectors are mapped by the adaptive localizing kernel, which the SARBF network will provide. However, the adopted ELM is used to accomplish the nonlinear classification globally. The separation of the original dataset is enhanced by the adaptive localization mapping of SARBF. Henceforth the classification is performed by the ELM. As shown in Fig. 1, each dataset of the HSARBF-ELM network has a unique flow mechanism. The different layers of the HSARBF-ELM classifier are illustrated in Fig. 2. The different layers are given below.

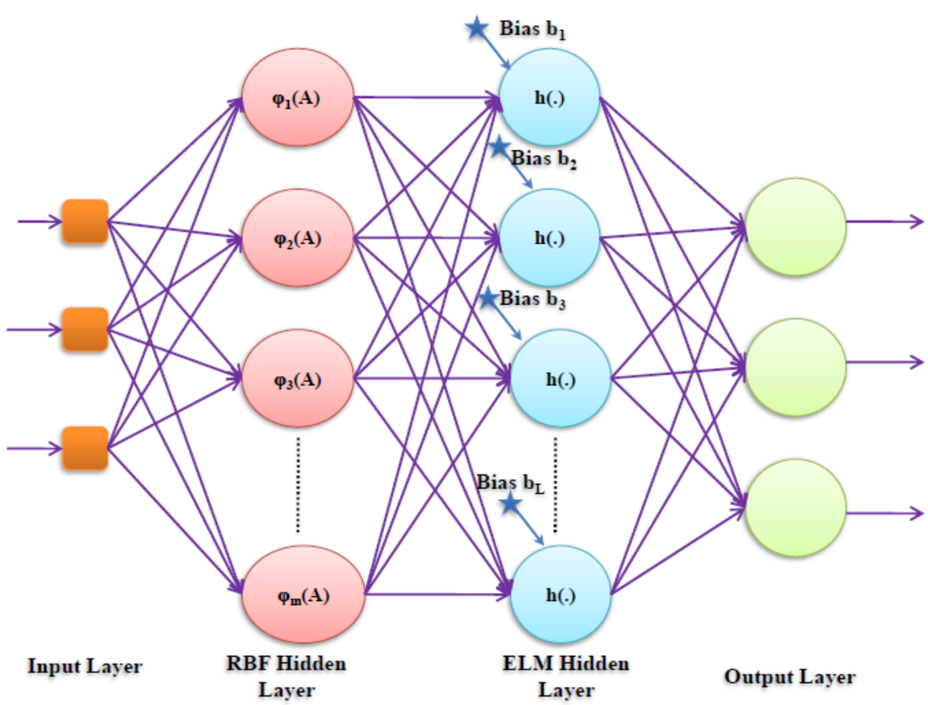


Fig. 2 Different layers of HSARBF-ELM network

Input Layer

This layer consists of n number of nodes, and the input vector is given as $A \in R^n$ the dimensionality of A is given as n.

SARBF Hidden Layer

The hidden layer is composed of M nodes and is formulated with the help of Gaussian kernels as,

$$\phi_m(A) = exp\left(-\frac{1}{2\rho_m^2}\|A-\mu_m\|^2\right) m = 1,2,\dots,M \quad (1)$$

The size of the SARBF network is defined as M, and its centre and width are denoted as μ_m and ρ_m correspondingly. Based on the spatial distributions, the M value is adjusted adaptively for the classification problem.

ELM Hidden Layer

This layer is composed of N nodes. Let the ELM hidden layer's input vector be taken as $\phi(A)$, i.e. $\phi(A) = (\phi_1(A), \phi_2(A), \dots\dots, \phi_M(A))$. The output matrix of the hidden layer is denoted as G and $G = \{g_{ij}\}$, where $g_{ij} = h(x_j.\phi(A_i) + y_j)$, and the parameters of the ELM hidden node $\{x_j, y_j, N\}_{j=1}^{N}$ can be formulated arbitrarily.

Output Layer

The HSARBF-ELM approach's output can be formulated as,

$$O_i = \sum_{j=1}^{L} \chi_j h(x_j.\phi(A_i) + y_j), i = 1,2,\dots.K \quad (2)$$

Here $\tilde{\chi} = G^{'}B$ G' is the inverse Moore-Penrose generalized matrix G. The target output can be given as $B = (b_1 b_2 \dots. b_K)$.

3.2.2. HSARBF-ELM Learning Algorithm

The merging of density clustering can obtain the learning algorithm for the HSARBF-ELM network with a potential function [18], the centre-oriented unidirectional repulsive force [19], and the ELM algorithm [20].

The potential functions consist of various functions and can be used for density clustering in the network. With the help of a potential function as a numerical tool, the RBF hidden nodes are constructed in the HSARBF-ELM network. The potential function can be given as,

$$\delta(A_1, A_2) = \frac{1}{1+X.d^2(A_1,A_2)} \quad (3)$$

The potentiality between two input vectors is given as $\delta(A_1, A_2)$, where A_1, A_2 are the input vectors. The distance between the two input vectors is given as $d(A_1, A_2)$. X is the predefined fixed value. If the value $d(A_1, A_2)$ is inversely proportional to the potentiality.

For L number of training samples of dataset T, $\{(A_i, b_i)\}_{i=1}^{L}$ here $A_i \in R^l$ and $b_i \in R^g$. The L_i feature vectors of T_i of the i[th] pattern $T_i = \{A_1^i, A_2^i, \dots., A_{L_i}^i\}$. Then $T = \cup_{i=1}^{g} T_i, T_i \cap T_j = \varphi, \forall i \neq j$. The potentiality of two randomly selected inputs A_u^i, A_v^i in T_i, can be given as,

$$\delta(A_u^i, A_v^i) = \frac{1}{1+X.d^2(A_u^i,A_v^i)} \quad (4)$$

Let, A_v^i be the benchmark input vector, then the potentiality of all the input vectors excluding the A_v^i can be evaluated as,

$$\sigma(A_v^i) = \sum_{u=1,u\neq v}^{L_i} \delta(A_u^i, A_v^i), v = 1,2,\dots., L_i \quad (5)$$

Then the potentiality of the initial centre vector can be estimated as,

$$\mu_m = A_p^i \quad (6)$$

After the completion of the initial parameter setting, the respective RBF hidden nodes can be produced automatically and are used to sheath the perspective area in the sample space. Meanwhile, the coverage area consists of both the messages of the present node and the previous node and thus affects the efficacy of the coverage. To circumvent this situation, a centre-oriented unidirectional repulsive force is used. This forces access to the available adjacent node's information and requests the configuration by sharing the address. Thus this force is used to optimize the centre selection.

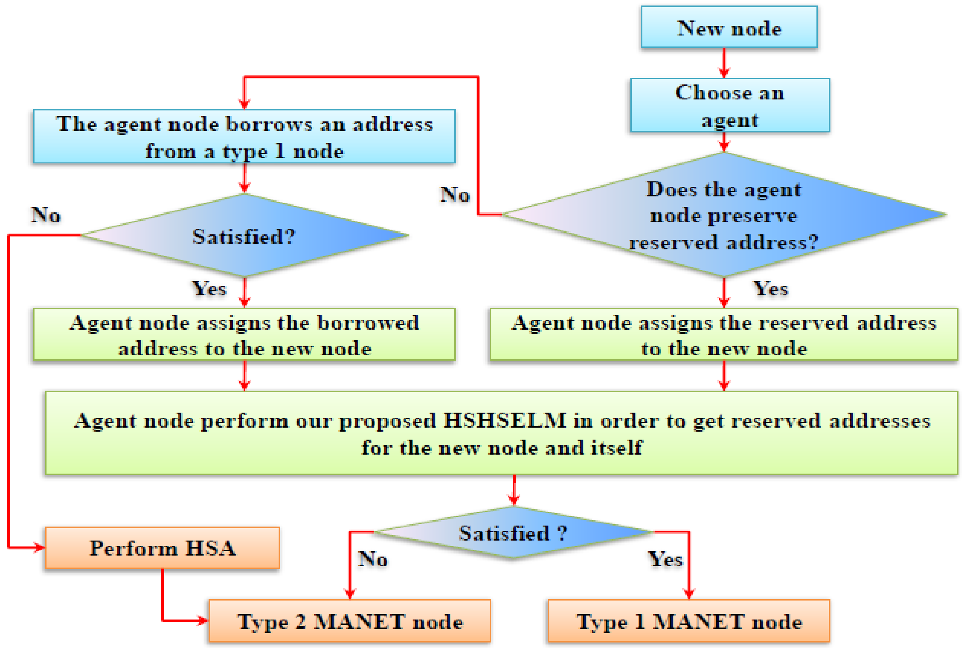


Fig. 3 Working mechanism of Proposed HSHSELM approach

4. Proposed HSHSELM Distributed Address Auto-Configuration Approach for Address Assignment in Adhoc Network

The proposed method utilizes the HSA and HSARB-based ELM network to reserve the address, thereby reducing the time consumption for the assignment of address and minimising the communication overhead. The HSA detects the duplicate node while verifying the node address. The HSARB-based ELM is used for the address allocation, as shown in Fig. 3. Here we have deemed three types of MANETs,

- MANET, which possesses both the reserved address and its address.
- MANET, which has only its address alone.
- A new node. The working principle of our proposed method is shown in Fig. 3.

The proposed HSHSELM provides swift address assignment for each arriving node with the aid of reserved addresses preserved in the already existing MANET node. Every node has its agent node, and the node itself has selected that. The selected agent node will send the reserved address to the node based on the request. If the agent node is a type I MANET, it automatically and swiftly assigns the reserved address to the agent node. If it is type II, it follows the address borrowing mechanism that has been followed in [21]. The type II MANET borrows the address from the type I MANET and sends it to the new node.

Meanwhile, the later process also performs swiftly due to the adopted HSA algorithm, which provides better configuration and automatically detects duplicate nodes. After assigning the address, the agent node and the new node are converted into type 1 nodes by selecting two random addresses and checking any duplicate node available to select unique addresses. If there are no negative messages, both nodes are deemed type 1 MANET nodes. On the other hand, if the agent node tries to get only one unique address, then the new node remains in type 2, and the agent node will convert into type 1. Meanwhile, if there are negative messages, the agent and new node remain type 2 MANET nodes.

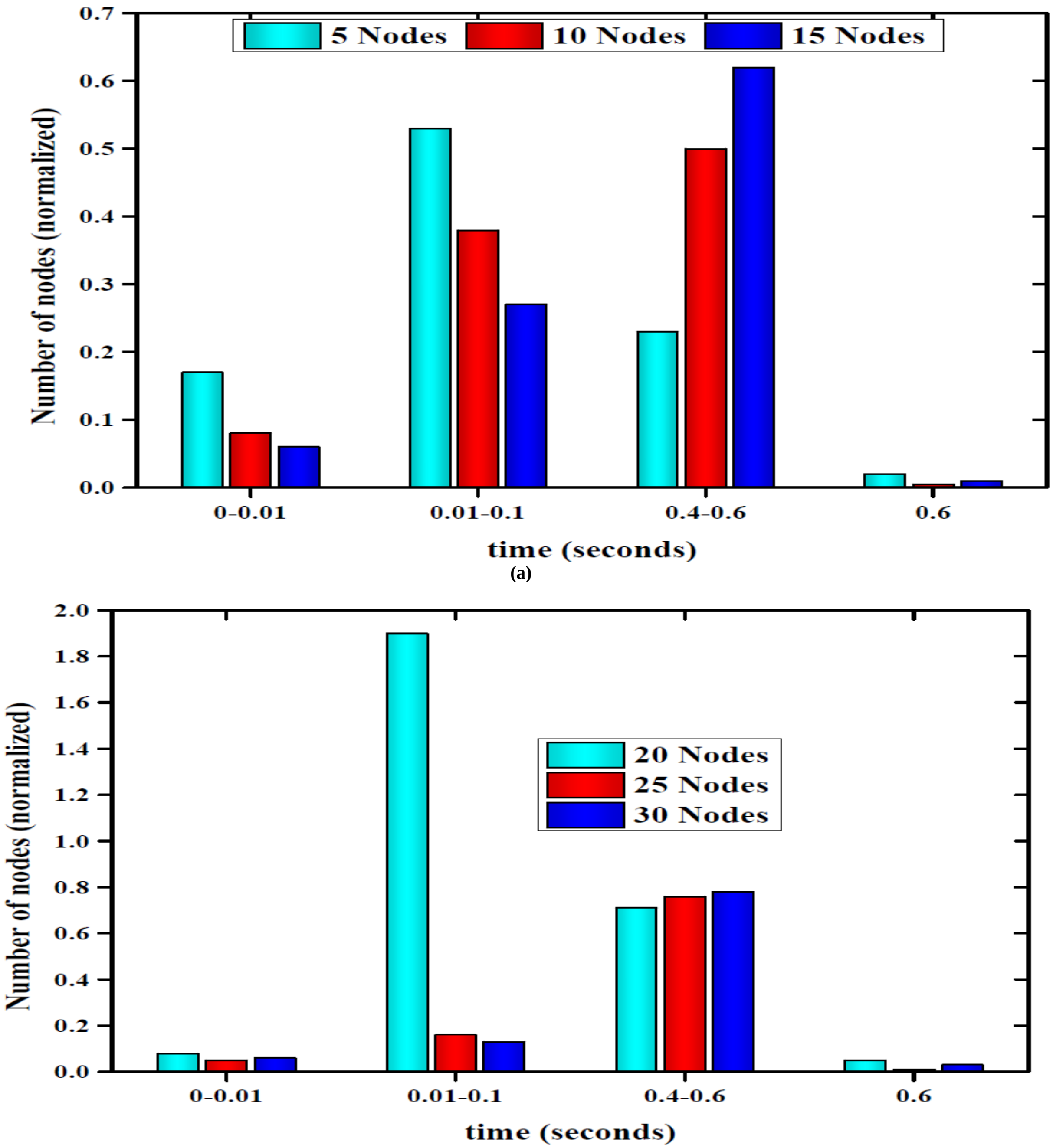
5. Result and Discussion

The performance of the proposed HSHSELM model for IP addresses auto reconfiguration in MANET. Table 1 describes the summary of the interconnection of nodes [8]. The fixed Random Waypoint Models with NS-2 version of 2.27 is used as the implementation platform. For these experiments, we employed 5 to 30 nodes in terms of the proportion of nodes connected.

Table 1. The interconnection of nodes summary

Number of nodes	5	10	15	20	25	30
Percentage (%) of nodes connected	25	50	55	60	70	83

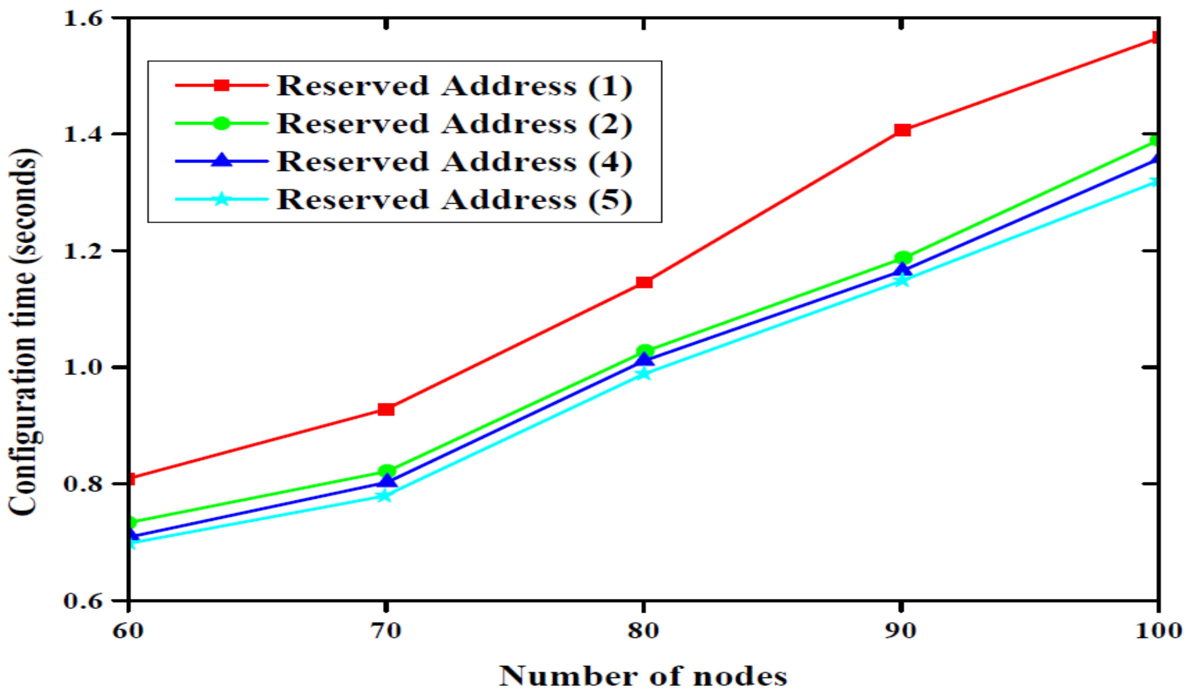
The configuration times based on histograms are described in Fig 4. In the abscissa, the amount of configuring nodes describes the configuration and ordinate times. The peaks in the configuration ties distribution are noticed from the simulation results. If the initiators select an IP address during the first configuration procedure [9], it runs two search IP broadcasts to face possible errors in the wireless channels. Since it has less configuration time, it never relies on an Initiator if a node is configured in less than 0.4 seconds. Due to new network formation, the initial interval consists of node address configuration. The network_initialization process is started. The second interval represents the number of nodes acquiring configuration settings from a neighbour. For valid address configuration, the third intervals require the Initiators. The selected search_IP timer with the available address is determined. The configuration time is affected by selecting collision probability.



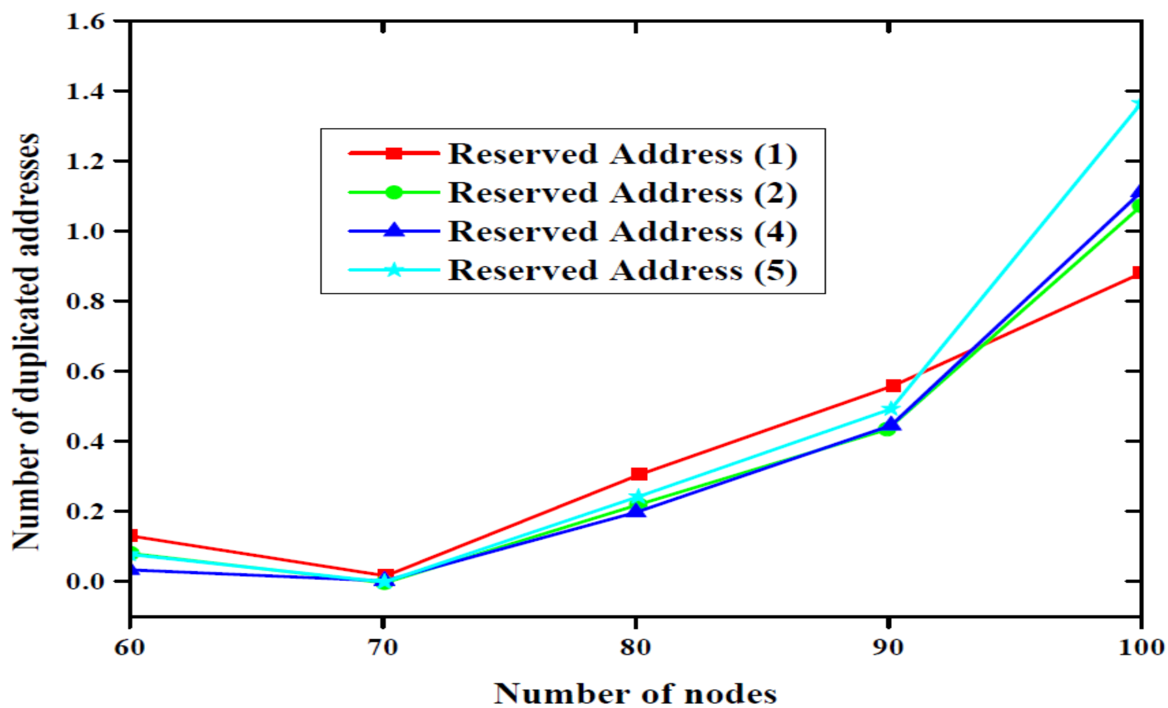
(b)

Fig. 4 The configuration times based on histograms

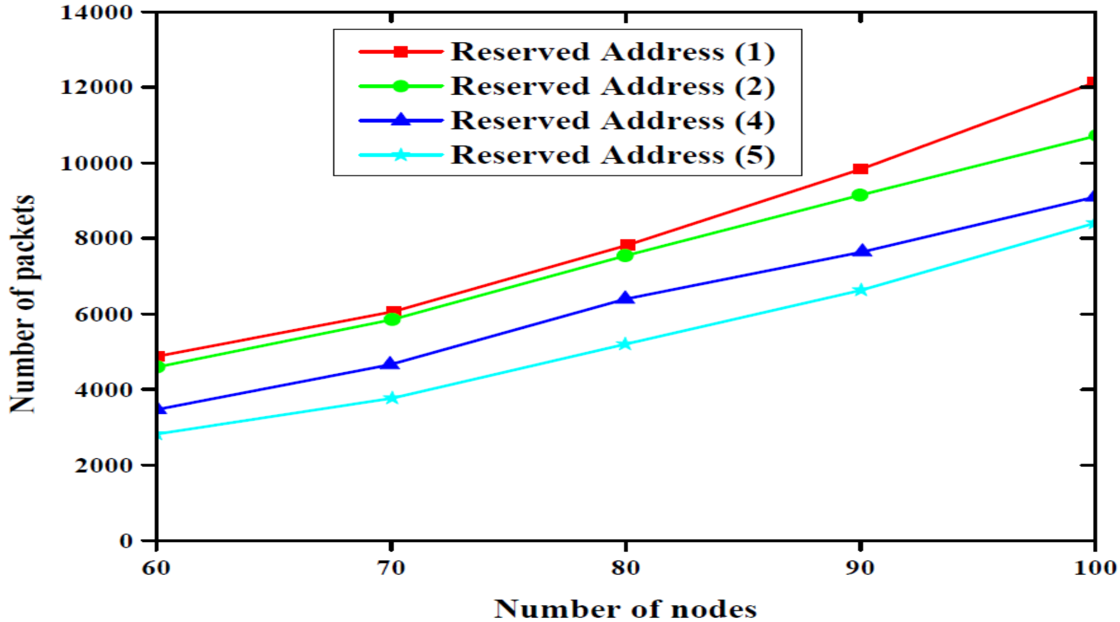
Fig. 5 (a) to 5(c) delineate the number of reserved addresses concerning average latency, uniqueness, and communication overhead. The average latency, uniqueness, and communication overhead are evaluated based on the number of reserved addresses. When the number of nodes is 100, fewer conflicts are reported. The proposed HSHSELM, described by four reserved addresses, describes optimal outputs [10]. The average latency allocation results with the reserved address and the exception of HSHSELM are very similar.



(a)



(b)



(c)

Fig. 5 The number of reserved addresses, (a) Average latency, (b) Uniqueness, and (c) Communication overhead

The characteristics of the HSHSELM model are summarized in Table 2. Furthermore, the HSHSELM model is fed to IPV6 via minor changes.

Table 2. The proposed HSHSELM characteristics summarization

Characteristics	HSHSELM
Based on routing protocols	No
Need reliable flooding	Yes
Method	Optimized HS algorithm and addressed reservation
Support for network merging	Yes
Class	No addresses table

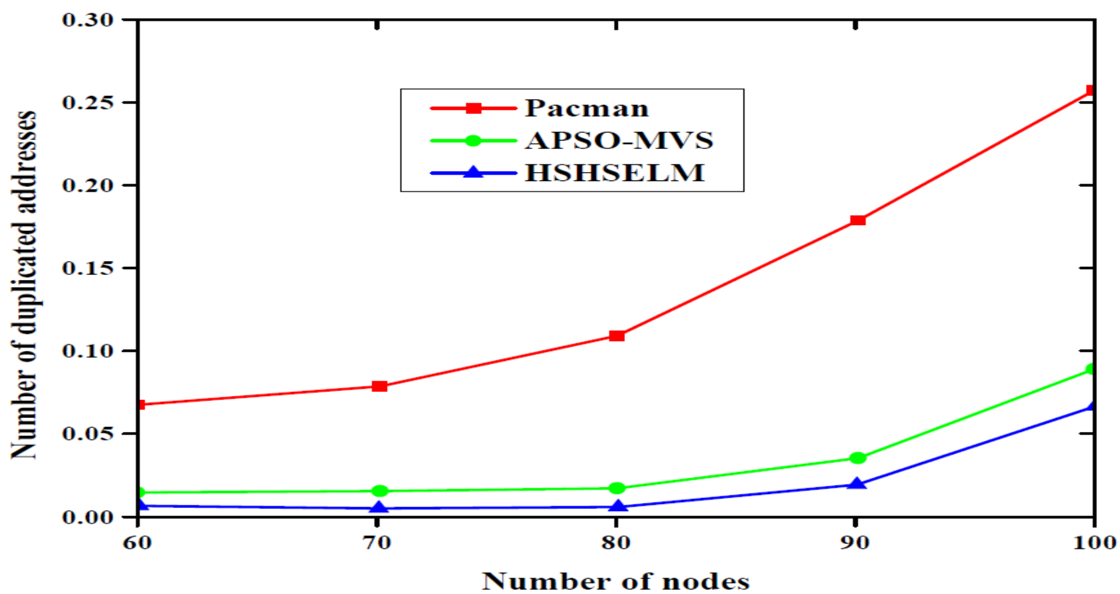


Fig. 6 describes the unique comparison of address range 65536

The application and abnormal characteristics of routing protocol are affected via address conflicts. The duplicated addresses are neglected by exploiting the Pacman and APSO-MVS. The address conflicts are verified via APSO-MVS, which does not possess a model. Because of the limited address range, several numbers are created for the proposed purpose. When the number of nodes is smaller, the Pacman demonstrates several duplicated addresses. The network's address range is *R*, and the number of present nodes is *M*. The amount of conflict nodes dramatically minimizes in the address range of 65536. Because the APSO-MVS is based on conflict probability, only a few conflicting addresses remain. Because the number of nodes is minimal, the APSO-MVS requires a wide range of addresses. The address space waste and how the MAC collision affects message loss are considered.

The communication overhead comparison of address range 65536 is described in Fig 7. The number of nodes in three techniques, Pacman, APSO-MVS, and proposed HSHSELM, is the proportion of the number of packet results. A new mode of communication obtains the addresses. In order to collect the acknowledgements, the APSO-MVS deluges a packet a single time. Whereas once the proposed HSHSELM performs better and repeats the procedure till the end of the node succeeds in obtaining the unallocated address. Whenever the new joins, the Pacman and APSO-MVS do this more than one time. The proposed HSHSELM has less communication overhead than Pacman and APSO-MVS.

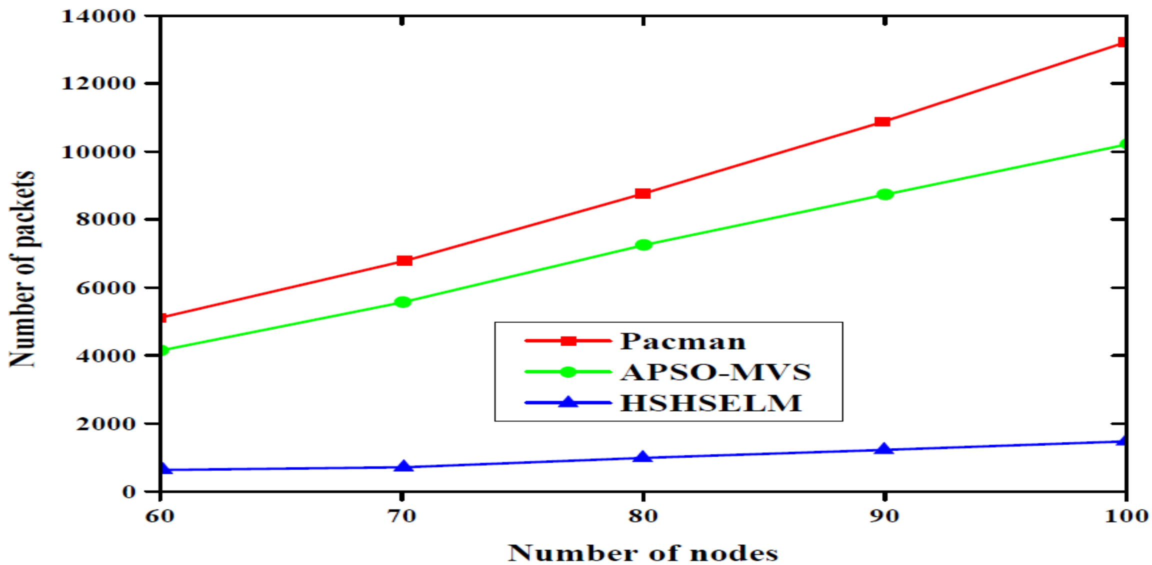


Fig. 7 Communication overhead comparison of address range 65536

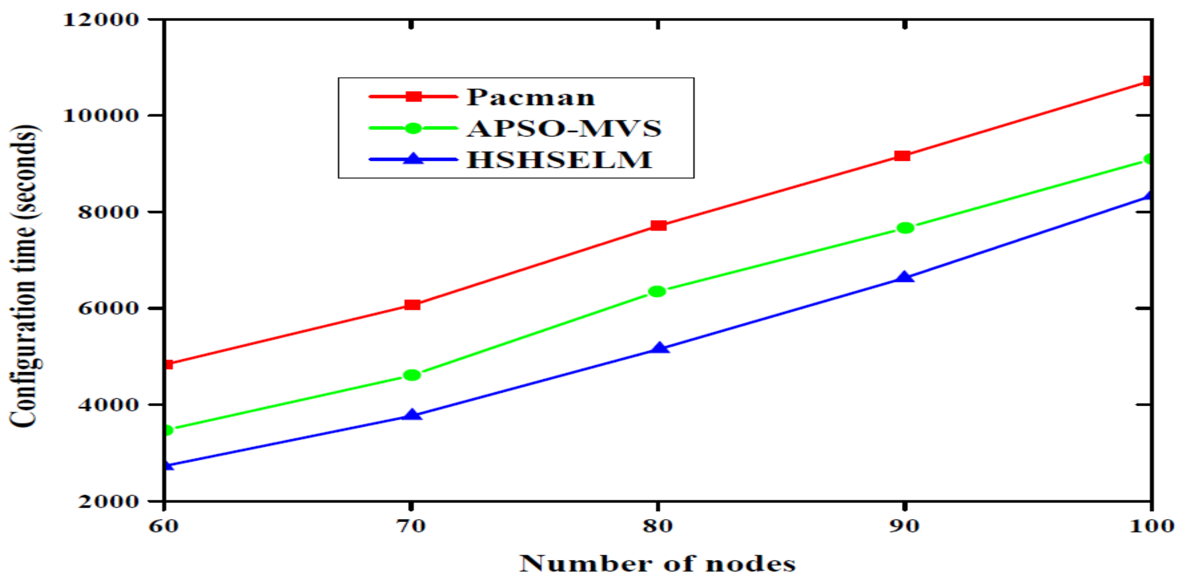


Fig. 8 An average latency comparison of address range 65536

6. Conclusion

This article proposed the HSHSELM model for IP address auto reconfiguration in MANET. The address latency allocation, communication overhead, and uniqueness of allocated addresses are the three major requirements of address auto-configuration. The fixed Random Waypoint Models with NS-2 version of 2.27 is used as the implementation platform. The state-of-the-art comparison between the Pacman, APSO-MVS, and the proposed HSHSELM model is performed. Based on the experimental investigations, the allocated address uniqueness is guaranteed, and also the communication overhead is minimized in which the multiple address reservation is determined. When the number of reserved addresses was four, the proposed HSHSELM demonstrated optimal uniqueness, latency time, address allocation, and communication overhead.

References

[1] Ackerson, Emmanuel, Ferdinand Katsriku, and Jamal-Deenabdulai, "Stateless Optimization Scheme for Ipv6 Address Assignment in Wireless Sensor Network (WSN)," *Int. J. Sci. Res. in Computer Science and Engineering,* vol.8, no.4, 2020.

[2] Ghosh, Uttam, Pushpita Chatterjee, Raja Datta, Al-Sakib Khan Pathan, and Danda B. Rawat, "Secure Addressing Protocols for Mobile Ad Hoc Networks," *in Security Analytics for the Internet of Everything*, CRC Press, pp.193-212, 2020.

[3] Samuel, Rajulaangelin, and D. Shalini Punithavathani, "Designing A New Scalable Autoconfiguration Protocol With Optimal Header Selection for Large Scale Manets," *Journal of Circuits, Systems and Computers,* vol.29, no.05, pp.2050068, 2020.

[4] Yang, Hua, Guojun Liu, Weiming Yang, and Chenglong He, "Dynamic IP Address Allocation with New Virtual Server Configuration Method," *in 2020 12th International Conference on Intelligent Human-Machine Systems and Cybernetics (IHMSC), IEEE,* vol.2, pp.92-95, 2020.

[5] Stewart, Randall, Qiaobingxie, Michael Tuexen, Shin Maruyama, and Masahiro Kozuka, "Stream Control Transmission Protocol (SCTP) Dynamic Address Reconfiguration," RFC 5061 (Proposed Standard), vol.2, no.1, 2007.

[6] Geem, Zong Woo, Joonghoon Kim, and Gobichettipalayam Vasudevan Loganathan, "A New Heuristic Optimization Algorithm: Harmony Search," *Simulation*, vol.76, no.2 , pp.60-68, 2001.

[7] Gbayan Bundega Martins et al, "A Novel Dynamically Sensing and Resource Allocation in a Cognitive Radio Network Using Inspiration from Hemoglobin Binding Algorithm," *International Journal of Recent Engineering Science,* vol.9, no.1, pp.22-30, 2022. Crossref, https://doi.org/10.14445/23497157/IJRES-V9I1P104.

[8] Abbas, Cláudia J. Barenco, Georges Amvame-Nze, and L. Javier García Villalba, "Performance Evaluation of Mobile IP Agents' Auto-Reconfiguration Mechanisms in MANET," *in International Conference on Embedded and Ubiquitous Computing*, Springer, Berlin, Heidelberg, pp.844-853, 2006.

[9] Amvame-Nze, Georges, Cláudia J. Barenco Abbas, and L. Javier García-Villalba, "Evaluation of the Dynamic Reconfiguration of Mobile Ipv4 Agents in MANET," *in Wireless and Optical Communications*, 2006.

[10] Lee, Geunhyung, Longzhe Han, Yunhui Park, Jung-Been Lee, Juwon Kim, and Hoh Peter in, "An Energy-Efficient Routing Protocol for CCN-Based Manets," *International Journal of Smart Home,* vol.7, no.1, pp.143-152, 2013.

[11] Jung, Younchan, and Matnelperadilla, "Domain Name to IP Address Resolution System with Multiple Name Servers Adaptable to Manets," in 2012 IEEE 11th International Conference on Trust, Security and Privacy in Computing and Communications, pp.1348-1357. IEEE, 2012.

[12] Rajesh Kumar M R, S.P.Malarvizhi, "Neighbor Discovery Based Routing in Code Based Mobile Adhoc Networks," *SSRG International Journal of Computer Science and Engineering*, vol.4, no.1, pp.14-18, 2017. *Crossref,* https://doi.org/10.14445/23488387/IJCSE-V4I1P103.

[13] Korichi, Afaf, and Youcefzafoune, "MAAC Protocol: Mobile Agents Based Address Auto-Configuration Protocol for MANET," in *2018 International Conference on Smart Communications in Network Technologies (Saconet), IEEE,* pp.194-199, 2018.

[14] Jiang, Xiangtao, Hui Huang, Dongjun Xin, and Jiayi Du, "The Simulation of Address Autoconfiguration Protocols in Mobile Ad Hoc Networks Based on NS2," in *2018 14th International Conference on Natural Computation, Fuzzy Systems and Knowledge Discovery (ICNC-FSKD) IEEE,* pp.1294-1299, 2018.

[15] Priya, J. Sathya, M. A. Femina, and R. A. Samuel, "APSO-MVS: An Adaptive Particle Swarm Optimization Incorporating Multiple Velocity Strategies for Optimal Leader Selection in Hybrid Manets," *Soft Computing* , vol.24, pp.18349-18365, 2020.

[16] S.V.Karthik, "A Study on Wireless Sensor Networks and Mobile Ad Hoc Networks," *International Journal of P2P Network Trends and Technology,* vol.9, no.6, pp.8-11, 2019. Crossref, https://doi.org/10.14445/22492615/IJPTT-V9I6P403.

[17] Wen, Hui, Hongguang Fan, Weixinxie, and Jihong Pei, "Hybrid Structure-Adaptive RBF-ELM Network Classifier," *IEEE Access*, vol.5, pp.16539-16554, 2017.

[18] Devroye, L., & Wagner, T, "Distribution-Free Performance Bounds for Potential Function Rules," *IEEE Transactions on Information Theory,* vol.25, no.5, pp.601-604, 1979.

[19] Indu Sharma, Shaina Pundir, "Enhancement in AOMDV Protocol to Reduce Chances of Link Failure in Mobile Adhoc Network," *International Journal of Computer & Organization Trends (IJCOT),* vol.6, no.2, pp.17-20, 2016. Crossref, https://doi.org/10.14445/22492593/IJCOT-V33P304.

[20] Ding, Shifei, Han Zhao, Yanan Zhang, Xinzheng Xu, and Ru Nie, "Extreme Learning Machine: Algorithm, Theory and Applications," *Artificial Intelligence Review*, vol.44, no.1, pp.103-115, 2015.

[21] Kim, Namhoon, Soyeonahn, and Younghee Lee, "AROD: An Address Autoconfiguration With Address Reservation and Optimistic Duplicated Address Detection for Mobile Ad Hoc Networks," *Computer Communications*, vol.30, no.8, pp.1913-1925, 2007.

[22] D. Naga Tej, K V Ramana, "An Application Data Privacy Preservation Strategy for MANET 2ACK to Identify and Mitigate the Effect of Routing Issue," *International Journal of Engineering Trends and Technology*, vol.70, no.7, pp.377-387, 2022. Crossref, https://doi.org/10.14445/22315381/IJETT-V70I7P239.

[23] Abbasi, Maysam, Ehsan Abbasi, and Behnam Mohammadi-Ivatloo, "Single and Multi-Objective Optimal Power Flow Using A New Differential-Based Harmony Search Algorithm," *Journal of Ambient Intelligence and Humanized Computing* , vol.12, pp.851-871, 2021.

[24] Chardet, Maverick, Hélène Coullon, and Simon Robillard, "Toward Safe and Efficient Reconfiguration With Concerto," *Science of Computer Programming*, vol.203, pp.102582, 2021.

[25] Soares, E., Aguiar, A., Brandão, P., & Prior, R, "Service for MANET Node Self-Configuration and Communication," *in 2018 11th IFIP Wireless and Mobile Networking Conference (WMNC)*, *IEEE*, pp.1-8, 2018.

[26] Wen, Hui, Tongbin Li, Deli Chen, Jianlu Yang, and Yan Che, "An Optimized Neural Network Classification Method Based on Kernel Holistic Learning and Division," *Mathematical Problems in Engineering,* 2021.