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Deep Learning Method of Predicting MANET Lifetime Using Graph Adversarial Network Routing

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ABSTRACT- The prominence of mobile ad-hoc networks (MANETs) is on the rise. Within the domain of machine learning, a specialized subset known as deep learning (DL) employs diverse methodologies, each providing unique interpretations of the data it processes. In existing system the vulnerabilities of MANETs to security threats stem from factors such as node mobility, the potential for MANETs to provide economical solutions to real-world communication challenges, decentralized management, and constrained bandwidth. The efficacy of encryption and authentication methods in safeguarding MANETs encounters limitations. Intelligence will be the future development direction of network adaptive optimization technology in response to the increasingly complex mobile communication network. Data from mobile communication is a crucial part of the future information society. This paper propose adaptive optimization scheme , employs a machine learning algorithm that is capable of realizing the optimal parameter configuration and coordinating various optimization objectives in response to changes in state and environment. The coordination and advancement of social, versatile and area administrations make the customary informal organization easily change to portable correspondence organization. Creation of a system that can learn some rules from data and apply them to subsequent data processing is the research objective. This paper examines the machine learning-based algorithm for big data analysis and effectively addresses the issue of communication network data using graph theory and the experimental result shows higher lifetime prediction accuracy compare to previous system.

Keywords: Deep Learning, Graph Theory, Prediction, Communication Network, Lifetime.

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1. INTRODUCTION

Human knowledge has shown explosive growth as a result of the rapid development of information science. Every day, numerous fields collect and store a large number of data [1]. Data from mobile communication is a crucial part of the future information society. The use of intelligent mobile terminal devices is increasing. Traditional social networks have made an easy transition to mobile communication networks thanks to the big data era and the integration and growth of social, mobile, and location services [2]. Big data presents a brand-new development platform and unprecedented opportunities for the mobile communication industry due to the rapid development of information construction [3]. People's work and personal lives are both closely intertwined with mobile communication, and the demand for more efficient mobile communication networks is also growing. People's behavior and habits in human society are constantly influenced by mobile communication in this day and age, when the Internet and mobile Internet are on the rise [4].

Notwithstanding progressively complex portable correspondence organizations, existing organization versatile enhancement speculations and techniques have numerous issues to accomplish the presentation prerequisites of super high information rates and super low inertness [5]. The research object of machine learning is data, and its goal is to discover laws and associations. The development of a system that can autonomously learn a particular law from the data and apply this law to subsequent data processing is the research goal of machine learning, which is a subfield of artificial

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intelligence [6-8].

2. RELATED WORKS

The combination of machine learning and wireless communication welcomes new development opportunities with the development of intelligent communication and 5G. The customary credit assessment model is chiefly subjective and depends vigorously on private emotional thoughts and experience [9-10]. A new communication system model based on machine learning, particularly deep learning, has been proposed, and pertinent research on machine learning, particularly the combination of deep learning and wireless transmission layer, has emerged. An organization model in view of adjoining hubs can be laid out by interfacing a line between two stations as the edge of the organization. A complicated weighted network can be built because stations have different communication services.

The greater the weight of the edge, the greater the traffic volume and significance of the service between two adjacent stations [11]. Ordinary organizations the executives framework interfaces all organization components and sub-network components, and could in fact arrive at the single leading group of the base station. The issues and faults in the network are resolved precisely thanks to the intervention and command of the personnel responsible for operation and maintenance. A specific index cannot serve as the standard for evaluating a mobile communication network. For comprehensive consideration of various reliability indices, the communication network as a whole must be taken into account [12]. To accurately reflect the communication network's current state.

3. CHANNEL ESTIMATION

Using the EM algorithm, traditional theoretical framework of machine learning does not include semi-supervised machine learning; however, semi-supervised machine learning has gradually emerged as a research hotspot in recent years. The sending and receiving ends of a traditional communication system are typically divided into a number of processing modules to optimize each part and achieve near-optimal overall performance. The proposed graph theory algorithm focuses primarily on the computation of a manifold sorting matrix, with the storage and computation of large matrices acting as a major bottleneck, making it difficult to apply to a wide range of real-world problems. The brand-new data include not only the data generated during the operation of the data in the information system, but also the views of students on various social network contents and school server logs [13]. As a result, there are significantly more unidentified data than identified data in the real world. Although the delivery success rate is not sufficient, the single copy routing algorithm that is based on the characteristic data of network connection information takes the structure of the network connection into consideration when routing.

In a nutshell, the study of graph models is the subject of graph theory. Chart model is a numerical model that portrays the connection between at least two things. There are three essential parts to it: weight, vertex, and edge in this paper, we just consider that the hubs are genuine vectors or separated feature vector, and the loads of the edges are non-negative genuine loads. There is a lot of data in the mobile communication network. To genuinely take advantage of these information assets later on network self-enhancement innovation and plan a more clever organization self-improvement innovation system, we should initially figure out exhaustively which information assets really exist in the organization. Conduct four data analyses following the completion of the configuration. The quantity of data hubs utilized for every investigation is unique, and the comparing handling time is additionally unique. For instance, the processing time and number of nodes for each analysis are shown in *table 1*. *Figure 1* depicts the relationship between processing time and the number of nodes.

Table 1: Nodes and Processing Time

S. No	Nodes	Processing time
1	2000	100000
2	3000	250000
3	5000	750000

The communication transmission system based on deep learning can simultaneously optimize the sending end, channel transmission and receiving end by means of an automatic encoder. This end-to-end communication realizes a new architecture with optimal overall performance. For example, *table 2* shows the name node size and data node size obtained from four operations. *Figure 2* shows the relationship between name node size and data node size.

The EM algorithm is an iterative method for maximum likelihood estimation of probability models with hidden variables that is utilized frequently in machine learning. The received signal in a wireless communication system can be expressed as:

$$y(i) = hx(i) + w(i), i = 1,2,\ldots,N \quad (1)$$

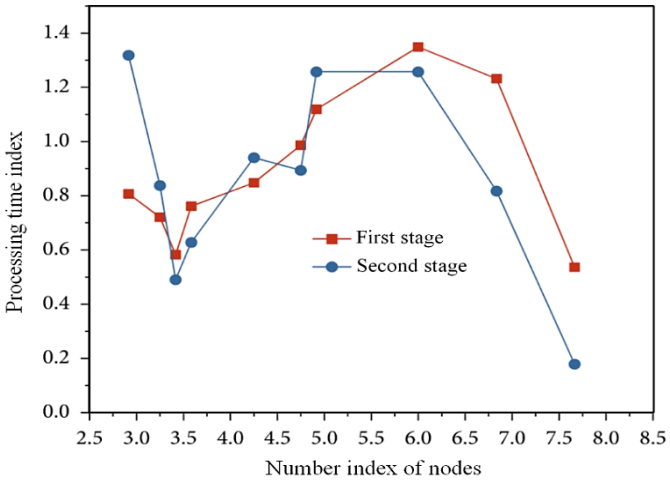

Figure 1: Nodes vs Processing Time

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In this likelihood model, the channel h is the amount to be assessed, the got signal *y(I)* is recognizable information, and *x (I)* can be viewed as an understood variable. The transmitted signal vector and the received signal vector are, respectively. Using the EM algorithm, a channel estimator based on the characteristics of the modulated signal is proposed.

4. DEEP LEARNING – PROCESS ESTIMATION

The EM algorithm can perform the observation data's maximum likelihood estimation, and its objective is to maximize the observation data's log likelihood function in relation to unknown parameters, *i.e.*, to maximize:

$$L(h) = \log P(Y|h) = \log \sum_X P(Y, X|h)$$
$$= \log\left(\sum_X P(Y|X,h) P(X|h) \right) \quad (2)$$

An automatic encoder allows the deep learning-based communication transmission system to simultaneously optimize the sending, channel, and receiving ends. Using this end-to-end communication, a new architecture that performs best overall is realized. Name node size and data node size, for instance, are shown in *table 2* as the outcomes of four operations. The relationship between data node size and name node size is depicted in *figure 2.*

Table 2: Name node size and data node size

S. No.	Node Sise	Data Node Values
1	24	1500
2	36	2000
3	78	3500

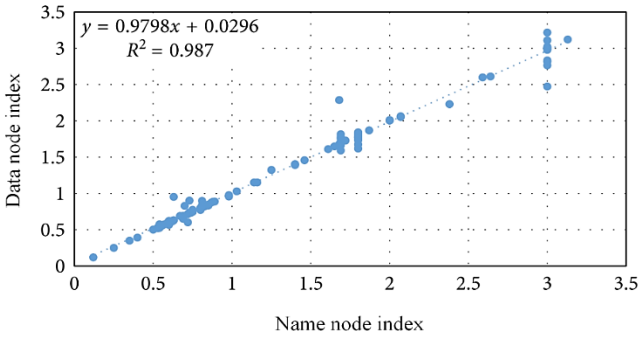

Figure 2: Node Index vs Data Node – Deep Learning Process

Because the relevant factors and characteristics of various customers are not uniform, evaluation results are also highly subjective. Finding the primary cause of the default time and assigning a weighted weight or comprehensive evaluation to the score is the credit scoring method.[14] This score is then used to evaluate credit risk. The snugness of a hub is utilized to depict the trouble of a hub to arrive at different hubs through the organization, and is the backhanded impact of a hub. Characterize it as the proportional of the amount of the separation from this hub to any remaining hubs [15].

Exactness implies that the information dependably mirrors the first information created by the client. Each iteration of the iteration process must include targeted data. During the preparation interaction, accomplishing information prediction is especially significant. When there is a problem with the prediction results, it can be automatically changed until the data in the training set can meet the needs and the accuracy of the data ends.

5. INTELLIGENT GRAPH ADVERSARIAL NETWORK

The security and stability of a mobile communication network depend on critical nodes within the network. These nodes' impact on network performance during failures reflects their importance. The evaluation of node importance is based on the degree of network cohesion, which is determined by shrinking the edge connected to the node. Nodes with higher network cohesion have greater weight.

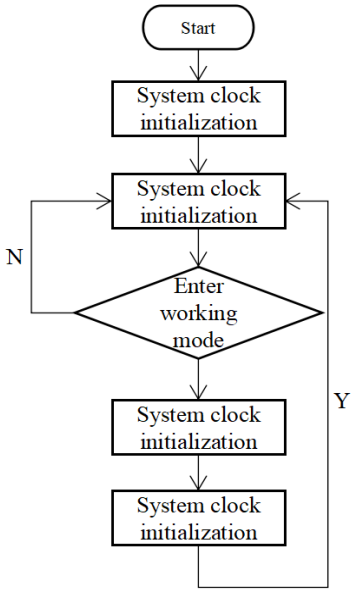

Figure 3: Process Flow – Deep Learning

When a task is received by the task tracker, it is assigned to the local work tracker, which generates data and reports progress. However, due to the wide range of information involved, the connection between them can be confusing [16]. Notably, there is no coordinated connection between performance indicators and organizational design boundaries. Changing various boundaries can yield similar results for an organization's performance indicators, and modifying certain boundaries can affect other performance indicators. To understand the linear correlation between variables, it is important to determine the best linear fitting of correlation results. Correlation operations can identify variables that mutually influence each other and quantify their degree of influence. Most steering convention scientists manually set weight boundaries. Typically, the boundary size is randomly assigned or set to a default value that remains unchanged over time. Exploring the reliability of network geography requires a

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thorough and comprehensive analysis of both network devices and traffic capacity. *Figure 1* illustrates the flow of the algorithm.

The actual deployment process is driven by distinct performance requirements because of the relatively closed network and centralized data center management, demonstrating the coexistence of multiple network forms. Meet the cointegration test's premise. Determine whether related variables have a long-term equilibrium relationship. *table 1* displays the test results.

Table 3: Chi Test – DeepQ Results – TensorFlow

Characteristic value	Trace estimation	Critical value
0.83	98%	1.29
0.92	94%	1.38
1.23	97%	1.48
2.23	96%	1.89

In the future, the customer's normal loan repayment behavior or default behavior will be recorded in the business data. Each business circuit set must pass as few communication nodes as possible in order to improve the compactness of the topology. *figure 2* shows the original data and predicted data.

The significance of nodes in a mobile communication network is assessed based on a single connection weight. However, there is currently no effective method for considering the combination of multiple indexes when evaluating node importance. The cluster's center is located far from any point with higher density due to its surroundings of neighboring points with lower local density [17]. To optimize a specific performance index in the network's current state, it is necessary to sort based on the correlation degree obtained from analysis and determine which index is currently the most optimized. Programmed learning techniques are superior to manual setting as they save the cost of physically setting boundaries and allow for real-time changes in weight parameters when the network structure changes [18]. An algorithm for data analysis should be developed to examine the influence and relationship of response variables. The security and stability of a mobile communication network directly depend on its security and reliability, and the importance of a node indicates its impact on network performance during failures.

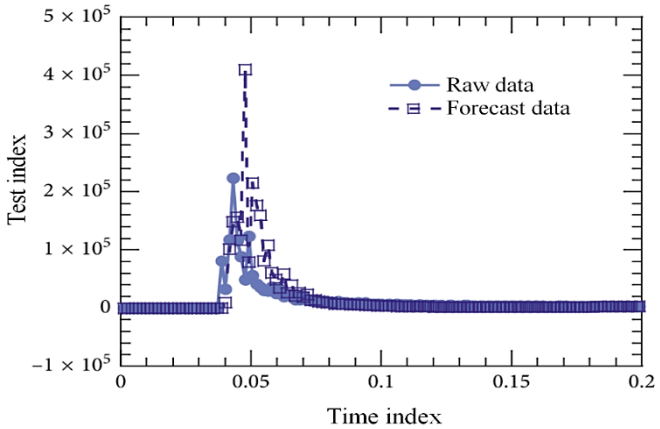

Figure 4: Forecast result of test index

Table 4: TensorFlow result of mean and average index

Network parameters	Minimum value	Maximum value	Medium number	Average value
0.5	75	93	81	87.25
0.75	79	94	82	89.21
1.00	82	93	83	91.23

Because it is generally difficult to calculate the maximum value, the objective function is changed from the solution to the minimum problem to the solution to the maximum problem using the negative log loss.

$$\begin{aligned}\min_{w} J &= -\ln p(i \succ j) \\ &= -\ln \frac{1}{1+e^{-W^T(V_i-V_j)}} \\ &= -\left[0-\ln\left(1+e^{-W^T(V_i-V_j)}\right)\right] \\ &= \ln\left(1+e^{-W^T(V_i-V_j)}\right)\end{aligned} \tag{6}$$

According to the objective function, the derivative of W can be calculated as:

$$\frac{\partial J}{\partial W} = -\frac{e^{-W^T(V_i-V_j)} \times \left(V_j - V_i\right)}{1+e^{-W^T(V_i-V_j)}} \tag{7}$$

Table 5: Lifetime prediction accuracy results

Business type	1	2	3	4	5
Machine Learning	25	28	32	35	49
Support Vector	33	31	32	34	48
Deep Learning	21	23	27	28	24

6. DISCUSSION

For mobile communication network topology to maintain a certain level of robustness, calculate the update value of the weight vector in response to the loss, and update the weight vector, the minimum redundant communication capability of all nodes must be as large as possible.

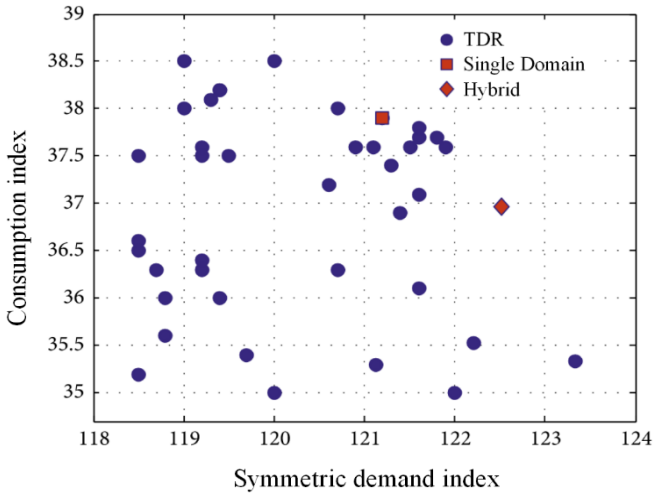

Figure 5: Lifetime measurement using index and demand access

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In order for gradient descent to locate a local optimal solution, we must establish a suitable optimization step size for the majority of optimization problems. Gradient descent can obtain the global optimal solution for convex optimization problems, or those in which the objective function is a convex function. To guarantee the nature of organization administrations, it is important to make a sensible forecast of the data transfer capacity of the versatile correspondence network arranging stage.

When the network reaches a certain training accuracy or a certain number of iterations, it frequently ends its iteration. Through comprehensive collection and mining of the operator's communication attribute and user behavior data, a comprehensive portrait data set was created. Users are evaluated for default risk in terms of identity characteristics, personal connections, consumption capabilities, and other dimensions using machine learning and big data-related technologies. These element data are extricated as character strings, and they should be communicated as component vectors.

7. CONCLUSIONS

In a computerized time, and during the time spent information collection, the issues in enormous information are turning out to be increasingly noticeable. Numerous classification and clustering algorithms are greatly influenced by the direct overlap or interference of noise points in the distribution of various classes in real data sets. In this paper, every hardware and line of versatile correspondence network are disconnected into hubs and edges, an organization geography model is laid out, and its boundaries are determined. The selection principle and measurement index of the reliability index system are provided in addition to an examination of the network topology's reliability. Mobile communication systems of the future will have more complex network structures and more powerful functions. Using graph theory to effectively handle the problem of communication network data, this research investigates the machine learning-based approach for large data analysis. The experimental result demonstrates greater lifespan prediction accuracy compared to the prior system. In light of the increasing complexity of mobile communication networks, existing theories and methods of network adaptive optimization must increase their intelligence and initiative.

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Conflicts of Interest - The authors declare that have no competing interest.

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