Communication Rules Learning Strategy in Big Data Network Based on SVN Neural Network

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***Abstract*—Big data system has great effect on improving the informational level of the application and demand. The Internet of things and wireless sensor network (WSN) is the typical manifestation of big data. Communication process of big data system can be done adopting various wireless communication rules which include 4G, WLAN and WAVE. As each wireless communication rule has different application scene applicability and different communication effects, this paper proposed a communication rules learning strategy based on SVN neural network. This strategy obtained learning samples which indicate the communication mode with best communication performance through simulation of various application scenes in OPENT Modeler. Through the study of neural network algorithm, this designed strategy can output the predicted result mode of wireless communication adaptively under unknown data application scenes. The outstanding results show that the learning strategy based on neural network can accurately choose the optimal communication rule in big data system.**

Keywords- Big data; wireless Communication Rules; Neural Network; Communication Performance; OPENT Modeler

I. INTRODUCTION

Big data is the conceptual name of huge amounts of information, the concrete content can be described as: As its huge size of information which contains a wide range of information, traditional information management mode can't satisfy the analysis, processing and effective use, and make it difficult become a usable information, so you need to use the advanced technology and plenty of resources to deal with it, and then the data information management platform system is generated which is called Big data platform[1-2].

Big data has four characteristics: one is the huge size of the data; secondly, there are many types of data; thirdly, under the use of science, information processing speed is high; fourthly, is the potential value of the data has higher returns [3-4]. The utilization level of big data can reflect the information management ability and the ability to value obtained of particular object. With the generation of big data concept, information technology has entered a new era of development [5].

The Internet of things and Wireless Sensor Network (WSN) is the typical manifestation of big data [6]. As topology structure of nodes in big data system changes rapidly, the efficiency and security of wireless communication are confronted with great challenges and it may need a variety of communication rules to complete wireless communication tasks, such as 4G, Wireless Local Area Networks (WLAN) and Wireless Local Area Networks (WAVE) [7-8]. In order to get better network performance, more appropriate should be adopted in specific data application scene. The application of big data diagram is shown in figure.1. It's important to note that the below big data system takes for example of wireless sensor network.

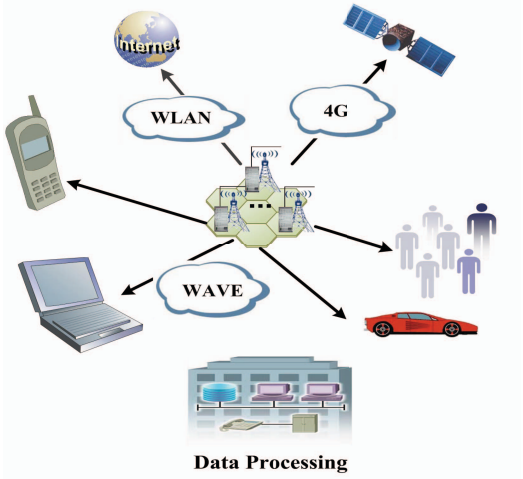

Figure 1. The structure and application of big data network

Now many experts and scholars have constructed various communication rules and networking communication architecture in big data system. An example method for analyzing big data in a network environment is provided and includes extracting a data set from big data stored in a network environment, detecting a pattern in the data set, and enabling labels based on the pattern, where each label indicates a specific condition associated with the big data, and the labels are searched to answer a query regarding the big data. In specific embodiments, detecting the pattern includes capturing gradients between each consecutive adjacent data points in the data set, aggregating the gradients into a gradient data set, dividing the gradient data set into windows, calculating a statistical parameter of interest for each window, aggregating the statistical parameters into a derived data set, and repeating the dividing, the calculating and the aggregating on derived data sets over windows of larger sizes until a pattern is detected[9].

The remainder of this paper is structured as follows. Section II gives a scope of wireless communication modes in big data system. Section III describes the proposed communication rules learning strategy based on neural

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network and verification for it is presented in Section IV. Section V finally concludes this paper.

II. Scope of Wireless Communication Rules

A. 4G Communication Mode

UMTS (Universal Mobile Telecommunication Systems), as a 4G &beyond cellular network technology, operates with a frequency range of around 2 GHz. UMTS make the WCDMA as the preferred air interface technology and achieve continuous improvement, but it also has introduced the TD-SCDMA and HSDPA technology. The structure of UMTS system mainly includes the wireless access network, CN (Core Network, the core network), UE (User Equipment) and UTRAN (UMTS Terrestrial Radio Access Network). UMTS support transmission rate with 1920 kbps and a peak downlink data rate of 2 Mbps [10].

4G communication mode is suitable for communication scenarios with long distance and less data load. The advantage of 4G communication mode has less demand on the moving velocity of the node, and the disadvantage of 4G is the data transfer rate and limited capacity.

B. Wlan Communication Mode

WLAN is a type of wireless communication big data system, with characters of flexibility, mobility, easy scalability, and low cost and used for providing wireless connectivity between moving nodes[11]. WLAN which is the widely application of WLAN is a brand of wireless communication technology, and its main communication protocol is the IEEE 802.11 series of protocol. WLAN communication mode is suitable for the communication scenario in which the number of communication nodes, node mobile velocity, and communication distance are moderate.

C. WAVE Communication Mode

WAVE technology is an efficient short-range wireless communication mechanism after the generation of cooperative vehicle infrastructure system in order to solve the mobile node-to- mobile node communication, node-equipment communication problems. The advantage of WAVE is mainly reflected in the message transmission latency, node mobility, communication frequency of anti-interference [12]. The applicability of the IEEE 802.11p for Internet of Vehicles, its comprehensive evaluation of network performance and cost of implementation and complexity aspects are superior to ordinary wireless communication technology.

The Data Link layer includes LLC (Logical Link Control) and MAC, the IEEE 802.11p of MAC layer is the concentrated reflection of the performance advantages in the protocol architecture. The IEEE 1609.4 standard sets rules on the multi-channel multiplexing technique and channels can be divided into SCH and CCH time slot by using the method of time slot, and the channel time is divided into synchronization intervals with a fixed length of 100ms. MAC layer provide services for data transmission channel and coordination control, and make more efficient exchange of data through reliable channel access protocol [13]. The WAVE mode is more suitable for scenarios with plenty of nodes and high mobile velocity. The protocol architecture of WAVE is shown in figure. 2.

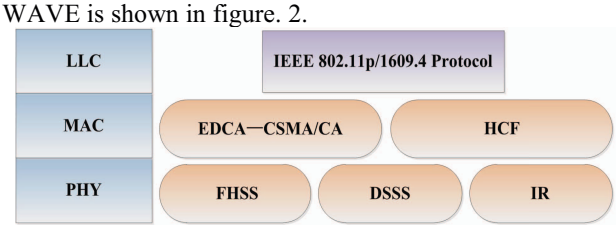

Figure 2: Protocol architecture of WAVE

III. Communication Rules Learning Strategy Based on Neural Network

The main function of proposed communication rules learning strategy for wireless communication modes is to select the most suitable wireless communication mode for the current big data application scene. Neural network can learn the rule of optimal communication mode according the learn simples. As communication node density and mobile velocity are the regular characters of internet of things and wireless sensor network system, so they regard as the input of the neural network. Support vector machine (SVM) neural network model is adopted in learning strategy proposed in this paper.

A. SVM Neural Network Model

The structure of SVM neural network is shown as figure 3. x_1 and x_2 represent node density and mobile velocity respectively. The essence of SVM is mapping the low-dimensional input space to a high-dimensional feature vector space. y is the output of neural network model and its range of value is $(0,1,2,3)$ which represent random mode, 4G mode, WLAN mode and WAVE mode.

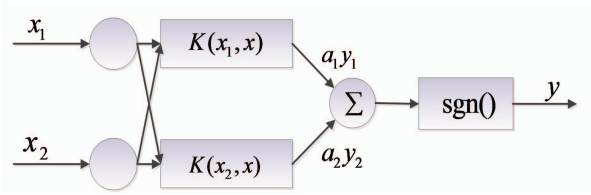

Figure 3. structure of SVM neural network

$K(x_i,x_j)$ is the inner product function which satisfies condition of Mercer. sgn() is the threshold function of this selection method.

$$K(x_i,x_j)=[(x_i\cdot x_j)+1]^q, q=1 \quad (1)$$