

Data Aggregation using Neural Network in WSN

Usha Rani¹, Amita Dhankher²

¹M. Tech. Student, U.I.E.T, MDU Rohtak, Haryana (India)
sweety_ushi23@yahoo.com

²Assistant Professor, U.I.E.T, MDU Rohtak, Haryana (India)
amita.infotech@gmail.com

Abstract

A sensor network is composed of a large number of sensor nodes, which are densely deployed either inside the phenomenon or in its proximity. The sensor nodes may be randomly deployed in inaccessible terrains or disaster relief operations hence sensor network protocols and algorithms must possess self-organizing capabilities. Wireless sensor network is highly data centric. Data aggregation are very important in wireless sensor networks because sending incorrect information by fault sensors make to wrong decision about environment and increasing defective sensor during the time incorrect data decries reliability of wireless sensor networks Data communication in WSN must be efficient one and must consume minimum power. Every sensor node consists of multiple sensors embedded in the same node. Thus every sensor node is a source of data. This research applies the neural network within the sensors, fault sensors and wrong data are discovered and eliminated. That is increased efficiency and reliability and longevity sensor networks. Simulation results show the better performance than the existing algorithm. For making the system self learning for the particular area the SOM Neural Network algorithm is implemented.

Keywords: *Wireless Sensor Network, Neural Network, Data Aggregation, SHA.*

1. Introduction

Wireless sensor networks [2] are an increasingly attractive means to bridge the gap between the physical and virtual world.. Sensor data is shared between these sensor nodes and used as input whose function is to extract the relevant information from the available data. Main objectives of sensor networks include reliability, accuracy, flexibility, cost effectiveness and ease of deployment. Each node has one or more sensing unit. A WSN consists of large numbers of cooperating small-scale nodes, each capable of limited computation, wireless communication, and sensing [3]. Typically, a sensor node is a tiny device that includes three basic

components: a sensing subsystem for data acquisition from the physical surrounding environment, a processing Subsystem for local data processing and storage, and also a wireless communication subsystem for data transmission [1].

2. Data Aggregation

Correct information and data aggregation are very important in wireless sensor networks because sending incorrect information by fault sensors make to wrong decision about environment and increasing defective sensor during the time incorrect data decries reliability of wireless sensor networks. Many sensors may be produce repetitive data with data aggregation schemas can reduce extra data [4]. Data aggregation is described as ‘a set of automated methods combining the data that comes from many sensor nodes into a set of meaningful information and eliminate the duplication [5].Aggregation refers to the technique that models the data and information in a dimensional construct that is easy to store and retrieve. The data collection technique is being employed to store and collect data items and parameters on a database server [6]. Data aggregation techniques explore how the data is to be routed in the network as well as the processing method that are applied on the packets received by a node. They have a great impact on the energy consumption of nodes and thus on network efficiency by reducing number of transmission or length of packet [7].

3. Neural Network

Recently there is a strong interest to use intelligent tools such as Neural Network in energy efficient

methods of Wireless Sensor Networks. Artificial Neural Networks are arithmetic algorithms which are able to learn complicated mapping between input and output according to supervised training or they can classify input data in an unsupervised manner [8]. Neural networks are a new tool to analyze complex and difficult issues, new strategies must be introduced [4].

4. Proposed Work

4.1 Secure Hash Algorithm

SHA512 is one member of a family of cryptographic hash functions that together are known as SHA-2. The standard for the SHA-2 algorithm specifies a procedure for adding padding to the input data to make it an integral number of blocks in length. The SHA-512 compression function operates on a 1024-bit message block and a 512-bit intermediate hash value. It is essentially a 512-bit block cipher algorithm which encrypts the intermediate hash value using the message block as key. Hence there are two main components to describe:

- (1) The SHA-512 compression function, and
- (2) The SHA-512 message schedule.

4.2 SOM Learning Algorithm

1. Initialize weights to small random numbers; set initial learning rate and neighborhood.
2. Present a pattern X and evaluate the network outputs.
3. Select the unit $c_i c_j$ with the minimum output:

$$|x - w_{c_i c_j}| = \min_{ij} |x - w_{ij}|$$
4. Update all weight according to the following learning rule:

$$w_{ij(t+1)} = \begin{cases} w_{ij(t)} + \alpha(t) [x(t) - w_{ij(t)}], & \text{if } (i, j) \in N_{c_i c_j}(t), \\ w_{ij(t)}, & \text{otherwise,} \end{cases}$$

Where $N_{c_i c_j}(t)$ is the neighborhood of the unit $(c_i c_j)$ at time t , and $\alpha(t)$ is the learning rate.
5. Decrease the value of $\alpha(t)$ and shrink the neighborhood $N_{c_i c_j}(t)$.
6. Repeat steps 2 through 5 until the change in weight values is less than a prespecified threshold or a maximum number of iterations are reached.

5. Result

The scenario of the simulation consists of four clusters. Each cluster consists of eight nodes. The scenario also consists of a base station. The below diagram shows the flow of data through the cluster heads and reach the base station.

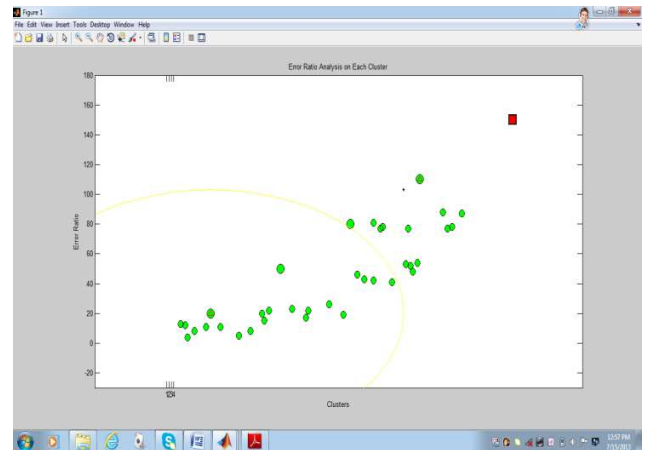


Figure 1: Data flow

The sensor nodes present in the modeled wireless sensor network use the Secure Hash Algorithm (SHA-2) for the transmission of data from the sink to other nodes and other nodes to the sink node.

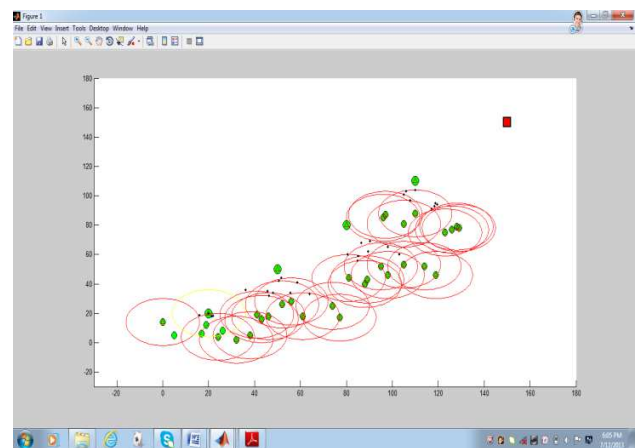


Figure 2: Data travel through cluster heads

Once the data transmitted to the base station then implementing SHA-2 algorithm, a dialog box appears that ensuring the data being transmitted to the base station or an authenticated place. The Neural

network tool is used that shows performance detail and training state of the data in WSN network.

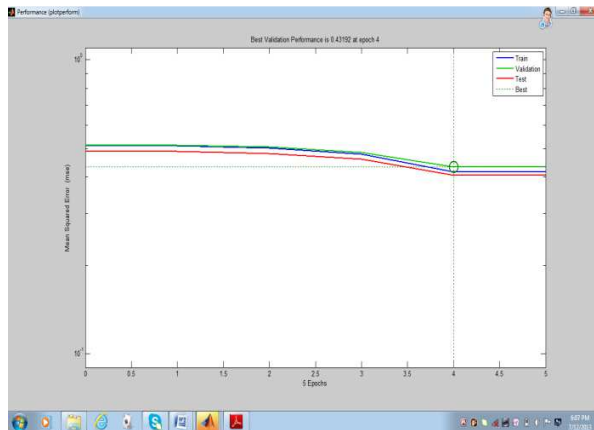


Figure3: Performance detail

From the above figure the various conclusions are observed in the proposed work

- ❖ The mean square error decreased.
- ❖ The best valid performance comes at 4 epochs.
- ❖ The training state and validation set shows the same characteristics.
- ❖ The validation and test case lines are very small.

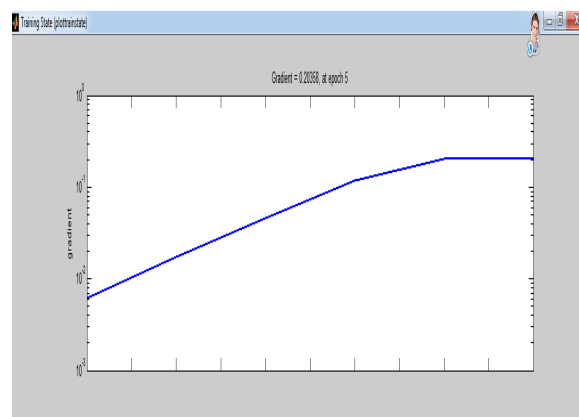


Figure 4: Gradient state

The graph showed a curve to the gradient value of 0.20358. Thus indicating the variation along the curve shown in the training state.

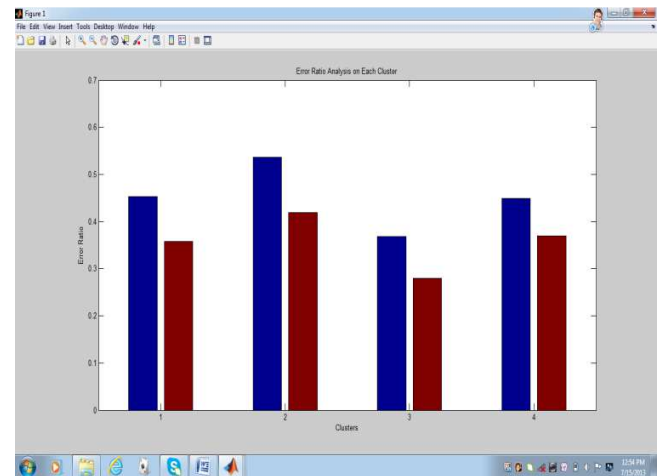


Figure 5: Error Ratio of Existing Vs. Proposed

In the above figure blue building blocks shows the existing error ratio and red building block shows the proposed error ratio. From the figure error ratio of proposed work decreased.

6. Conclusion

A sensor network is composed of a large number of sensor nodes, which are densely deployed either inside the phenomenon or in its proximity. Data communication in WSN must be efficient one and must consume minimum power. Thus every sensor node is a source of data. These raw data streams cannot be straightway communicated further to the neighboring node or the base station. The similarities between wireless sensor networks and neural networks suggest that combination of these two networks is possible. Various issues of wireless network give the idea for the combination of this technology to others. In this research work it resolve data aggregation using neural network in sensor network. The results show that the combination of this technology is needed and gives best performance than the ordinary technology. The results show that mean square error decrease and performance increased as compare to the existing technique .SHA-2 which are more efficient than the existing algorithm. The error ratio also decreased.

References

- [1] Zahra Rezaei and Shima Mobininejad "Energy Saving in Wireless Sensor Networks" International Journal of Computer Science &

- Engineering Survey (IJCSSES) Vol.3, No.1, February 2012.
- [2] Jeremy Elson and Kay Romer “Wireless Sensor Networks: A New Regime for Time Synchronization” In Proceedings of the First Workshop on Hot Topics in Networks (HotNetsI), 2829 October 2002, Princeton, New Jersey, USA.
<http://www'.acm.org/sigcomm/HotNetsI>
 - [3] Namarta Kapoor, Nitin Bhatia and Simranjeet Kaur “Wireless Sensor Networks: A Profound Technology” I S S N: 2 2 2 9 - 4 3 3 3 (P r i n t)
 | I S S N : 0 9 7 6 - 8 4 9 1 (O n l i n e) IJCST Vol. 2, Iss ue 2, June 2011.
 - [4] Saeid Bahanfar, Helia Kousha and Ladan Darougaran “Neural networks for error detection and data aggregation in wireless sensor network” IJCSI International Journal of Computer Science Issues, Vol. 8, Issue 5, No 3, September 2011
 ISSN (Online): 1694-0814 www.IJCSI.org
 - [5] P.K. Mishra, Harshit Bhardwaj and Pradeep Rana (2012) ” Neural Network based Power Efficient Decision Making about Natural Hazards Using Wireless Sensor Network” National Conference on Advancement of Technologies – Information Systems & Computer Networks (ISCON – 2012) Proceedings published in International Journal of Computer Applications® (IJCA)
 - [6] Sumit Chaudhary, Neha Singh, Avinav Pathak and A.K Vatsa “Energy Efficient Techniques for Data aggregation and collection in WSN” International Journal of Computer Science, Engineering and Applications (IJCSEA) Vol.2, No.4, August 2012
 - [7] Amanpreet Kaur¹, Vinni Kaur², Arvind Pathak “Data Aggregation Approach Using Neural Network in Wireless Sensor Networks” International Journal of Technological Exploration and Learning (IJTEL) Volume 1 Issue 1 (August 2012)
 - [8] Neda Enami, Reza Askari Moghadam and Kourosh Dadashtabar “NEURAL NETWORK BASED ENERGY EFFICIENCY IN WIRELESS SENSOR NETWORKS: A SURVEY” International Journal of Computer Science & Engineering Survey (IJCSSES) Vol.1, No.1, August 2010.