An Implementation of Genetic Algorithms in Big Data Processing for Medical Data

G. Renukadevi, K Selvakumar, S. Tamilarasan, S. Venkatakrishnan

***Abstract:** The large amount of real time medical measurement parameters stored in the SQL server needs processing using a specific algorithm. One of the big data processing techniques is available for medical data is Genetic algorithm. The acquired medical parameters are combined together to predict or diagnose the disease using the genetic algorithm. In this paper, the genetic algorithm is used to process the medical measurements data. The medical parameters are posted temporarily in the Representational Structure (REST) Application Program Interface (API) using a gateway protocol MQTT. The genetic algorithm can easily diagnose the disease using the existing stored parameters. The medical parameters of the patient like ECG, Blood pressure and skin temperature are posted frequently in the cloud server for continuous monitoring, and the huge data is also processed using this proposed method.*

***Keywords:** Big data Processing, Genetic Algorithm, Medical data, REST API, SQL Server, Thermistor, Digital Sphygmomanometer, Node MCU, HTTP Gateway*

I. INTRODUCTION

The continuous monitoring of patients' medical parameters is required in the intensive care unit and critical care unit, and all the acquired data is posted in the cloud server to alert the hospital server and to schedule the doctor's visit and consultation. The genetic algorithm is suitable for this application for processing the big data. There are many options to measure temperature with different components, and any component can be used to measure the temperature. The component should provide accurate values with high precision. Here the thermistor is used for measuring the skin temperature. Another measurement is systole and diastole values using the analog sphygmomanometer or Digital sphygmomanometer. The measurement is always analog, but the output representation is digital. The accuracy of the digital output can be increased by increasing the number of bits of representation of digital values.

Fig.1. Digital Sphygmomanometer

Fig.2. Thermistor (Negative Temperature Coefficient)

Proposed Methodology

The sensor data is processed through a microcontroller, and the gateway protocol can be chosen by the module. The gateway protocol may be HTTP or MQTT, which is used to access the web server to post the huge real time data acquired by the sensors.

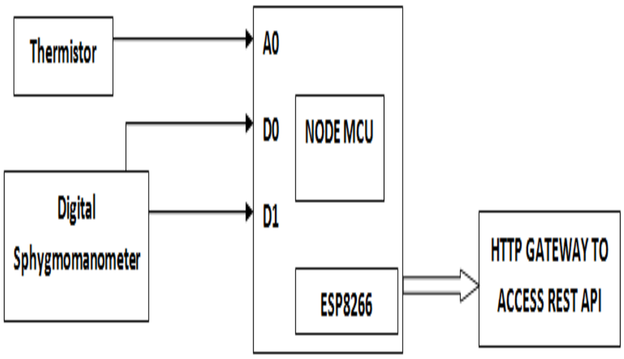

Fig.3. Stage 1 Flow Diagram of Proposed model

Revised Manuscript Received on January 22, 2020.

G. Renukadevi, Research Scholar, Department of Computer Science & Engineering, Annamalai University, TN, India.

Dr. K. Selvakumar, Department of Information Technology, Annamalai University, TN, India.

S. Tamilarasan, Department of Computer Science, Bharathiar University, TN, India.

Dr. S. Venkatakrishnan, Department of Computer Science, Annamalai University, TN, India.

The thermistor is used as a temperature sensor, which is a negative temperature coefficient, and the digital sphygmomanometer is used to measure the systole and diastole values from the human body. The Node MCU is used as a microcontroller to process the sensor data. The temperature is measuring in analog form. So, the data from thermistor is connected to the analog input of the Node MCU. The systole and diastole is also measuring in analog form, but, it is converted into digital by the same device. So, the data is directly applied to the digital pins of Node MCU. The ESP 8266 is used to get the Wi-Fi connectivity, which is available inbuilt in the Node MCU. The HTTP is a gateway communication protocol used to access the REST API. The flow diagrams are shown in figure1 and figure 2.

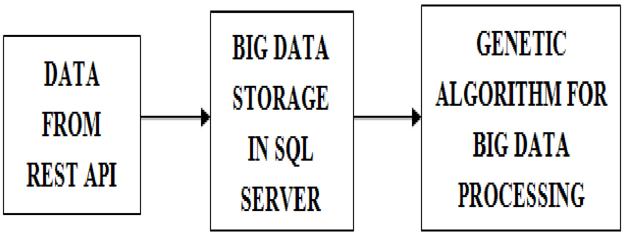

Fig.4. Stage 2 Flow Diagram of Proposed model Results and Discussions

The table 1 shows the continuous monitoring of the patients' data posted in the web server. The data is updating for every 15 seconds. So, the huge data is posted and stored in the SQL server for a day. The genetic algorithm is used to manage and process the data, which is suitable to alert the hospital server as well as scheduling the tasks for the medical practitioners.

Table 1. Continuous Monitoring of Temperature, Systole and Diastole for Patients

[1] Time	[2] Skin Temperature	[3] Diastole	[4] Systole
[5]	*[6] Patient 1*	[7]	[8]
[9] 12.59.30	[10] 97.2	[11] 85	[12] 135
[13] 12.59.45	[14] 97.1	[15] 85	[16] 135
[17] 13.00.00	[18] 97.1	[19] 84	[20] 134
[21] 13.00.15	[22] 97.2	[23] 84	[24] 134
[25] 13.00.30	[26] 97.3	[27] 84	[28] 134
[29]	*[30] Patient 2*	[31]	[32]
[33] 12.59.30	[34] 98.4	[35] 94	[36] 144
[37] 12.59.45	[38] 98.3	[39] 93	[40] 143
[41] 13.00.00	[42] 98.2	[43] 93	[44] 143
[45] 13.00.15	[46] 98.1	[47] 93	[48] 143
[49] 13.00.30	[50] 98.1	[51] 92	[52] 142
[53] Time	[54] Skin Temperature	[55] Systole	[56] Diastole

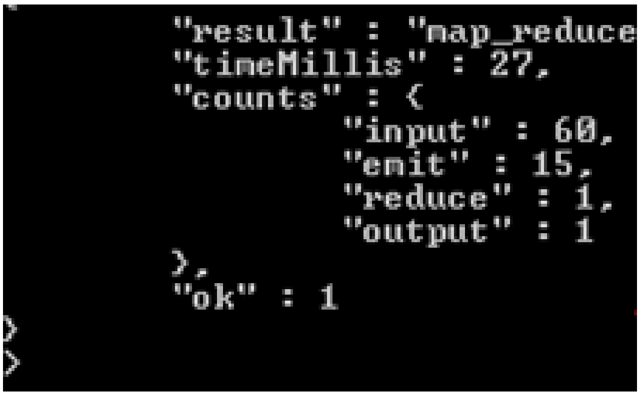

Fig. 6. Consolidated Output of the Genetic Algorithm

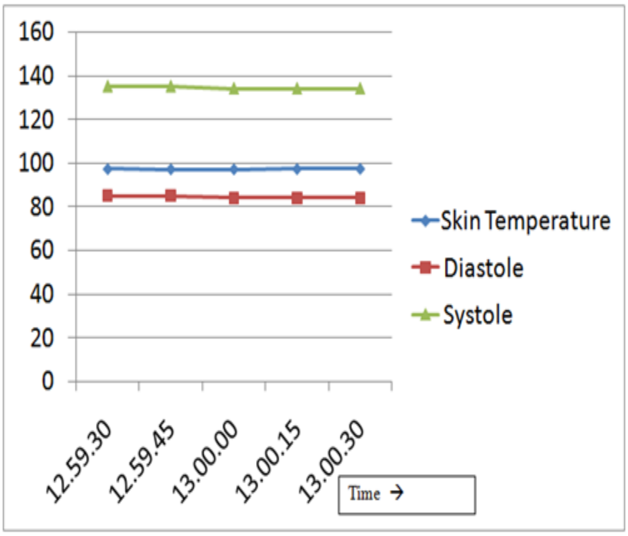

Fig.5. Medical parameters for Patient 1

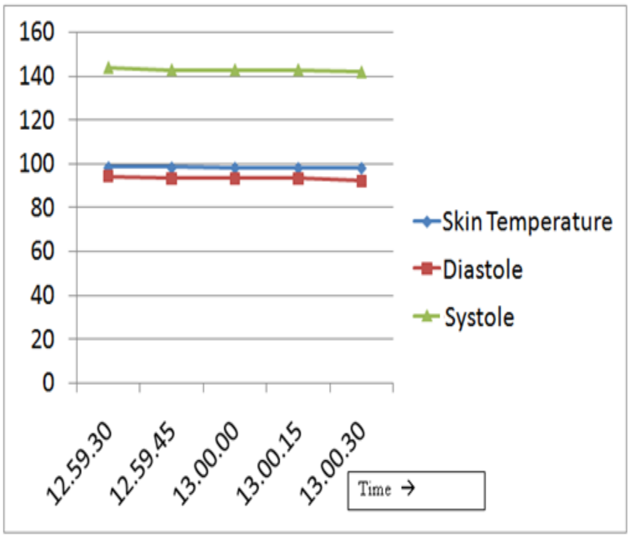

Fig.6. Medical parameters for Patient 2 Conclusions

The medical parameters of different patients are updating in the cloud server for every 15 seconds if continuous monitoring is needed and base on the posted data, the genetic algorithm diagnosing the disease and predicting the future data. The genetic algorithm easily processed the big data produced and stored in the SQL server in this proposed method.

REFERENCES

1. G. Halevi et.al, "The evolution of big data as a research and scientific topic: overview of the literature," Research Trends, Special Issue on Big Data, vol. 30, pp. 3-6, 2012.
2. N. Laptev et.al, "Very fast estimation for result and accuracy of big data analytics: The EARL system," in Data Engineering (ICDE), 2013 IEEE 29th International Conference on, 2013, pp. 1296-1299.
3. M. Schroeck, et.al, "Analytics: the real-world use of big data: How innovative enterprises extract value from uncertain data, Executive Report," IBM Institute for Business Value and Said Business School at the University of Oxford, 2012.
4. Vianna VP. Study and development of a computer-aided diagnosis system for classification of chest X-ray images using convolutional neural networks pre-trained for imagenet and data augmentation. 2018. arXiv preprint arXiv :1806.00839 .
5. Beutel J et.al, Handbook of Medical Imaging: medical image processing and analysis, vol. 2. Bellingham: Spie Press; 2000.
6. Rathore MM et.al, Real-time medical emergency response system: exploiting IoT and big data for public health. J Med Syst. 2016;40(12):283.
7. Zhao T, Ni H et.al,. Detecting abnormal patterns of daily activities for the elderly living alone. In: International conference on health information science. Berlin: Springer; 2014. p. 95–108.
8. Ed-daoudy A, et.al, Application of machine learning model on streaming health data event in real-time to predict health status using spark. In: 2018 International symposium on advanced electrical and communication technologies (ISAECT). New York: IEEE; 2018. p. 1–4.
9. Akhtar U et.al, Challenges in managing real-time data in health information system (HIS). In: International conference on smart homes and health telematics. Berlin: Springer; 2016. p. 305–13.
10. Rettig L et.al,. Online anomaly detection over big data streams. In: 2015 IEEE international conference on big data (Big Data). New York: IEEE; 2015. p. 1113–1122.
11. Guha S et.al, Clustering data streams. In: 41st annual symposium On foundations of computer science, 2000. Proceedings. New York: IEEE; 2000. p. 359–366.
12. Gupta M et.al, Outlier detection for temporal data: a survey. IEEE Trans Knowl Data Eng. 2014;26(9):2250–67.
13. Agarwal DK et.al, Statistical methods for recommender systems, Chap. 7. New York: Cambridge University Press; 2016. p. 120–41.
14. Chen J et.al, A parallel random forest algorithm for big data in a spark cloud computing environment. IEEE Trans Parallel Distrib Syst. 2017;28:919–33.

AUTHORS PROFILE

G. Renukadevi, Research scholar, Department of Computer Science and Engineering , Annamalai University. She has graduated in Bachelor of Information Technology from Vivekanandha college of Engineering, Tiruchengode in May 2008 and received her Master's degree in Computer science and Engineering from Jayam college of Engineering, Dharmapuri in June 2012. Her area of Interest include Big data , Business Intelligence and Data Analytics. She has extended her interest in implementing Big Data Processing on classification tree model where the server can store huge data and the process of separating payloads and documents are easily classified.

Dr. K. Selvakumar is currently working as a Professor in Department of Information Technology, Annamalai University . He has more than 20 years of teaching experience and a year of industrial experience. His area of Interest includes Cryptography and wireless networks. He has also published papers in many international and national journals and also attended many international conferences. His interests further extend on Intelligent systems, Routing protocols for mobile networks, Utilization of Wireless Multi-hop Networks for improving Transmissions Rate and Power, Maximal Entropy Design in Space Time blick Codes for future wireless technology.

S. Tamilarasan, Research scholar, Department of Computer Science, Bharathiar University. He has graduated in Bachelor of Sanskrit and Computer Science from Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya University, Kanchipuram in May 2003 and received his Master's degree in Computer science from Vinayaka Missions University, Salem in May 2013. His area of Interest include Cloud Analytics, IoT and Big data . He has extended his interest in a new approach using IoT sensor to oversight the smart home environment. His research area also include Big data Exploration, Visualization and Analytics.

Dr. S. Venkatakrishnan, Annamalai University. His area of specialization is Image processing. He has more than 15 years of Teaching and Research experience. His area of interest also extended to the applications of image processing in the field of science and technology including computer vision, remote sensing, feature extraction, forecasting and optical sorting. He has done a study on Image acquisition, storage, transmission, Image Enhancement and Restoration, Image Understanding and Image Recognition.