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A CANONICAL CORRELATED MULTI-AGENT REINFORCEMENT FOR E-HEALTHCARE MONITORING

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ABSTRACT
Internet of Things (IoT) is becoming more popular, sensors are used to identify the patient's condition. Heart failure is a significant problem worldwide. It is a complicated task to forecast heart illness for a medical practitioner since it requires more contribution and understanding. Heart frequency monitoring is the fundamental computation that is crucial for heart attack prediction based on parameters like blood pressure, plasma cholesterol, and hemoglobin healthcare system, which can sense different human body parameters remotely over the Internet and then send them to an automated classification system for statistical analysis using Deep Neural Learning (DNL) techniques. The classification system is based on a DL classifier that uses IoT wearable device's log dataset to predict heart diseases. To achieve more accuracy a CCMARD approach is implemented. CCMARD is a (Multi -Agent reinforcement learning) approach. It can be classified into two categories. First, the Agent based approach provides the overall theoretical verifications. Second, Formalized approach provides the theoretical results for Patient Health monitoring system. By this way, an efficient diseased patient health monitoring is carried out with minimal time consumption. For experimentation, systematic cardiovascular healthcare data is produced utilizing Kaggle dataset and medicinal gadgets to foresee the diverse patient levels of disease severity. A detailed comparative analysis is carried out and the simulation outcome ensured the goodness of the CCMARD method over the compared methods under various aspects.
KEYWORDS: ***Internet of Things, Big Data, CCMARD Technique, Deep Neural Learning process, Multi- Agent Reinforcement Learning, Health Monitoring.***

I. INTRODUCTION

Big data is a large volume of structured and unstructured data. Internet of things (IoT) is a new Paradigm where every node communicates with other node that is connected over the network to transfer essential data. Health issues like cardiovascular diseases need immediate attention to protect the patient's health. For this a Health specialist developed healthcare system for many diseases with the help wearable devices with sensors. Now doctors can monitor the patient's health without any intervention.

II. LITERATURE REVIEW

Now-a-days healthcare monitoring systems in hospitals and health centers has experienced large development and therefore portable healthcare monitoring systems is found to be in rising trends globally. Moreover, the initiation of Internet of Things (IoT) helps the progress of healthcare from face-to-face consulting to telemedicine. Internet of Things (IoT) is an environment where every connected node communicates with other nodes in order to transfer essential data for accurate decision making. Smart healthcare system in IoT environment monitor patient basic health signs in real-time.

An IoT-based E-healthcare monitoring model was introduced to check the cardiovascular patient's vital symptoms and identify both biological as well as behavioral changes via smart healthcare technologies. Here, the vital data were acquired from IoT devices. Moreover, data analysis was performed by means of machine learning techniques for identifying probable risks concerning physiological and behavioral variations. However, the extent of accuracy was not reduced using IoT-based student healthcare monitoring model. Multi-Agent Systems (MASs) composed of multiple interacting intelligent entities. This can be used to solve the problem of E-Healthcare system with incomplete information. The designed mechanism comprised three phases, namely emergency detection, adapting sensing frequency and real-time patient situation prediction. However, sensor nodes failed to avoid repeated collision. The designed mechanism failed to adjust sensing frequency based on available energy beside redundancies between readings at different periods.

To fill the gap between these two kinds of approaches (Agent-Based and Formalized approach) we propose a **Multi- Agent Reinforcement Learning** Approach is implemented. To address these a method called CCMARD for IoT based healthcare Monitoring is proposed.

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III. E-HEALT MONITORING SYSTEM WITH IOT AND BIG DATA

For IoT related to health sciences with big data, healthcare monitoring is a crucial parameter with respect to accuracy, time and error involved in several diseases like diabetes, cardiovascular disease and so on. The objective is to propose a healthcare monitor system which will improve the QoS in terms of Clustering accuracy, clustering time and error. IoT sensors collecting patients' data, large amount of data is said to be created by sensors while extracting healthcare data.

A. A CANONICAL CORRELATED MULTI-AGENT REINFORCEMENT DEEP NEURAL LEARNING APPROACH FOR DISEASE DIAGNOSIS

An IoT healthcare monitor system has been proposed based on machine learning for cardiovascular disease prediction in large volume of data. The patient's healthcare monitor based cardiovascular disease prediction model is proposed to achieve the human beings affected with disease regarding further treatment. CCMARD (canonical correlated multi-agent reinforcement deep neural learning) technique for patient's health monitoring with lesser time consumption was proposed. Data preprocessing is performed to remove the data with missing value to enhance the classification performance.

In CCMARD technique, the canonical correlation analysis has been calculated between the features and objectives for choosing relevant features. Activation function is used for multi-class classification problem. This technique function on three subsystems, namely user subsystem, cloud subsystem and alert subsystem. The initial subsystem collects the data from various IoT devices by means of wearable sensors. Then IoT devices choose the appropriate cluster to transmit the data that are sensed from IoT devices to gateway devices and cloud subsystem. In cloud subsystem, disease diagnosis process was carried out with Deep Neural learning DNL to identify the disease severity level of the patient and can generate Alert system. Fitness Function (FF) of every data employed to find the optimal solution.

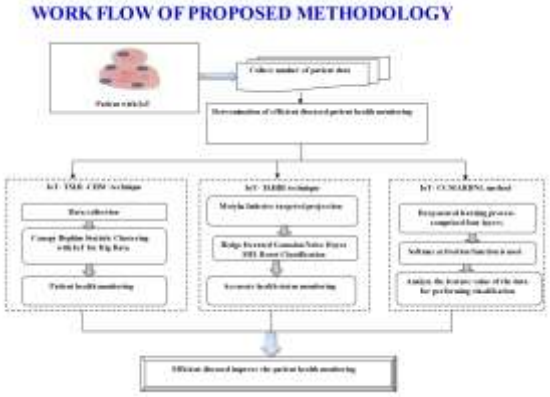

Fig 1: Workflow of CCMARD Technique

Fig 1 consists of three phases namely TSLR-CHSC, TAHIB technique and CCMARD Technique. A CCMARDNL method comprised of three layers namely Deep Neural learning Process, SoftMax Activation function is used and analyze the feature value of data for performing calculations.

B. A DEEP NEURAL LEARNING – BASED HEALTHCARE MONITORING FOR CARDIOVASCULAR DISEASE DIAGNOSIS IN INTERNET OF THINGS ENVIRONMENT

Deep Neural Learning Process comprised of three layers namely Input Layer, two hidden layers and one output layer. In first layer, IoT Patient data is gathered from database and that data is given to the input layer. Then the Input Patient is transmitted to Hidden Layer 1. Here, Data Preprocessing is performed in hidden layer 1. This process is to remove the data with missing value to enhance the classification performance and then that data is transmitted to hidden layer 2. In hidden layer 2, canonical correlation analysis is calculated between the features and objective for choosing relevant features. In output layer, SoftMax Activation function is used in CCMARD model is used to analyze the probabilities of feature classified data .

IV. PERFORMANCE EVALUATION OF E-HEALTH MONITORING SYSTEM WITH IOT AND BIG DATA

To evaluate the different E- healthcare Monitoring system, number of patient data is taken as input to perform the evaluation. For Evaluation Cardiovascular Disease Dataset is considered as input.

Table 1: Cardiovascular Disease Dataset Details

This dataset comprises of 11 features and 60000 records the dataset includes the cardio -train .csv. Result analyses are evaluated with certain parameters like Accuracy, Time complexity and Error rate.

IMPACT ON ACCURACY: Accuracy is described as the ratio of number of patient data that are correctly classified the patient health condition to the total number of patient data considered as input. Then the accuracy value is calculated. when the accuracy value is higher, the method is said to be more efficient. Accuracy is maximized to 87%.while using CCMARDNL model .

Table 2 explains the accuracy, time complexity and error rate by using CCMARD model.

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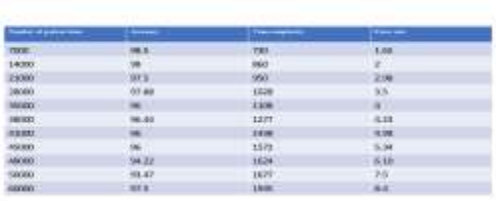
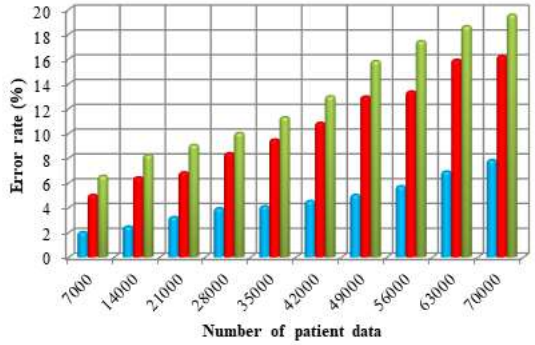


Table 2: Accuracy , Time complexity and Error rate Attained Using CCMARDNL

IMPACT ON TIME COMPLEXITY: Time complexity is measured as an amount of time consumed by the algorithm to classify Normal and Abnormal patients. Time complexity is measured in milliseconds. Time complexity is minimized to 19% by using CCMARDNL model.



GRAPH 1: Represents the Error rate.

IMPACT ON ERROR RATE: Graph 1 depict the Error rate is measured based on the ratio of several patient data that are incorrectly classified into the class to the total number of patient data. The error rate is minimized to 8.4 % by using CCMARDNL model.

CONCLUSION

In this paper, A IoT enabled healthcare monitoring technique called CCMARDNL is introduced. The developed E-health system are used to monitor, process and disease prediction of patient data. The comprehensive experimental evaluation is carried out with respect to the number of patient data. Using CCMARDNL technique, the statistical assessment results with higher accuracy level and minimizes time complexity with minimal error rate than the other convolutional methods.

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