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Cloud Based Resource Provisioning method for IoT enabled Sensory Monitoring: A Healthcare Application

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Abstract

Fog is a data management and analytics service. This paper introduces a novel approach for providing Fog computing is used to offer IoT-enabled services in healthcare applications. Data for this study were gathered from the Google Scholar, Science Direct, and Medline databases. To deliver quality services to customers, IoT-based Fog Computing solutions are presented. For an IoT client, an effective resource provisioning solution for boundary discovery, service level agreements, and administrative services has been developed. The deep Q residual information processing technology is used to link cloud data centers, and the computing paradigm approach is used to determine the reference depth of fog levels. The suggested optimum resource provisioning method analyses the dataset and simulates the environment using the tensor flow tool. Fog's computation layer is made up of IoT sensor data, cloud data centers, and modelling layers. The deep belief network is built using a 256 X 256 X 3-layer architecture with 5000 training data, with 1000 test data used for simulation. Using supervised and unsupervised learning approaches, each dataset simulation was recorded. According to the findings, fog computing data management and analytics systems. The proposed method has achieved 92% accuracy, further it shows better performance in terms of security and convenience compared with existing methods.

Keywords: IoT, Resource provisioning, Fog computing, Deep learning, Tensor flow

1. Introduction

Cloud computing is a most recent technology that supports IT infrastructure in a flexible way. The needed resources might be accessed from any location that has Internet access. Cloud services access data stored remotely. These are demand-based services, and resources are accessed based on user demands. Resources might exist at the application, software, computing and storage. Data governance is a vital component of cloud data management and security. The end user accesses cloud resources via a laptop, desktop, smartphone, or other computer device. It is a transmission and wearable technology that processes the application as needed. [1].

As in the current scenario, many organizations are moving towards Industry 4.0 such as Cloud Computing, Internet of Things, Deep Learning and Big Data. Massive amount of data or data sets are collected, processed and analyzed. Therefore, it is required quicker and more efficient data access [2]. The principles of fog computing will be crucial in obtaining data from the cloud and executing big data analytic activities. Cloud services may be accessible from a variety of computer devices, each of which is referred to as an edge. With the convergence of cloud, IoT, and data analytics processes for healthcare applications, Salesforce.com pioneered the fog computing trend [3].

The current situation in the field of health care is growing tremendously. There are many internets based counseling and medical facilities and most people are using them effectively. According to a Google survey, almost 3 billion individuals utilized internet health services in the last two years. The government has embraced and supported home services, as well as a door-to-door immunization approach with automated services. It is a smart model that includes IoT services for patient monitoring and status checks on a regular basis. The whole monitoring procedure is recorded and documented. [4][5].

2. Related Works

Various researchers have observed that the main challenges are related to the data collection and the analysis process. IoT-enabled cloud services mean that we receive unstructured/NoSQL data or datasets, so performance prediction, allocation, and resource allocation are major challenges [6][7]. Wong et al., the proposed smart device pressure map system is available based on their temperature measurement. Implications for healthcare systems require some learning algorithms to analyze the data. Application of various data analytics operations such as data modeling, data formulation, integration and recovery services [8] [9]. Data association is required for service recommendation and proposed by Runga et al.

Manzoor and Chigao et al., provided that IoT, cloud and fog computing are the key players and these three technologies enable access to remote data services. Healthcare industries are coming to smart automation services. Edge computing is a combination of three building blocks for processing a dataset and ensuring efficiency [10]. Gigoer et al. Cloud and fog computing are the main computing paradigm for home healthcare monitoring applications. Edge Computing helps healthcare industries communicate and make decisions [11].

Manikandan et al., cloud data can be transferred to a healthcare repository and data analytics process can be applied so that we can provide accurate process to users. This approach would have a greater impact on device access levels than a judgment-based survey [12]. The PubMed dataset is collected from Google Scholar and results from MEDLINE information. Recently, IoT and Cloud Services data can be managed using logical operations. This method allows multiple research-based services to process transactions.

Different research papers are taken to analyze fog datasets, and each application may contain different operational procedures. Healthcare datasets are taken and exclusion of unstructured data is indicated [13]. After 2015, more papers are published in the field of data analytics. According to the Scopus survey, from 2015 to 2020, about ten thousand citations for health-related documents and services were achieved. Therefore, we believe that the aforementioned literature of the health care industry is obliged to process data analytics [14][15]. Fog computing is offered to handle the data analysis process with effective decision making.

3. Fog based Optional Resource Provisioning Method

Fog computing is a method of handling the data and its services that gather the data from various isolated servers such that data from multimedia, unstructured data, data from NoSQL database and dataset from multiple servers. The resources can be accessed by the user via a variety of computing devices and mobile applications. The various process of healthcare application in fog computing are all healthcare data stored either in web server or cloud server, the person can access the data from server, data operations can be managed by IoT enabled sensor and data analyses for decision making.

Sensors on the edge devices receive the necessary data, which is then sensed. The patient's body contained an embedded sensor that collected raw data, sent it to the server, and further stored it there as depicted in Figure 1. The adoption of data analysis resources is supported by user-defined programmes, which develop workable functions. Based on time, the collected data can be examined and responses can be given.

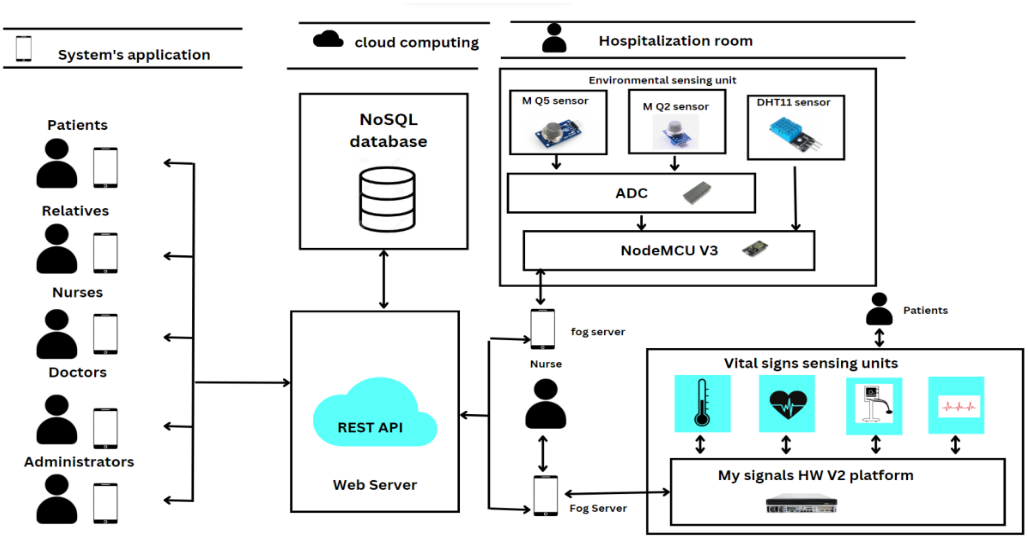

Figure 1: Application Server - Fog Selection Module

1. The Fog node is used to collect the unprocessed the data from edge device and mark the sensitive data.
2. The data management processes are modeling the data, find the association, forming a cluster and normalize the data.
3. The minimal sensitive and unnecessary data is eliminated and the fog node contents are scrutinized.
4. The data can be received from distinct sources and applied the fogging process to all edges, nodes and cloud platform using IoT enabled services.

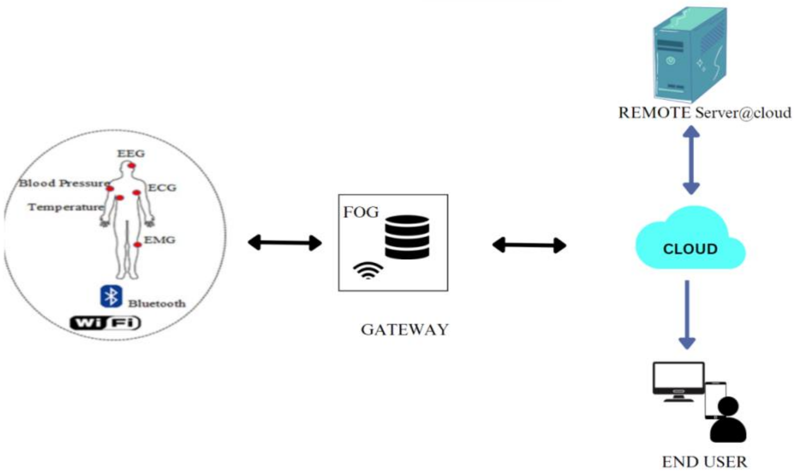

Figure 2: Data Processing – Fog Dataset

Figure 2 depicts the process of collecting information from patients and sending it to a cloud server or the web for storage. The edge devices receive patient data such as blood pressure levels, heart beats, temperature, and other critical parameters via a communication channel such as Bluetooth or Wi-Fi technology. The raw data is processed and analyzed by the cloud server for performance measurement.

4. Resource Allocation and Monitoring

The proposed method is used to select optimal resource provisioning for fog data processing and accuracy measurement coefficient. The parameters such as low latency, better throughput, allocation values, business continuity, real time interaction ratio and mobility index should be considered for better data management. The data which are in server should be analyzed and the optimal data is to be selected as index. The data management process employs an effective resource provisioning strategy as shown in Figure 3.

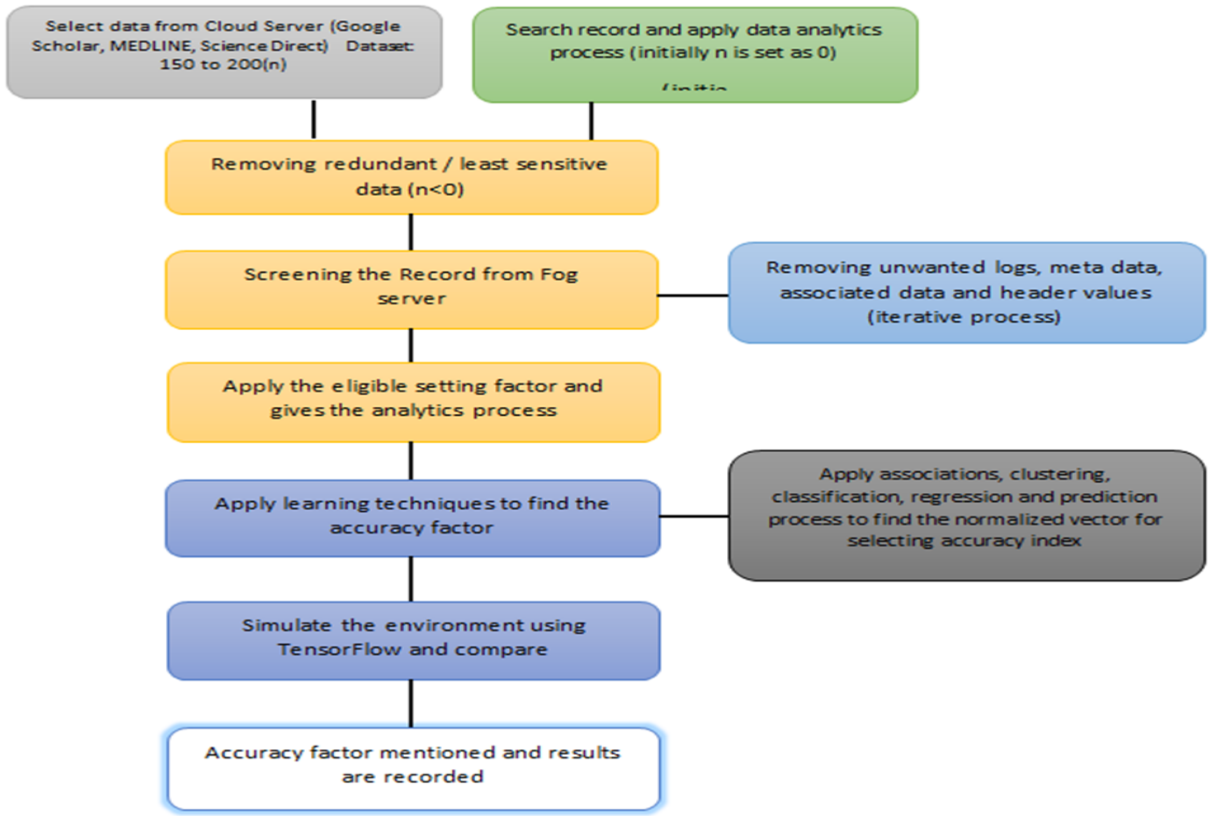

Figure 3: Flow Diagram – Monitoring System

To process the dataset and execute the sensing system, the proposed system integrates IoT and fog computing. There is a node module, a power protection system, a detection system, and a detection module as a result of this optimal resource provisioning technique. The algorithm for calculating efficiency is provided below.

The optimal resource provisioning technique uses fuzzy Markov predictions to choose user demand characteristics such as fog server value, cloud service provider representation, and services.

S & T is the set of services and the set of suppliers S_p are denoted by (s_p1, s_p2 ... s_pn)

The cloud service provider's data and the Markov prediction are expressed as

$F \infty \{SP \leq S\ (S_p) / SP(T) * S_p\ (T)\}$

The data management process comprises of data deconstruction, aggregation, and prioritization, and the rank for each data is formed as a result of these processes. Membership is calculated as

$As = \{s\epsilon\ S_p;\ A(s) \geq SP\}$ for any $N\epsilon\ [0, 1]$

$At = \{t\epsilon\ S_p;\ A(t) > SP$ for any $N\epsilon\ [0, 1]$

The membership value and the amount of entropy are used to compute the accuracy. This is the average value calculated from the transmitted data.

5. Performance evaluation

Input: (SP,SQ) ≡ SP and SQ is aTraining and test data set 256 X 256 X 3 layers respectively.

Output: Data management – optimal resource provisioning Accuracy ratio

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Step 1: fog data is recorded and the Apply DEEPQ process

Step 2: Compute DeepQ(SP,SQ) = (1/N) ∑_(i=0)^(p-1) G 〖F(i)- ∑(i-0)^(p-1) X [V(i)- V(minx)]]

Step 3: Compute the accuracy ratio is calculated by Deep (SQa) = ∑(i=0)^(p-1) G / ((V(i)-S(i)/N))

Step 4: Once the saved value is noted, continue the operation until N<0.

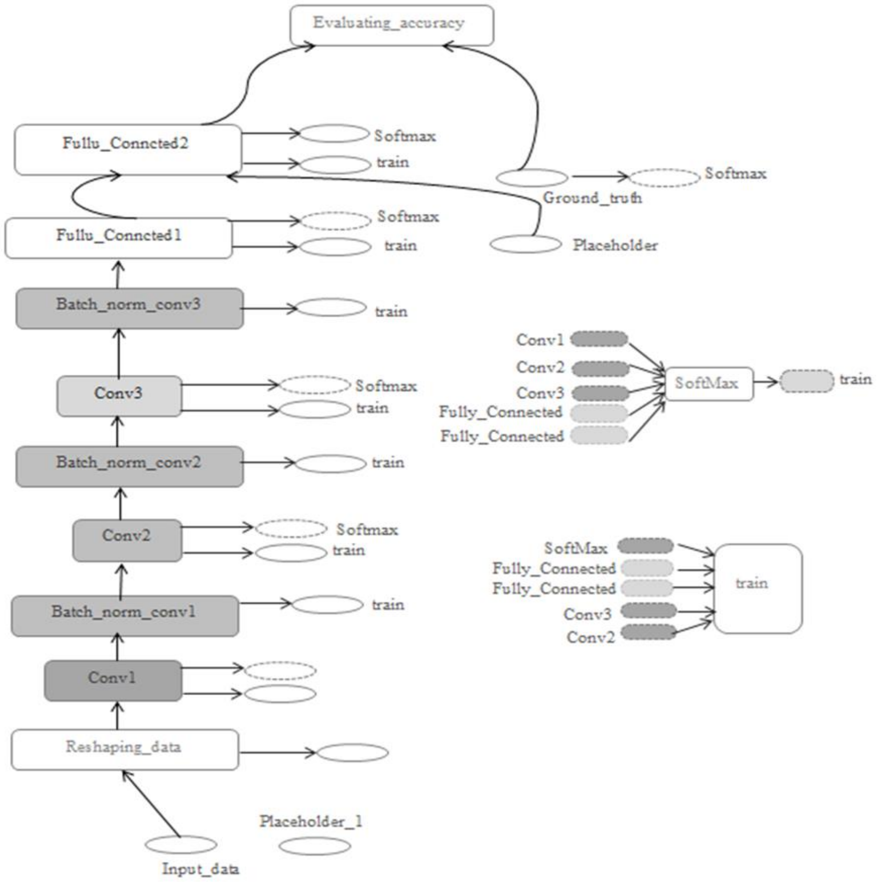

Figure 4: Deep Convolution Neural Network (CNN) – outcome of linked graph

Figure 4 shows the deep CNN designed with appropriate input conditions and Google TensorFlow. This proposed method consists of smart recommendation system and fog-based results. It gathers data and applies the hidden layer strategies. From fog server, the data has analyzed and accuracy calculated with a 256 X 256 X 3 node as shown in table 1 graphs below.

Table 1: Result using a performance metric for the proposed approach

Iteration	**Hidden values**	**Dimensions**	**Accuracy**	**Precision**	**Recall**	**Measure**
1	8,16,32,64	500,250,100,10	0.99,0.98,0.94,0.95	0.13,0.15,0.14,0.16	0.88,0.87,0.84,0.85	97,98,97,94
2	8,16,32,64	500,250,100,10	0.88,0.89,0.92,0.91	0.20,0.21,0.24,0.21	0.89,0.88,0.87,0.83	96,97,94,96
3	8,16,32,64	500,250,100,10	0.98.0.92.0.91.0.91	0.19,0.22,0.16,0.18	0.81,0.79,0.82,0.94	92,83,89,91

4	8,16,32,64	500,250,100,10	0.92.0.91,0.94,0.92	0.21,0.17.0.19,0.14	0.82,0.81,0.79,0.82	93,92,91,92
5	8,16,32,64	500,250,100,10	0.92,0.93,0.94,0.95	0.18,0.14,0.15,0.18	0.92.0.91,0.87,0.91	93,94,94,94
6	8,16,32,64	500,250,100,10	0.90,0.91,0.94,0.92	0.21,0.17,0.19,0.14	0.83,0.81.0.79,0.82	92,92,91,92
7	8,16,32,64	500,250,100,10	0.88,0.92,0.91,0.91	0.21,0.22,0.16,0.18	0.82,0.79,0.82,0.94	92,88,89,91
8	8,16,32,64	500,250,100,10	0.87.0.91,0.94,0.92	0.21,0.17.0.19,0.14	0.82,0.81,0.79,0.82	92,92,91,92
9	8,16,32,64	500,250,100,10	0.92.0.93,0.94,0.95	0.15,0.14,0.19,0.18	0.92,0.91,0.87,0.91	92,94,92,94
10	8,16,32,64	500,250,100,10	0.92.0.89,0.92.0.91	0.21,0.21,0.24,0.21	0.82,0.88,0.87,0.83	93,97 94,96
11	8,16,32,64	500,250,100,10	0.92.0.91,0.94,0.92	0.18,0.17,0.19,0.14	0.82,0.81,0.79,0.82	92,92,91,92
12	8,16,32,64	500,250,100,10	0.89,0.91,0.94,0.92	0.19,0.17,0.19,0.14	0.82,0.81,0.79,0.82	92.92.91.92
13	8,16,32,64	500,250,100,10	0.88,0.91,0.94.0.92	0.21,0.17,0.19,0.14	0.82,0.81,0.79,0.82	93,92,91,92
14	8,16,32,64	500,250,100,10	0,92,0.98,0.94,0.95	0.22.0.15,0.14,0.16	0.88,0.87,0.84,0.85	96,98,97,94
15	8,16,32,64	500,250,100,10	0.93,0.91,0.94.0.92	0.13.0.17.0.19.0.14	0.82.0.81,0.79,0.82	92.92.91.92

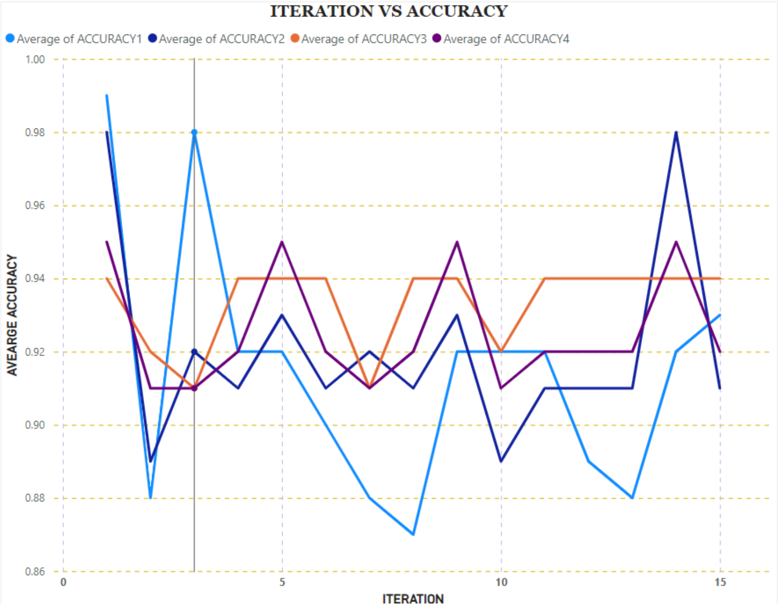

Figure 5: Iteration vs Accuracy

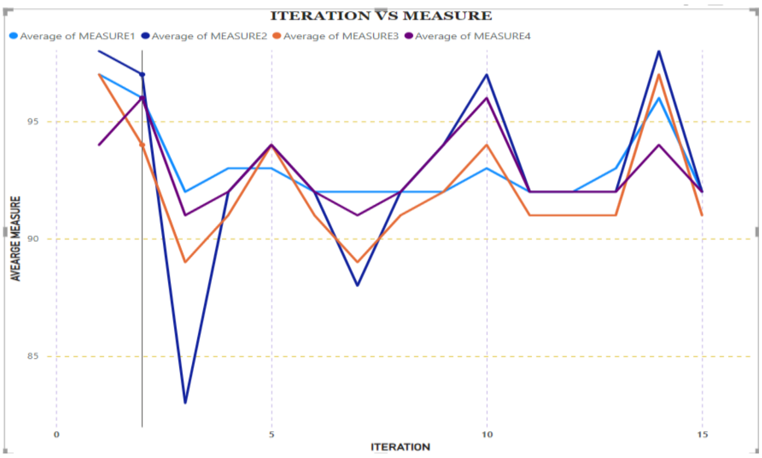

Figure 6: Iteration vs Measure

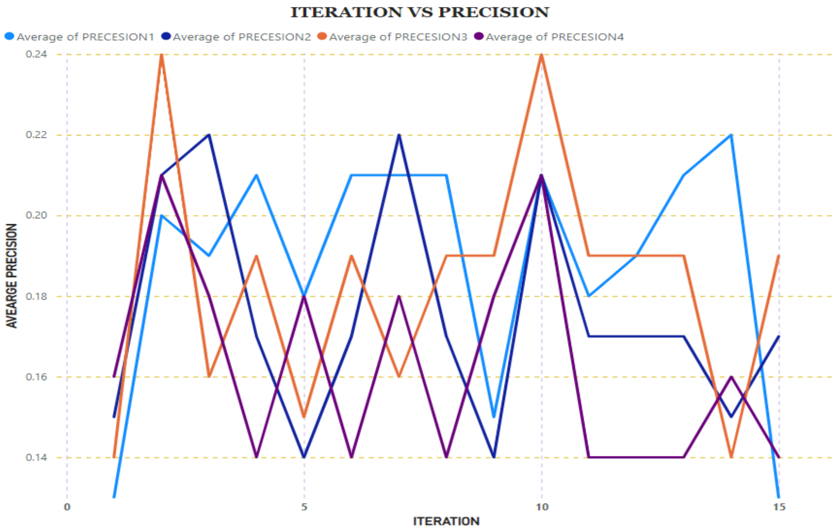

Figure 7: Iteration vs Precision

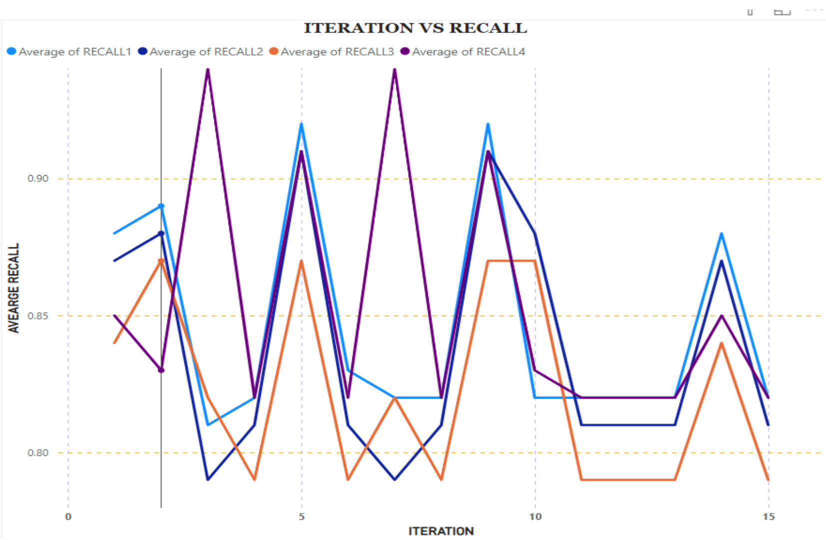

Figure 8: Iteration vs Recall

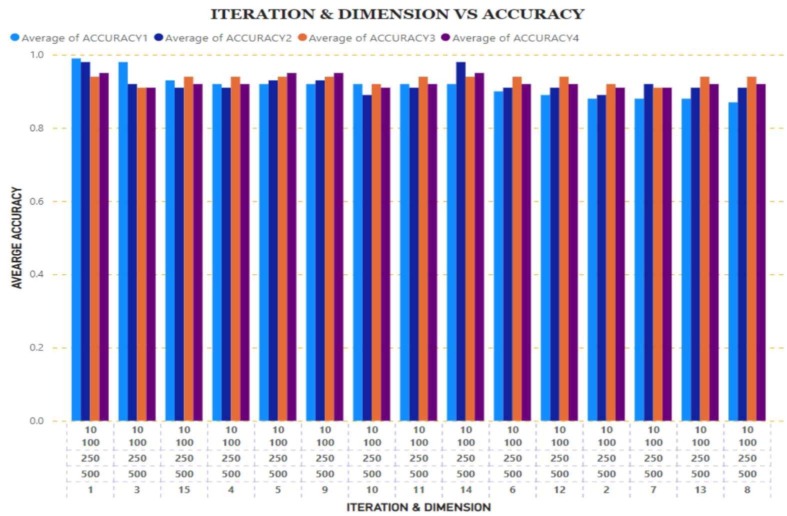

Figure 9: Iteration & Dimension vs Accuracy

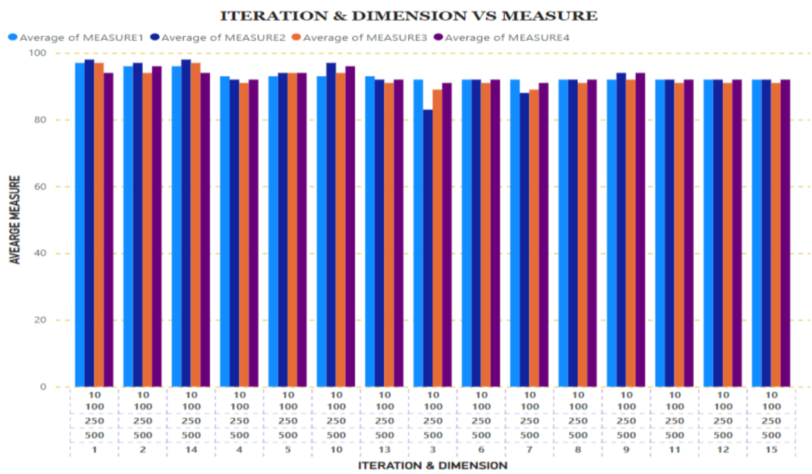

Figure 10: Iteration & Dimension vs Measure

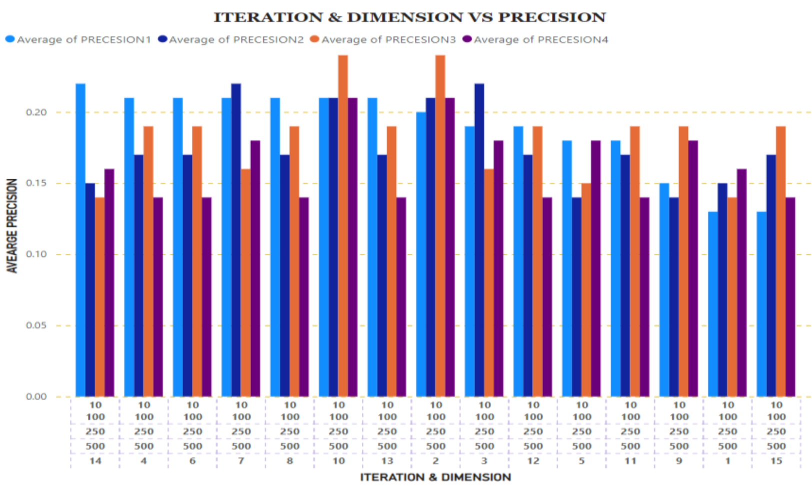

Figure 11: Iteration & Dimension vs Precision

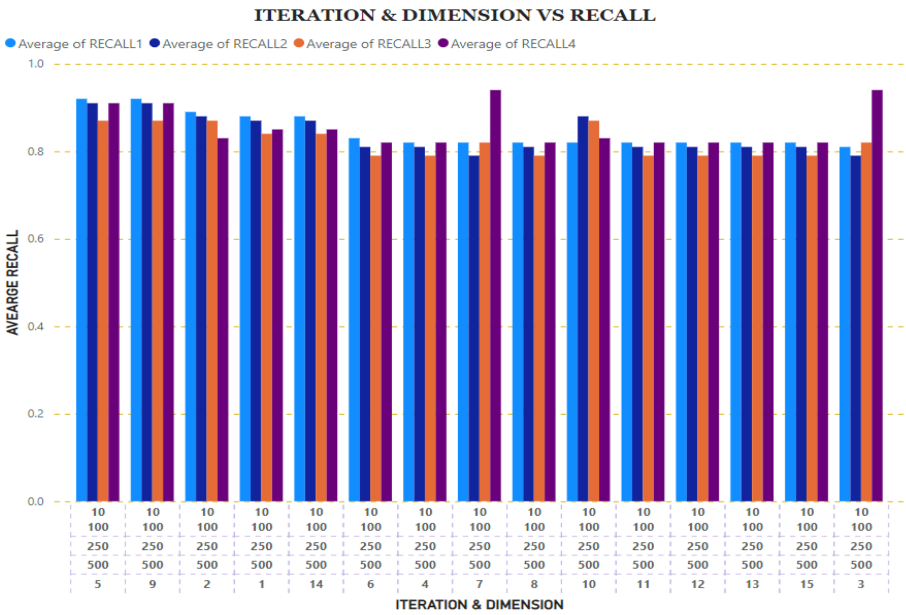

Figure 12: Iteration & Dimension vs Recall

Our proposed system is produced an optimal accuracy rate of 92% for designed with TensorFlow model and has 1000 testing data and 5000 trained data with hidden layer with node values 256 X 256 X 3 8,16,32,64 as shown in Table 1. The comparison of Iteration versus other performances are shown as follows: Figure 5 shows Iteration vs Accuracy, Figure 6 shows Iteration vs Measure, Figure 7 shows Iteration vs Precision and Figure 8 shows Iteration vs Recall. The comparison of Iteration & Dimension versus other performances shown as follows: Figure 9 shows Iteration & Dimension vs Accuracy, Figure 10 shows Iteration & Dimension vs Measure, Figure 11 shows Iteration & Dimension vs Precision and Figure 12 shows Iteration & Dimension vs Recall implemented in this work. TensorFlow's optimal handling of resource provisioning data assures accuracy, precision, and recall.

6. Conclusion

This paper presents an ideal resource provisioning strategy for deep learning-based accurate search for data management in medical applications. The dataset is assessed using the DeepQ analysis method, and the accuracy ratio is calculated using the data analysis model. This strategy yielded a higher accuracy rate than previous approaches. To identify the user and save values in the cloud, an Internet of Things fog server is employed. TensorFlow is used to mimic the training and testing data using a three-layer deep belief network with a 256 x 256 X size, resulting in a 92% accuracy. Fog computing will eventually be expanded to include intelligent decision-making strategies.

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