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BIG DATA IN E-HEALTH SERVICE USING WEARABLE SENSORS

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Abstract- Big Data being the emerging technology drives many factors such as in weather forecasting, education field, e-commerce, stock exchange market and healthcare. In this digital era healthcare is emerging as a hot topic in the Big Data technology, which generates data from various wearable devices and sensors. The sensor data comprises of all types of data such as structured, unstructured data, maintaining and monitoring of unstructured data is a challenging task which is not possible by the normal processing software's.
Wearable devices such as electrocardiogram, pulse rate generates the data in the form of signals, to extract the values from these signals several algorithms are used such as fiducial feature extraction, support vector machine algorithm, confusion matrix algorithm. These values helps the physician to improve the patient's health digitally, effectively, efficiently with low investment.

Keywords— Wearable device, Sensors, Fiducial feature, Support Vector machine.

I. INTRODUCTION

Today the world is moving towards digitization, aiming to become digital world. Among all the topics healthcare is one of the important thing in the world, it has transformed the whole process to be efficient, effective with low cost. Digitization in healthcare is generating lots of data ranging from petabytes to zeta bytes. It is excepted to be 10-12 zeta bytes of data by 2020.

Digitization in healthcare is achieved through wearable devices, sensors etc.., the data emitting from these devices are maintained as an electronic medical record, this record results the stream of data from all types of patient's, which is maintained at hospital, insurance companies and doctor's office. Thousands of elements are generated from a single patient starting from his registration to the final treatment. Similarly multiplying all the patient's records result in huge amount of data gives rise to the technology Big Data.

Wearable devices and sensors plays a vital role in generating data, sensors such as body temperature, pulse rate electrocardiogram and etc... are used. Electrocardiogram data are in the form of signals, in order to process, analyse and extract value form these signals we use an algorithm called fiducial feature algorithm, to classify these data support vector machine algorithm is used and also to draw the conclusion confusion matrix algorithm is used.

The challenges like crowdsourcing in sensor data, heterogeneity and disparity, multi resolution and multi scale, data uncertainty and trustworthiness, model and decision masking and big data context has given rise to a concinnity platform architecture, which acts as a general platform to provide a service for sensor data management and applications.

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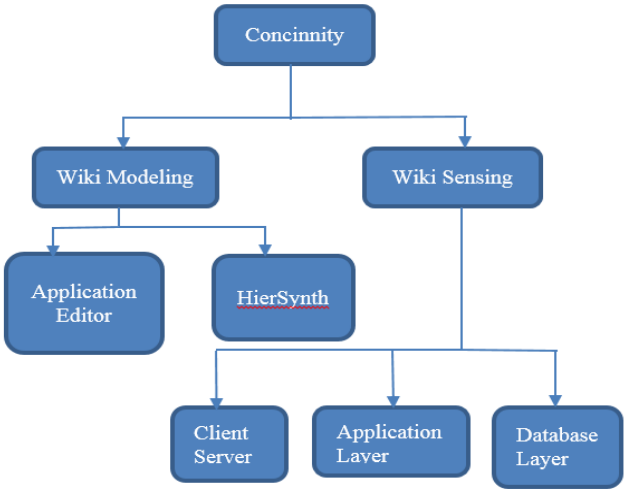

Figure 1: Concinnity Platform Architecture

Architecture in above figure explains how sensor data are managed, it consists of wiki modelling and wiki sensing.

- Wiki modeling includes an editor which provides an environment to build sensor data applications.
- HireSynth is a platform that provides a workflow execution environment.
- Wiki Sensing provides the elastic capabilities for storing the large amount of datasets, and also monitors storage management.
- Client server is in charge of giving the online user-interface for dealing with sensor data and furthermore wiki based front-end for learning and data sharing.
- Business logic for managing and storing data is maintained by the application layer.

II. ELECTROCARDIOGRAM DATA

As discussed electrocardiogram data are represented in the form of signals, in order to retrieve the real value of the data fiducial feature extraction algorithm is used.

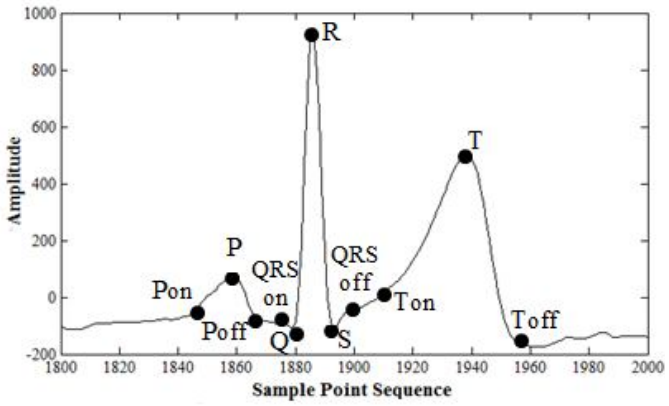

Figure 2: ECG Signal Representing PQRS as Peaks

ECG signals are the results of the electric activity of the heart, it consists of the three successive dimensions known as P, QRS and T which reflects the relaxation and contraction of the heart chamber. ECG based biometric device utilise the fiducial features, which represents the temporal and amplitude distances between fiducial point and also angles feature. Total 11 fiducial points from three dimensions are required to detect the fiducial features. Fiducial points are classified into 11 peaks in which (P, R,T) are the 3 peak points, (Q,S) as two valley, and six onset and

offset for 3 dimensions. The accuracy of the fiducial points determines the fiducial feature which is a challenging task.

Heart rate is defined as rate of heartbeat per unit time, distance between the two successive R peaks is the duration of a heartbeat. So, any changes in the lengths of the RR intervals is heart beat variability. It causes a changes in the length of the QT interval which is the time between starting and ending of the QRS and T wave respectively.

Identification of data from ECG includes four steps Pre-processing, Feature extraction, Feature reduction and Classification.

- Pre-processing involves the removal of the noise distribution and detecting of the initial fiducials point.
- Features extraction mechanism extract all the blocks of feature which represent the major of the features
- Feature Reduction is used to increase the performance by removing the time complexity and computation overload.
- Low pass filter are used to remove the high frequency muscle artefact and external interference
- High pass filters are used to remove the low frequency components such as motion artifacts.
- Derivative filters are used to enhance the dominant peaks.

The flowchart of a fiducial feature extraction can be shown below

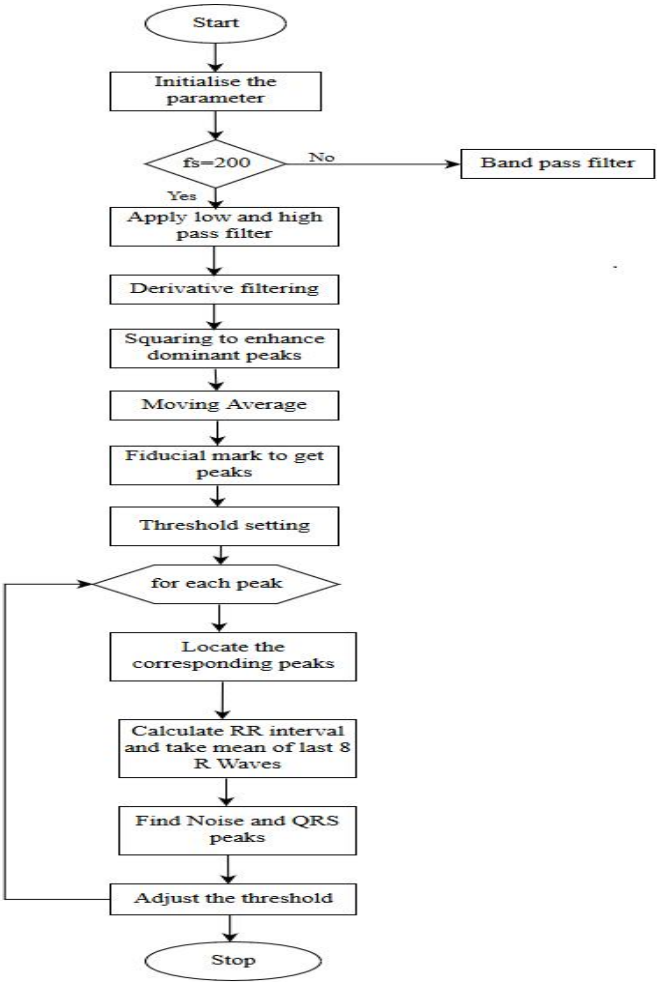

Figure 3: Flowchart for a fiducial feature extraction

This fiducial feature algorithm is more suitable in extraction of the patterns and the real values from the data as compared to the other algorithms such as Naïve Bayes and KNN algorithm.

III Solution of e-Health services in Big Data

Research of big data in healthcare has derived a number of flow stream as described in figure.

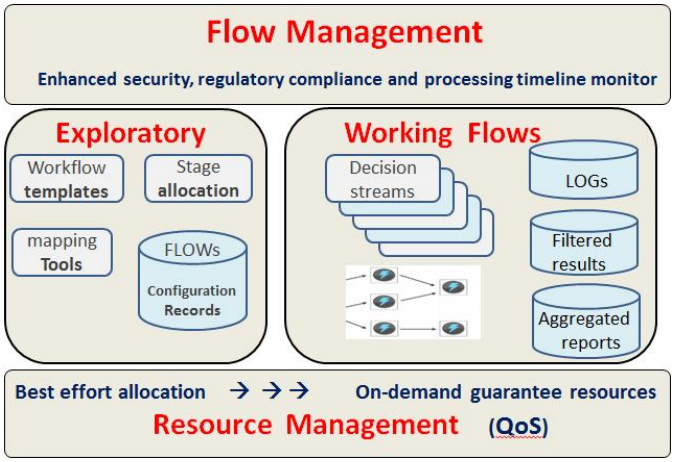

Figure 4: BDeHS Solution Diagram

A. **Flow of data in e-health**

The whole centre concept of the application is to set up the flow procedures for processing stages of data, a flow of data in the e-Healthcare is traversed into a stream with other computing stages. Initially the data format is generated in a common formats as specified by e-health meta data models via adaptation gateway.

B. **Securities and Regulatory Compliance**

Security in big data e-health service require payload and information flow which is to be a part of e-health solution. Whenever the data streams routes into data analytics, the identification and details of the patients are to be removed as per the service policy.

Whenever we allow a security operations with number of items, a problem has to be raised because different parties are interested to view the different sets of records, in order to merge all the records of the patient during safety process. For example: few records of patient may not be similar with other similar healthcare parties, in simple words a processing entities in the laboratory requires only patient_id but not all the records of the patient.

C. **Data Management operation and Timeliness of data**

In order to obtain better QoS, we need to develop realtime batch process, which makes easy to visualise the e-health data this helps in analysis of the aggregate models. The present healthcare service includes some policy actions that are to be combined with the quality of service in order to increase the performance of pattern matching process.

In simple words application-oriented policies are satisfied using routing policies that are to be referenced further. The best approach to manage a large amount of flowing e-health application are done by maintaining a large number of e-health service records which can be easily transformed to the necessary actions format.

This solution structure is more perfect which handles not only the other sources but also the new emerging schemas and structure which are defined to store the data.

IV SUMMARY

The whole idea was to present the data management in the BDeHS, initially it is understood how the data is generated, and different types of data in healthcare gives rise to the Big Data technology. Data is generated from various wearable devices and various sensors, these sensor data are in the form of structured and unstructured format. The value of the data form unstructured data is extracted using various algorithms such as fiducial feature extraction, support vector machine algorithm etc. These values helps in the treatment of the patient digitally with efficient, effective and also with low investment.

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