Chapter 5

Development of an Efficient Monitoring System Using Fog Computing and Machine Learning Algorithms on Healthcare 4.0

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ABSTRACT

Disruptive innovations in data management and analytics have led to the development of patient-centric Healthcare 4.0 from the hospital-centric Healthcare 3.0. This work presents an IoT-based monitoring systems for patients with cardiovascular abnormalities. IoT-enabled wearable ECG sensor module transmits the readings in real-time to the fog nodes/mobile app for continuous analysis. Deep learning/ machine learning model automatically detect and makes prediction on the rhythmic

anomalies in the data. The application alerts and notifies the physician and the patient of the rhythmic variations. Real-time detection aids in the early diagnosis of the impending heart condition in the patient and helps physicians clinically to make quick therapeutic decisions. The system is evaluated on the MIT-BIH arrhythmia dataset of ECG data and achieves an overall accuracy of 95.12% in classifying cardiac arrhythmia.

1. INTRODUCTION

The Healthcare 4.0 paradigm, at its core, involves providing highly personalized services to patients. For this to be realized in the healthcare industry, real time service is of the essence. Fog Computing enables computations to be performed at the edge, while simultaneously utilizing the cloud to store large amounts of data. Thus, it can be leveraged to meet the real-time servicing needs of Healthcare 4.0. We use an ECG to get the readings and use high performance computing (HPC) and ML algorithms for monitoring and analysis. Develop an efficient system based on the fog computing paradigm for the real-time monitoring and analysis of ECG data of users and decrease response time in case of emergencies. The Overall Objectives can be stated as

- Accurate and Real-Time monitoring and analysis of ECG data.
- Immediate notification to Doctors and Emergency Services in case of anomalies.
- Performance enhancement of Healthcare 4.0 using Fog Computing, HPC and ML algorithms.
- Decreasing the latency of monitoring and analysis by the utilization of fog architecture.
- Creation of a mobile application for visualization of the data by doctors/ patients.

The Deliverables can be achieved such as Machine Learning and Deep Learning Models for the analysis of ECG Data to detect anomalies, Fog Architecture on which the Model is deployed for decreased latency, a mobile application for patients and doctors to view the diagnosis and data.

The scope is limited to Detect anomalies in heartbeat based on ECG Reading, notify assigned doctors in case of emergency and/or when an anomaly is detected, Fog computation architecture for real time predictions and notifications, Mobile app for both doctor and patient to keep track of heart health history, prescriptions etc.

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