Big data analytics for sensors signal processing in healthcare

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This paper presents aspects regarding big data used for sensor signal processing analytics for biomedical sensors. The exponential data increasing is due to the number of IoT developments (internet, technology able to measure and collect data). Progress in wearable technologies for health monitoring is driven by new communication tools such as wearable devices that provide signal processing and ubiquitous connectivity. New direction has emerged as a result of micro – nano electronics and communication technologies advances, but also because of miniaturization and low power computing. For remote heath monitoring the electrical potential rate of the heart can be tracked by wearable biomedical.

The ECG represents the evaluation of the electrical potential of the heart in a period of time (24h), by biopotential electrodes sensors attached to the skin surface. Data obtained are collected and recorded by using a data logger. The ECG is useful for measure the rate and regularity of heartbeats in order to diagnostic arrhythmia because these episodes are in strong correlation with hyperglycemia crises. Apart from simple records and general instructions, the system also provides detailed ECG physiological indexes for medical experts who need to obtain complete user information for diagnosis. Data analytics is used for analyzing and setting a model correlated with other human body parameters (respiratory rate, temperature and moisture) and arrhythmia or bradycardia, and the rhythm frequency.

Signals from biopotential sensors are continuous and it is required to be discretized by using discrete time sampling (10000 milliseconds) and frequency f_e. ECG data is collected from human body with frequency range between 0.1 and 100 Hz.

In order to avoid noise from the environment the ECG data processing was divides in 4 phases:

- Filtering baseline wander;
- Noise reduction;
- QRS wave detection;
- Postprocess operations.

Big data received from sensors (biomedical signal datasets - ECG) and stored in private cloud can be used for predictive analyses with Hadoop MapReduce framework. For ECG signal improvement was used the Hilbert–Huang transform by empirical mode decomposition (EMD) for decomposition of data into a collection of intrinsic mode function (IMF). For EMD we considered signals at the level of their local oscillations and we searched for local extremes in an establish time interval. In this work was used Hilbert-Huang transformation for noise reducing from ECG signal.

Soorma et al. (2014) mention about of using the Hilbert Huang Transform and Wavelet Transform for data extraction algorithm, in order to obtain information about amplitude, duration, pre-gradient, post-gradient.

The phase of filtering baseline wander take a consistent time in ECG processing and the solution is to be computed in parallel by MapReduce Haadoop, because this framework allow distributed processing of big data and fault-tolerant parallelized analysis.

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