Epileptic seizure detection using Wireless Body Area Network

Mots clés:
- Directeur de thèse: osman SALEM
- Co-encadrant(s):
- Unité de recherche: Laboratoire d'Informatique PARis DEscartes
- Ecole doctorale: École Doctorale Informatique, Télécommunications, Électronique de Paris
- Domaine scientifique principal: Divers

Résumé du projet de recherche (Langue 1)

Wireless Body Area Network (WBAN) is a set of sensor attached to (or implanted in) the body of monitored patient to collect one or several vital signs, as such Heart Rate (HR), pulse, oxygen saturation (SpO2), respiration rate, body temperature (T°), ElectroCardioGram (ECG), ElectroMyoGram (EMG), Blood Pressure (BP), Blood Glucose Level (BGL), Galvanic Skin Response (GSR), etc. The collected data by sensors are transmitted in real-time to a central station, denoted by access point (i.e., smart phone) for real time processing and detection of anomalies. Upon detection of abnormal change, an alarm is raised for family or healthcare professionals to react quickly by taking the appropriate actions [1], [2]. Thus improves the life quality of patients through pervasive monitoring [3], and enable long term monitoring and analysis of chronic diseases [4], [5]. Recently, various inertial sensors are available in the market and are able to add valuable information to the vital signs, especially for the early detection of motor seizures. Several studies has been conducted to propose an approach for seizures detection based on data from accelerometer and muscles contractions. However, epileptic seizures have impact on various physiological and inertial parameters, and the identification of optimal parameters have not been addressed. Furthermore, the optimal places of sensor need also to be analyzed to enhance the detection accuracy. Our goal is to deploy a platform of wireless sensors in order investigate the collected data during seizures in order to identify the optimal parameters and locations of sensors to provide the best detection accuracy with the lowest false alarms. We want to investigate the impact of seizures on ECG, EMG, T°, HR, BP, BGL, etc. to pinpoint the most impacted parameters. The correlation of changes with inertial data need also to be determined to reduce the false alarm rate. Modeling the patient motions before and after the seizure is necessary to enhance the detection accuracy. In the other hand, the collected data by sensors have low accuracy and reliability. With patient movements, the connections with access point is intermittent and subject to many sources of errors, such as interference, energy depletion, badly attached sensor, etc. These reasons prevent their adoption and their widespread deployment.

Résumé du projet de recherche (Langue 2)

The candidate must deal with the following tasks:
- State of art on existing framework for seizures detections
- Deployment of Shimmer platform for data collection in Necker Hospital
- Identification of optimal physiological and inertial parameters
- Proposal of adequate algorithm with sensor constrained resources for seizures detection
- Performance analysis and comparison with existing techniques

Informations complémentaires (Langue 1)

Collaboration with several universities:
- Florida Atlantic
- Beijing University of Post and Telecommunications
- Peking University
- etc.

Informations complémentaires (Langue 2)
**Required Skills**

- Data mining and Decision theory for anomaly detection
- Wireless Body area Network
- Programming skills in MatLab, C and C++
- Writing in English, autonomy and initiative

**References**