Developing a cloud based platform as a service to improve public health of epileptic patients in urban places

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Background: Epilepsy affects about three million Americans and is one of the common nationwide neurological disorders. However, public (knowledge) of epilepsy is limited and most of the time people do not know how to react when someone is having a seizure attack in urban areas. The best strategy to prevent epileptic seizures is to detect them accurately at onset and to attempt promptly the appropriate therapy (e.g., by administering anticonvulsant drugs or applying brain neurostimulation), which depends on several factors including the frequency and severity of the seizures as well as the person’s age, overall health, and medical history [1,2, 3].

Objective: For ubiquitous real-time seizure detection, monitoring, and alarming a cloud based platform as a service is proposed for urban places. As a first step towards a system that we believe will ultimately reduce the suffering caused by epilepsy, we propose a cloud-computing framework that automatically detects epileptic seizures. Cloud computing provides a simple way to access storage, databases, and computational resources over the Internet. This growing area of IT services offers ubiquitous access with the potential to increase agility with lower costs. The proposed service platform makes decision based on comparing the extracted EEG patterns with the cloud data.

Methods: The proposed system for automatic seizure detection is designed to be performed in the cloud. In this study, a pervasive computing application for real-time generalized seizure detection is developed.

Figure 1 Cloud-computing framework enabling pervasive healthcare for epileptic

Presented at Reimagining Health in Cities: New Directions in Urban Health Research, Drexel University School of Public Health, Philadelphia, USA, Sept. 2015.
which can be implemented as a cloud-based service [4]. By non-invasive small wearable devices, EEG’s are recorded in mobile patients and are sent to a cloud by communication devices such as smartphones. Then, informative components of epileptic seizures are extracted. A new feature reduction method is developed using Infinite Independent Component Analysis. After preparing feature subspace by random selection, Support Vector Machines (SVM’s) [5] are classified in each subspace to normal and epileptic patterns. Then, majority voting is used for aggregating of each SVM’s output. Finally by the detection onset of epileptic seizures, a notification is sent to the closest medical emergency centers.

**Results:** Using leave-one-out cross validation on epileptic EEG segments recorded at sample rate 173.61 HZ and band-pass filtered on 0.53–40 HZ (12 dB/oct) from five patients, sensitivity, specificity, positive predictive value, negative predictive value, and accuracy [6] of our method were 90%, 91.7%, 90%, 91.7% and 90.9% respectively.

**Implications:** There is a crucial need to develop new methods using advanced technologies such as cloud and mobile computing in order to assist in the processing of EEG data [7] and develop pervasive computing applications such as real-time seizure detection. Our system’s service platform can be hosted at a remote location and may be used anywhere via Internet. The proposed low computational-complexity framework makes decisions based on the EEG patterns with clinical significance to provide high sensitivity and low false detection service.

**References:**


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