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学位（博士）論文要旨
(Doctoral thesis abstract)

論文提出者 (Ph.D. candidate)	工学府博士後期課程　電子情報工学　専攻 2017 年度入学 学籍番号　17834203　氏名　Most. Sheuli Akter
主指導教員氏名 (Name of supervisor)	Prof. Dr. Toshihisha Tanaka
論文題目 (Title)	Machine Learning-Based Approach for Identification of Seizure Onset Zone in Patients with Focal Epilepsy from Interictal Intracranial EEG.

論文要旨 (2000字程度)
(Abstract(400 words))
※欧文・和文どちらでもよい。但し、和文の場合は英訳を付すこと。
(in English or in Japanese)

Epilepsy is a chronic disease of the central nervous system characterized by repeated and unpredictable seizure. A seizure is a sudden disturbance in the brain's neural activity that produces disruptive physical prefix. To localize the area of cortex from where the seizures are initiated known as the seizure onset zone (SOZ), epileptologists need to analyze long term multichannel iEEG data by visual inspection, which is a very time consuming and laborious process. Moreover, there is a shortage of clinical experts for such diagnosis.
Therefore, designing an artificial intelligence-based computer aided system for localizing the SOZ from interictal and ictal iEEG has been expected by epileptologists. The aim of this thesis is to detect the SOZ electrodes using high frequency components (HFC) with machine learning approach. It is known that the high frequency components (>80 Hz) including ripple and fast ripple bands, of interictal iEEG signal, are associated with epileptic seizure. In this thesis, our proposed computer aided system provides an intuition for epileptologist which assist them in two ways: (1) to observe the localization of SOZ and non-SOZ segments over duration of the iEEG data, and (2) gives feasible information about the active electrodes located close to the SOZ electrodes.

For localization of SOZ electrodes, in our first proposed system, we have used entropy-based feature extraction method with SVM classifier. Sparse linear discriminant analysis (sLDA) was used to select prominent features. To handle imbalanced learning problems, an adaptive synthetic oversampling approach

(ADASYN) was used. Eight patients were examined to evaluate the proposed system.

However, an entropy-based system has some problems including, firstly, the performance of entropy estimation strongly depends on the appropriate parameter selection. Besides, some entropy features have higher computational cost. Secondly, the detection was made by SVM classifier based hard thresholding. Thirdly, epileptic activities related to appropriate bands selection not reported in the previous studies that may improve the performance of the system. To solve these problems, in our second proposed system, we have used statistical features for identifying SOZ electrodes. Mutual information (MI) was developed to jointly optimize the bands and features. A LightGBM classifier was used to score each channel and the probable SOZ channels were localized based on the higher scores of the channels. To observe the efficiency of method, eleven patients were used in a time series prediction way. The methodological framework of the proposed design will be more practical use in clinical applications.

（英訳）※和文要旨の場合(400 words)