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Abstract

Background: The precise localization of epileptic foci is an unavoidable prerequisite for epilepsy surgery. Simultaneous EEG-fMRI recording has recently created new horizons to locate foci in patients with epilepsy and, in comparison with single-modality methods, has yielded promising results although it is still subject to a few limitations such as the lack of access to information between interictal events. This study assessed its potential added value in the presurgical evaluation of patients with complex source localization. Adult candidates considered ineligible for surgery on account of an unclear focus and/or presumed multifocality based on EEG underwent EEG-fMRI.

Objectives: Adopting a component-based approach, this study attempted to identify the neural behavior of the epileptic generators and detect the components of interest to be later used as inputs in the GLM model, substituting the classical linear regressor.

Methods: Nine IED sets from five patients were analyzed. These patients were rejected for surgery because of an unclear focus in two, presumed multifocality in one, and a combination of both in two of them.

Results: Component-based EEG-fMRI improved localization in three out of four patients with unclear foci. In patients with presumed multifocality, component-based EEG-fMRI advocated one of the foci in five patients and confirmed multifocality in one out of five patients. In two patients, component-based EEG-fMRI opened new prospects for surgery. In these complex cases, component-based EEG-fMRI either improved source localization or corroborated a negative decision regarding surgical candidacy.

Conclusion: As supported by the statistical findings, the developed EEG-fMRI method led to a more realistic estimation of localization than the conventional EEG-fMRI approach, making it a tool of high value in the presurgical evaluation of patients with refractory epilepsy.

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Diagnostic Accuracy of Multi-Parametric Magnetic Resonance Imaging for Differentiation of Benign and Malignant Lesions of Prostate Using Radiomics Analysis

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Abstract

Background: Prostate cancer is the second most common cancer-related cause of death in men. Accurate diagnosis of prostate cancer plays an important role in decreasing mortality rates. European Association of Urology (EAU) suggests multiparametric MRI (mp-MRI) of the prostate as a noninvasive method to evaluate prostate lesions. To leverage the interbreeder variability in the interpretation of mp-MRI, computer-aided diagnostic (CAD) systems can be used for automatic detection and characterization of prostate lesions.

Objectives: The goal of this article was to design a quantification method based on mp-MRI for the discrimination of benign and malignant prostatic lesions with MR imaging/transrectal ultrasonography fusion-guided biopsy as a reference for pathology validation.

Methods: Mp-MR images, including T1- and T2-weighted, diffusion-weighted imaging (DWI), and dynamic contrast enhancement imaging (DCE) MRI were acquired at 1.5T from 27 patients. Then, 106 ra-

diomic features (first-order histogram (FOH), gray-level co-occurrence matrix (GLCM), run-length matrix (RLM), and Gabor filters) were calculated from mp-MRI. Statistical analysis was performed using receiver-operating-characteristic curve analysis for feature filtering, linear discriminant analysis (LDA) for feature extraction, and leave-one-out cross-validation for evaluation of the method in the differentiation of benign and malignant lesions.

Results: An accuracy of 96.6% was achieved for discriminating benign and malignant prostate lesions from a subset of texture features derived from ADC and DCE maps (radiomics-based method) with sensitivity and specificity of 100% and 85.7%, respectively.

Conclusion: A radiomic quantification method based on T2-weighted images, ADC maps, and quantitative and semiquantitative DCE maps can discriminate benign from malignant prostate lesions with promising accuracy. This method is helpful to avoid unnecessary biopsies in patients and may provide information for CAD systems for the classifications of prostate lesions as an auto-detection technique.

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An Efficient Framework for Accurate Arterial Input Selection in DSC-MRI of Glioma Brain Tumors

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Abstract

Background: Arterial input function (AIF) accurate extraction is an important step in the quantification of cerebral perfusion hemodynamic parameters using dynamic susceptibility contrast magnetic resonance imaging (DSC-MRI).

Objectives: In this study, using machine learning methods, an optimal automatic algorithm was developed to accurately detect AIF in DSC-MRI of glioma brain tumors with a new pre-processing method.

Methods: DSC-MR images of 43 patients with glioma brain tumors were retrieved retrospectively. Our proposed method consisted of a pre-processing step to remove non-arterial curves such as tumorous, tissue, noisy, and partial-volume affected curves and a clustering step through agglomerative hierarchical (AH) clustering method to cluster the remaining curves. The performance of automatic AIF clustering was compared with the performance of manual AIF selection by an experienced radiologist, based on curve shape parameters, i.e., maximum peak (MP), full-width-at-half-maximum (FWHM), M (= MP / (TTP × FWHM)), and root mean square error (RMSE).

Results: The mean values of AIFs shape parameters were compared with those derived from manually selected AIFs by a two-tailed Paired t-test. The results showed statistically insignificant differences in MP, FWHM, and M parameters and lower RMSE, confirming the resemblance of the selected AIF with the gold standard. The intraclass correlation coefficient and percentage coefficient of variation showed a better agreement between manual AIF and our proposed AIF selection method rather than previously proposed methods.

Conclusion: The results of the current work suggest that by using efficient preprocessing steps, the accuracy of automatic AIF selection could be improved and this method appears to be promising for efficient and accurate clinical applications.

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Automatic Myocardial Segmentation in Four-Chamber View Echocardiography Images

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Abstract

Background: Most quantitative features in analyzing echocardiography images are elicited from the shape of different parts of the heart. One of the challenging tasks in this area is detecting the border between the left ventricle and its wall. Segmentation that is a process to extract the shape of objects in an image is a way to have a better observation of epicardial and endocardial parts of the left ventricle. Today, manual segmentation is performed by