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Implementation of a pattern recognition system for the discrimination of multiple sclerosis from ischemic lesions based on MRI

Abstarct

The goal of the present study is the design of a computer-assisted diagnosis system for the discrimination of ischemic (ISH) from multiple sclerosis (MS) lesions based on texture analysis of brain magnetic resonance images (MRI). The initial step of the procedure included the retrieval of the brain MR images from experienced radiologists. These images were further processed and analyzed in order to achieve the correct classification of the lesions in the ISH or MS group.

The ISH group comprised 22 patients diagnosed with clinically definite ISH. The MS group comprised 13 patients diagnosed with clinically definite MS. From the ISH group, 83 regions of interest (ROIs) were extracted, whereas from the MS group 46 ROIs were extracted. From these 129 ROIs, 34 textural features of 1st and 2nd order statistics were calculated. From the initial set of 34 features, the optimal subset of features was derived employing the Sequential Backward Selection (SBS) method and rank-features criterion. For the classification of the patterns (ROIs), 6 different classifiers were designed and their overall accuracy was evaluated by two different evaluation methods: the Leave-one-Out (LOO) method and the External Cross Validation (ECV) method.

The system's performance to 'unknown' data was about 75.7±3.5% employing the Quadratic Bayesian classifier along with the rank-features criterion as the feature selection method. The proposed system could be used as second opinion tool for the discrimination of lesions.

SUBJECT AREA: Image Analysis

KEYWORDS: Multiple sclerosis, Ischemia, medical image analysis, pattern recognition, brain lesions, magnetic resonance imaging