ORIGINAL ARTICLE

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Tumor Classification in Breast Magnetic Resonance Images (MRI) Using the Level Set–Based Segmentation Method and Gabor-Haralik Feature

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Abstract

Introduction: Breast cancer can be considered as the most common cancer among women in the world. Hence, finding appropriate diagnosis methods is a critical and sensitive challenge in the health of the human community. Various methods have been proposed for breast screening in women, and one of the safest methods is magnetic resonance imaging. Tumors do not have morphological features of their own. Therefore, differentiating between benign and malignant lesions is normally very time-consuming and difficult. In this study, a computer-aided autodiagnosis system is developed for diagnosis and classification of axial magnetic resonance images of the breast in two classes of benign and malignant.

Methods: Initially, suspected parts of the lesion were separated as a rectangular box around the lesion by an experienced radiologist. Then, we used, for the first time, a level set–based algorithm to precisely separate the lesion considering the unevenness of the images and to remove false positive regions using morphological operations and removing veins. In the next stage, four groups of features expressing particular states of the lesion structure are extracted from the separated parts of the lesions. These four groups are textural, kinetic, frequency, and morphological features. Here a new group of features called the Gabor-Haralik features, which present a particular efficiency, was extracted for each lesion. Finally, MLP classification was used to classify the lesions.

Results: The proposed method was tested on 46 lesions. By utilizing Gabor-Haralik features, we achieved mean sensitivity, specificity, accuracy, and F-measure of 95.41, 90.70, 92.76, and 92.19%, respectively.

Conclusion: The performance measures indicate the efficiency of the proposed diagnosis system for classification of benign and malignant breast lesions in magnetic resonance imaging.

Keywords: Diagnosis System, Breast Segmentation, Feature Extraction, Classification