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Local and Global Fractal Behaviour in Mammographic Images

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Abstract

Breast cancer is one of the leading causes of cancer in women. Most studies attempt to perform segmentation of tumors highlighted in mammogaphic images, or analysis of the contours of tumors for classification purposes. Successful segmentation and classification of tumors can assist physicians in revealing suspicious regions or masses, or differentiating malignant from benign tumors in the mammogram. However, relevant studies do not focus on the tumor surface statistics for the purpose of clustering or classification. In this work, we present a statistical, fractal-based approach, for the analysis of annotated tumors, reduced from the DDSM database. Using local and global fractal properties, obtained from the tumor surface, we show that malignant and benign tumors from are separable in an appropriate feature space. K-means-based clustering is performed, showing the efficacy of the method.

1 Introduction

Breast cancer is the most common cancer among women, and the second leading cause of cancer death in the general population [1]. Subsequent to the introduction of digital mammography, computer aided detection (CAD) methods have been extensively developed and used for various purposes, including classification of types of breast tissue highlighting suspicious regions and enhancement of calcifications.

Most of the classification-based approaches extract statistical information that is later fed to a classifier such as support vector machines (SVM) or k-nearest neighbours (kNN) [1–3]. Many such methods use texture-based or fractal-based properties for characterization of either segmented regions or complete tissues. These methods classify tissue properties related to density or fat, as these have been linked to existence of tumors in tissues [4, 5].

In this work, we attempt to differentiate malignant and benign tissue by local and global fractal properties. Rather than analysis for various properties such as