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An Automated Confirmatory System for Analysis of Mammograms

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Abstract. This paper presents an integrated system for the automatic analysis of mammograms to assist radiologists in confirming their diagnosis in mammography screening. The proposed Automated Confirmatory System (ACS) can process a digitalized mammogram online, and generates a high quality filtered segmentation of an image for biological interpretation and a texture-feature based diagnosis. We use a serial of image pre-processing and segmentation techniques, including 2D median filtering, seeded region growing (SRG) algorithm, image contrast enhancement, to remove noise, delete radiopaque artifacts and eliminate the projection of the pectoral muscle from a digitalized mammogram. We also develop an entire-image texture-feature based classification method, by combining a Rough-set approach to extract five fundamental texture features from images, and then an Artificial Neural Network technique to classify a mammogram as: normal; indicating the presence of a benign lump; or representing a malignant tumor. Here, 222 random images from the Mammographic Image Analysis Society (MIAS) database are used for the offline ACS training. Once the system is tuned and trained, it is ready for the automated use for the analysis and diagnosis of new mammograms. To test the trained system, a separate set of 100 random images from the MIAS and another set of 100 random images from the independent BancoWeb database are selected. The proposed ACS is shown to be successful in confirming diagnosis of mammograms from the two independent databases.

Keywords: Computer-aided-diagnosis, Mammogram, Breast-cancer, Texture-feature, Rough-set Theory, Artificial Neural-Networks.

1. Introduction

Screening mammography is an effective tool for early detection of breast cancer [1]. However, the accuracy of diagnosis depends on both the quality of the mammographic images and the ability of the radiologist to interpret those images [2]. Currently, some radiologists misdiagnose mammograms as mentioned by some recent media reports. For example, in 2013, radiologists' errors in a Toronto hospital contributed to delays in diagnosing and treating eleven patients, the death of two of them, and the subsequent reassessment of 3,537 CT scans and mammograms [3]. It is estimated that radiologists fail to detect 10% to 30% of cancer cases [4, 5].