CLASSIFICATION OF MAMMOGRAPHIC MASSES USING 3D SURFACE TEXTURE

THANAPOL INTRAESVN

With compliments of

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Breast cancer is still the cause of death of several millions of women around the
world. In medical fields, X-ray mammogram or breast X-ray is a popular examination method
for detection of breast cancer because it is the most cost-effective and accurate method of
early detection of breast cancer. Nevertheless, radiologists encounter problems of
misdiagnosis which may be cause by inexperience. This problem can be decreased by using
computer-aided diagnosis (CAD). In the past few years, several researchers have investigated
the problem of computer-aided diagnosis via digital mammograms. The primary features used
to classify mammographic masses relate masses’ size, shape, margin, density, texture features
and so on.

This research proposed an approach of classifying mammographic mass images using
3D surface texture features, focusing on mammographic mass associated with calcifications
(calcified mammographic mass) only. The 3D texture features were applied to improve the
performance of traditional texture features consisting of the roughness average ($R_u$),
roughness root mean square ($R_q$), skewness ($R_s$) and kurtosis ($R_k$). In previous research, it
was reported that the effective traditional texture features based on spatial gray-level co-
ocurrence matrices (SGCMs) consisted of inverse difference moment (distance = 1 at
direction = $0^\circ$ and $135^\circ$) and correlation (distance = 1 at direction = $135^\circ$). Thus in this study,
the performance of using 3D surface texture features was compared with that of using the
traditional texture features based on SGCMs.

The sample dataset involved 100 digital calcified mammographic masses, which
consisted of 50 benign and 50 malignant images from the Mammographic Image Analysis
Society (MIAS). This sample dataset was a standard dataset for the research in
mammographic image analysis. The experiments in this research conducted five different
classifiers: Euclidean distance, Mahalanobis distance and three different structures of Multi-
layer Perceptron Neural Network (MPNN) classifiers. It was found that the best classification
accuracy rate achieved was the method based on the Neural Network with two hidden layers,
each with five nodes, using a combination of 3D surface texture features and traditional
texture features. It achieved the highest classification accuracy rate of 76% with the true
positive rate (TP) of 0.72 and the true negative rate (TN) of 0.80. Using 3D surface texture
features alone, it attained classification accuracy rate of 70% with the TP rate of 0.68 and the
TN rate of 0.72. Finally, using traditional texture features achieved the lowest classification
accuracy rate of 68% with the TP rate of 0.64 and the TN rate of 0.72.
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