

Chapter 47

A Hybrid Scheme for Breast Cancer Detection Using Intuitionistic Fuzzy Rough Set Technique

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ABSTRACT

Diagnosis of cancer is of prime concern in recent years. Medical imaging is used to analyze these diseases. But, these images contain uncertainties due to various factors and thus intelligent techniques are essential to process these uncertainties. This paper hybridizes intuitionistic fuzzy set and rough set in combination with statistical feature extraction techniques. The hybrid scheme starts with image segmentation using intuitionistic fuzzy set to extract the zone of interest and then to enhance the edges surrounding it. Further feature extraction using gray-level co-occurrence matrix is presented. Additionally, rough set is used to engender all minimal reducts and rules. These rules then fed into a classifier to identify different zones of interest and to check whether these points contain decision class value as either cancer or not. The experimental analysis shows the overall accuracy of 98.3% and it is higher than the accuracy achieved by hybridizing fuzzy rough set model.

1. INTRODUCTION

Diagnosis of a disease in medical science has always been considered critical. The type of diseases may vary from a normal viral fever, to the case of cancer. The major problem is in identifying the features and to correlate them with test data coming from several tests to diagnose the case. To limit our discussion, we have considered breast cancer, which is common in recent years. The topic has importance because breast cancer accounts for 10% of all cancers in women and approximately 22% of invasive cancer con-

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contributing to 18.2% of all cancer deaths worldwide (Tazhibi, Dehkordi & Babazadeh, 2014). Breast cancer is the second leading cause of death in females worldwide. It may occur if the normal growth control of cells in the breast is blocked. This results in malignant tumour that spreads throughout the body. The topic is a consequential public health quandary throughout the world because the prospective treatment of breast cancer is linked to early diagnosis.

Formation of layers, classes or categories of breast cancer have traditionally relied on measurement of clinical markers such as tumour size, histological grading, age, etc. Many existing tumour imaging techniques are available at the clinical level namely, x-ray mammography, magnetic resonance imaging, and ultrasound. Each of them has its strengths and limitations. However, mammography is considered a reliable method for early detection of breast cancer. X-ray images are generally analysed by radiologists to conclude whether there are any abnormalities present. This kind of breast cancer screening performs poorly with dense breast tissues as it results in large false-negatives (Hata, Takahashi, Watanabe, Takahashi, Taguchi, Itoh & Todo, 2004). For major abnormalities like masses, micro-calcifications and speculated lesions, computer aided detection system has been used in last 20 years (Veldkamp, Karssemeijer, Otten & Hendriks, 2000; Mudigonda, Rangayyam & Desautels, 2001; Liu, Babbs & Delp, 2001). It usually consists of initial segmentation, feature extraction, and classification of abnormal from normal. The computer aided detection system includes digitization of the mammogram with different sampling and quantization rates. The digitized mammogram of particular regions is further enhanced. Further, the suspicious areas are identified with segmentation process. This helps to differentiate suspicious areas from the background. Determinately, the features are filtered and selected from mistrustful regions in the feature selection process. Additionally, mistrustful regions are classified into two sections such as cancer and non-cancer (Hata, Takahashi, Watanabe, Takahashi, Taguchi, Itoh & Todo, 2004; Veldkamp, Karssemeijer, Otten & Hendriks, 2000; Mudigonda, Rangayyam & Desautels, 2001; Liu, Babbs & Delp, 2001).

Agrawal & Agrawal (2015) presented a survey on cancer classification using neural network techniques. Singh & Gupta (2015) proposed a method for detection of breast cancer using averaging and thresholding. The proposed model uses max-min and least variance for the identification of tumour. But, they have not addressed the accuracy of experimentation. Mohammadzadeh, Safdari, Ghazisaeidi, Davoodi & Azadmanjir (2015) outlined the experience of using image processing techniques in lung and breast cancer. Also, they fail to address the accuracy with existing techniques. Mert, Niyazi, Erdem & Aydin (2015) proposed a method for breast cancer detection using computational techniques such as independent component analysis, and classifier methods. The proposed model classifies the cases on considering 95% confidence interval. Though the confidentiality is increased, but the accuracy of the proposed model is not addressed. Pak & Kanan (2015) proposed a breast cancer detection model using non-subsampled contourlet transform and super resolution technique in mammography images. They achieve maximum accuracy of 96.29%.

Many algorithms proposed during the last decade are based on nearest neighbour, genetic algorithms, neural networks, decision trees, Bayesian classification, fuzzy theory and rough sets (Reyes & Sipper, 1999; Ryu, Chandrasekaran & Jacob, 2007; Bagui, Pal & Pal, 2003; Hasanien, 2004; Hasanien, Ali & Hajime, 2004; Hasanien, 2003; Hasanien, 2007; Kendall, Barnett & Praznik, 2013). The fuzzy systems are used to represent different degrees of the disease such as malignant or benign a patient suffers from. Rough set (Pawlak, 1991) is used for the discovery of data dependencies, attribute selection, dimensionality reduction, and pattern classification of data. This technique is fairly new in medical science as compared to other techniques. The major advantages of rough sets are that it requires no external

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