Chapter 12
Split and Merge-Based
Breast Cancer Segmentation and Classification

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ABSTRACT
Breast cancer is the most frequent cancer in Morocco with 36.1%. It is the second leading cause of death for women all over the world. The effective way to diagnose and treat breast cancer is the early detection because it increases the success of treatment and the chances of survival. Digitized mammographic images are one of the frequently used diagnosis tools to detect and classify the breast cancer at the early stage. To improve the diagnosis accuracy, computer-aided diagnosis (CAD) systems are beneficial for detection. Generally, a CAD system consists of four stages: pretreatment, segmentation, features extraction, and classification. In this chapter, the authors present some work in the development of a CAD system in order to segment a breast tumor (microcalcifications) on mammographic images and classify it by choosing the algorithm that gives a good rate using a technique of a vote.

INTRODUCTION
Breast cancer is a malignant tumour that originates in breast cells. The word “malignant” means the tumor can spread (metastasize) to other parts of the body (Institut National du Cancer, 2016). Breast cells sometimes undergo changes that make their growth or behaviour abnormal. These changes can lead to benign breast conditions, such as atypical hyperplasia and cysts. In some cases, changes in breast cells can cause breast cancer. In the context of prevention it is necessary to use a radiography tool that allows to better visualize the different parts of the breast and one of the best tools is Mammography which is a technique of radiography, particularly adapted to the breasts of the woman. It is intended to detect abnormalities as soon as possible before they cause clinical symptoms (IMENE CHEIKHROUHOU, 2012).
The mammography image is the result of attenuation of a beam of X-rays passing through the different mammary tissues. The attenuation of this beam depends essentially on the composition of the tissues through which it passes. Indeed, the grease is considered a transparent radio zone since it has a very light physical density. As a result, it appears very dark on a mammogram. The opaque radio zones appear clear and correspond to the fibroglandular tissue and calcium which is the essential component of the mammary lesions (IMENE CHEIKHROUHOU, 2012). Mammography is usually taken in different directions called incidences. A good incidence is to visualize the maximum breast tissue by spreading it as much as possible on the X-ray plate. Depending on the part of the breast examined, different implications are used. The most frequently used incidences are the incidence of the face also called Cranio Caudale (CC), the oblique external incidence called Medio Lateral Oblique (MLO) and the incidence of profile.

The mammography is an essential examination for the diagnosis of breast diseases in the presence of a symptom: palpable nodule, skin changes, discharge, inflammation.

**Background**

In the detection of breast cancer, several studies have been performed using mammographic images to determine microcalcifications.

This first work (M.Nafi Gurcan, Yasemin Yardimci, A.Enis, Cetin and Rashid Ansari, 1997) consists in improving the digital mammographic images in order to use them in the diagnostic process, so in this work the detection of microcalcifications is performed in the sub-band domain (application of a filter bank to have an image decompose into sub-band), the resulting sub image is analyzed to detect microcalcifications groupings using third and fourth order correlation parameters (asymmetry and kurtosis) to find microcalcifications clusters, then the obtained sub-images will be divided into square regions whose asymmetry and Kurtosis will be estimated, if a region has a positive and high value of asymmetry and kurtosis then it is considered to be a region of interest.

The second work (T.Balakumaran, Dr.Ila.Vennila, C.Gowri shankar, 2010) consists in improving the microcalcifications using the wavelet transform, and for the detection phase they used the fuzzy shell method.

- **Microcalcifications Improvement:** wavelet analysis allows image decomposition at different resolution levels according to a two-dimensional structure.
- **Microcalcifications Detection:** this involves identifying the region of interest (ROI), after improving the mammographic image by the wavelet transform, the resulting detailed horizontal or vertical image is used to identify the region by surrounding the microcalcification clusters, the third and fourth order statistical parameters, asymmetry and Kurtosis are used to find the microcalcification regions. Then Fuzzy shell clustering is used to perceive the nodular structure of the ROI.

In (Saranya R, M. Bharathi Ph.D, Showbana.R, 2014), their work is based on four main steps:

- **Preprocessing:** They use the median filter which is a nonlinear digital filtering technique, often used to eliminate noise and also it keeps the edges while eliminating noise.
- **Segmentation:** The segmentation method used is the region growth method, this method takes an initial set of points as input and these initial points mark each of the objects to be segmented. Regions magnified iteratively by comparing all the neighboring pixels not allocated to the regions