Chapter 4
Breast Cancer Diagnosis in Mammograms Using Wavelet Analysis, Haralick Descriptors, and Autoencoder

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ABSTRACT

In this chapter, the authors used autoencoder in data preprocessing step in an attempt to improve image representation, consequently increasing classification performance. The authors applied autoencoder to the task of breast lesion classification in mammographic images. Image Retrieval in Medical Applications (IRMA) database was used. This database has a total of 2,796 ROI (regions of interest) images from mammograms. The images are from patients in one of the three conditions: with a benign lesion, a malignant lesion, or presenting healthy breast. In this study, images were from mostly fatty breasts and authors assessed different intelligent algorithms performance in grouping the images in their respective diagnosis.

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INTRODUCTION

Cancer is a leading cause of death and, nowadays, is one of the largest public health issue worldwide. For decades, breast cancer has been the most common type of cancer among women around the world. The World Health Organization (WHO) estimates an occurrence of 1.7 million new cases per year (DeSantis et al., 2014). This disease is now placed on the top five causes of cancer death around the world (American Cancer Society, 2019). Survival rates for breast cancer can range from 80%, in high-income countries, to below 40%, in low-income countries (Coleman et al., 2008). The low survival rate in some countries is due to the lack of early detection programs. These programs have a major impact on the success of cancer treatment, since treatment becomes more difficult in later stages.

The gold standard method for breast cancer diagnosis is the digital mammography (Maitra, Nag & Bandyopadhyay, 2011). However, visual analysis of mammography can be a difficult task, even for specialists. Imaging diagnosis is a complex task due to the great variability of clinical cases (Ferreira, Oliveira & Martinez, 2011). Most of the cases observed in clinical practice do not match to classical images and theoretical descriptions (Juhl, Crummy, & Kuhlman, 2000). That is why Computer Aided Diagnosis (CAD) plays an important role in helping radiologists to improve diagnosis accuracy.

Many studies worldwide, are applying traditional image processing and analysis techniques to medical field. Therefore, the combination of professionals specialized knowledge and pattern recognition computational tools may improve diagnosis accuracy (Araujo et al., 2012; Azevedo et al., 2015; Bandyopadhyay, 2010; Commowick et al., 2018; Cordeiro, Bezerra & Santos, 2017; Cordeiro et al., 2012; Cordeiro, Santos & Silva-Filho, 2013; Cordeiro, Santos & Silva-Filho, 2016a; Cordeiro, Santos & Silva-Filho, 2016b; Cruz, Cruz e Santos, 2018; Fernandes & Santos, 2014; Lima, Silva-Filho & Santos, 2014; Mascaro et al., 2009; Santana et al., 2017; Santos, Assis, Souza & Santos Filho, 2009; Santos et al., 2008a; Santos et al., 2008b; Santos et al., 2009a; Santos et al., 2009b; Santos et al., 2010; Santos, Souza & Santos Filho, 2017). Intelligent systems may be used to assist these professionals in decision-making, thus improving the efficiency in identifying anatomical abnormalities (Araujo et al., 2012; Azevedo et al., 2015; Commowick et al., 2018; Cordeiro, Bezerra & Santos, 2017; Cordeiro et al., 2012; Cordeiro, Santos & Silva-Filho, 2013; Cordeiro, Santos & Silva-Filho, 2016a; Cordeiro, Santos & Silva-Filho, 2016b; Cruz, Cruz e Santos, 2018; Fernandes & Santos, 2014; Ferreira, Oliveira & Martinez, 2011; Lima, Silva-Filho & Santos, 2014; Mascaro et al., 2009; Santana et al., 2017; Santos, Assis, Souza & Santos Filho, 2009; Santos et al., 2008a; Santos et al., 2008b; Santos et al., 2009a; Santos et al., 2009b; Santos