# Chapter 13
# The Efforts of Deep Learning Approaches for Breast Cancer Detection Based on X–Ray Images

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## ABSTRACT

*In this chapter, deep learning-based approaches, namely deep feature extraction, fine-tuning of pre-trained convolutional neural networks (CNN), and end-to-end training of a developed CNN model, are used to classify the malignant and normal breast X-ray images. For deep feature extraction, pre-trained deep CNN models such as ResNet18, ResNet50, ResNet101, VGG16, and VGG19 are used. For classification of the deep features, the support vector machines (SVM) classifier is used with various kernel functions namely linear, quadratic, cubic, and Gaussian, respectively. The aforementioned pre-trained deep CNN models are also used in fine-tuning procedure. A new CNN model is also proposed in end-to-end training fashion. The classification accuracy is used as performance measurements. The experimental works show that the deep learning has potential in detection of the breast cancer from the X-ray images. The deep features that are extracted from the ResNet50 model and SVM classifier with linear kernel function produced 94.7% accuracy score which the highest among all obtained.*

## INTRODUCTION

The Correct clarification of thyroid gland is very important for the diagnosis of breast infections. Breast is the most important part in the body for women's to be safe against any infections, and the diagnosis for treatment will help radiologist to decide faster. Working with the breast has an influence on most women's body organs.

Currently, malignant is a massive public health issue around the globe. According to the International Agency for Research on Cancer (IARC) Keller, et al (2012). Part of the World Health Organization (WHO), there is 8.2 million passing away caused by cancer in 2012 and 27 million of new cases of this disease are predicted to occur until 2030 [26]. The status of developing medicinal solution for the breast cancer classification allows medical specialists to obtain perfect datasets that guides their decision-making procedure. Analysis of the ANN Multi-Layer Perceptron depicts the neurons coordination within the breast nodules.

Cancer can be diagnosed by classifying lumps in two different types such as benign and malignant. Benign lumps represent an unusual outgrowth but rarely lead to a patient's passing away; yet, some types of benign tumors, too, can increase the probability of developing malignancy Kinzler et al.(1996). On the other hand, malignant lumps are more thoughtful and their timely diagnosis contributes to a successful action. As a result, diagnosis and predication of malignancy can boost the chances of treatment, decreasing the typically high costs of medical dealings for such patients Steyeberg et, al (2008)..

Breast cancer (BC) is the most commonly identified cancer and the principal cause of death for women in globe. Excluding cancer of skin, breast cancer is the second most common cancer in women Siegel et al (2011). in addition, the humanity of breast cancer is very high when associated to other types of cancer Miller et al (2016).Breast cancer, similar to other malignancies, starts with a rapid and uncontrolled outgrowth and multiplication of a fragment of the breast tissue, which depending on its potential damage, is divided into malignant and benign types.

Artificial Neural Network approaches helps medical doctors to diagnose diseases with a higher degree of proficiency, while minimizing inspection cost and time, as well as avoiding unnecessary excisional biopsy procedures. However, ANN systems not only allow a better imagining of mammograms, but also using different digital image processing (DIP), information discovery from data (KDD), artificial intelligence (AI) techniques such artificial neural networks (ANN) allow to preselect certain regions of interests (ROIs) for later analysis by the radiologists.

The contribution of this paper is as following;

A novel application of the deep learning on breast cancer detection is carried out based on the X-ray breast images. The remainder of this paper is as following. The next section gives the materials and methods that are used to in this work. CNN, and ELM, The methodology of the work is briefly introduced in this section too. Section 3 describes the experimental works and results. Section 4 gives the conclusions.

## RELATED WORK

Artificial Neural Network (ANN) can be extensively used to analyze breast Infection and develop accurate diagnostics about the infections. Most researchers have been using ANN to develop solutions that enable medical practitioners too accurately and diagnose breast Infections. During developing optimal

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