# Chapter 7
# Adaptive Edge Detection Method towards Features Extraction from Diverse Medical Imaging Technologies

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## ABSTRACT

*The CAD is a relatively young interdisciplinary technology, has had a tremendous impact on medical diagnosis specifically cancer detection. The accuracy of CAD to detect abnormalities on medical image analysis requires a robust segmentation algorithm. To achieve accurate segmentation, an efficient edge-detection algorithm is essential. Medical images like USG, X-Ray, CT and MRI exhibit diverse image characteristics but are essentially collection of intensity variations from which specific abnormalities are needed to be isolated. In this chapter a robust medical image enhancement and edge detection algorithm is proposed, using tree-based adaptive thresholding technique. It has been compared with different classical edge-detection techniques using one sample two tail t-test to exam whether the null hypothesis can be supported. The proposed edge-detection algorithm showing 0.07 p-values and 2.411 t-stat where $\alpha = 0.025$. Moreover the proposed edge is single pixeled and connected which is very significant for medical edge detection.*

## INTRODUCTION

Medical diagnosis process is dealt with patient's signs and symptoms of potential health problems to determine the disease accurately whereas clinical investigation procedure is a major backbone of accurate diagnosis apart from physical examination and past records. In statistical point of view, clinical investigation procedure is a classification test to confirm the diagnosis and to determine the follow up

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actions. Typically the clinical investigation process is of two folds namely, invasive and non-invasive tests. Invasive tests mostly depend on open surgery, fine needle aspiration cytology (FNAC) etc. which involve puncturing of skin or incision. These processes are expensive, time consuming and pain staking. Non-invasive medical investigation techniques, on the other side, do not involve incision into the body or the removal of tissues. Medical imaging is one of the most important non-invasive investigation processes to aid the accurate diagnosis.

## Medical Imaging

Medical imaging has been undergoing a revolution in the past decade with the advent of faster and more accurate devices. Medical image are images of the human body or parts of the body intended for clinical purposes of revealing or diagnosis of disease in medical science. Digital Radiography, Mammogram, Ultrasound (USG), Computed Tomography (CT), Magnetic Resonance Imaging (MRI) are some well accepted imaging techniques used for clinical diagnosis. The quality and characteristics of images obtained depend on the different sensors, parameters set by the operators and individual characteristics of the patients. Medical image analysis is critical in numerous biomedical applications such as detection of abnormalities, tissue measurement, surgical planning and simulation, and many more. Medical imaging is used to determine the relative change in size, shape and the spatial relationships between anatomical structures. The radiologists are particularly interested to observe the size, shape and texture of the organs and/or parts of organ for recognition, levelling and quantitive measurement of the specific objects and structures which are involved in the analysis of medical images.

Radiography is one of the most commonly used and oldest form of medical imaging. The ionizing radiation produce by X-ray technology determine the internal structure of a person depending on the density of body parts. Whereas mammography, interventional radiology, computed radiography, digital radiography and computed tomography (CT) are the different variant of conventional radiography. Radiographic image technology are typically used to evaluate broken bones, cavities, swallowed objects lungs, liver, pancreas, blood vessels, breast (mammography), etc. Diagnostic ultrasound in this field of medical imaging technology, also known as medical ultrasonography, uses high frequency sound waves to create images of the interior parts of the body. Ultrasound is often used to evaluate pregnancy, abnormalities in the heart and blood vessels, organs in the pelvis and abdomen symptoms of pain, swelling and infection. The most modern and effective medical imaging technology is Magnetic Resonance Imaging (MRI) which uses radio waves and a magnetic field to create detailed images of organs and tissues. MRI is often used to evaluate the blood vessels, abnormal tissue, breasts bones and joints organs in the pelvis, chest and abdomen.

## Image Processing and CAD

Varieties of these machines and techniques can create picture of the structures and activities inside human body and the type of imaging used depends on the symptoms and the part of the body being examined. Generalized feature extractions from such images are difficult as they involve diverse technologies. The only commonality among all imaging technologies is the intensity features exhibited by them. DICOM (Digital Imaging and Communication in Medicine) image format is universally well accepted among all the above. In general, the grayscale image pixel is represented by 8 bits in DICOM format having 256 ($2^8$) grayscale colour intensities.