

# Chapter 51

## Calcifications Attenuation in Left Coronary Artery CT Images Using FDA Domain

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### **ABSTRACT**

*The calcification plaque is a one kind of artifacts or noises, which is occurred in the Computed Tomography (CT) images as a very high attenuation coefficient. Computed Tomography (CT) images are more helpful than other modalities (e.g. Ultrasonic Imaging, Magnetic Resonance Imaging (MRI) etc.) for disease diagnosis but unfortunately, CT image is an affected sometime by calcification plaque. Medical image segmentation cannot be optimum because of having calcification in the CT images, which is absolutely unexpected. The calcification plaque is the major problem for optimal organ segmentation and detection. This proposed task is a subjective as well as an effective for calcification alleviation from CT images. In this paper, Firstly, we applied the Fisher's Discriminant Analysis (FDA) for optimal threshold value estimation. Secondly, the proposed optimal threshold value is used for the optimal threshold image extraction. After this, the morphological operation is used for heavy calcification erosion and the XOR operation is used for adjusting the optimal threshold image with the input image. Finally, we implemented the Extra-Energy Reduction (EER) Function to smooth the desired image. Therefore, our investigated method is the most significant and articulate in order to attenuate calcification plaque from CT images.*

### **INTRODUCTION**

Calcifications can typically be seen on X-rays. Calcification plaques are the most complete barrier for the actual organ detection or segmentation from CT scan images. When bloodstream fails to get rid of excess calcium, it can end up in the: arteries of the heart, brain (cranial calcification), breasts, kidneys (as a part of kidney stones, or calcium deposits in the kidneys). A variety of factors can lead to calcification. In many cases, it is a normal part of aging or the result of an injury. Other factors may include:

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(a) infection of the breast, brain, or kidneys, (b) disorders of calcium metabolism, such as osteoporosis or hypercalcemia (too much calcium in the blood), (c) genetic or autoimmune disorders that affect the skeletal system and connective tissues. X-rays are the most common diagnostic tools used to detect calcification. These tests utilize electromagnetic radiation to record images of internal organs. A type of X-ray called a mammogram is used to see calcium deposits in the breast tissue.

A novel mammogram image segmentation algorithm that makes use of Scale Invariant Feature Transform (SIFT) to compute the key point in the suspicious area of the mammograms automatically (Guan, Zhang, Chen, & Todd-Pokropek, 2008). Fuzzify the original image of a mammogram in order to make the difference between the backgrounds and object more than the region of interest is enhanced and simultaneously suppressed the tissues along with background (Mohanalin, Kalra, & Kumar, 2008). A method is depicted for automatic detection of clustered micro calcifications (both malignant and benign) in digitized mammograms on the basis of UIQI (universal quality index) (Murty, Sudheer, & Reddy, 2011). Introduce computer aided two separate techniques for mass and micro-calcification segmentation in digital mammograms using several steps of operations (Hanmandlu, Vineel, Madasu, & Vasikarla, 2008). The computer aided micro-calcification detection based on regular wavelets, multiplexed wavelet transform technique and wavelet domain hidden Markov tree model (Lemaur, Drouiche, & DeConinck, 2003; Mini, Devassia, & Thomas, 2004; Nakayama, Uchiyama, Yamamoto, Watanabe, & Namba, 2006; Regentova, Zhang, Zheng, & Veni, 2007). The image filtering methods are described on computer-aided detection of micro-calcification clusters in mammograms and the performance of those methods (Ed-daoudi & Rezagui, 2011; El-Naqa, & Yang, 2005; Jing, Yang, & Nishikawa, 2011; Kabbadj, Rezagui, & Himmi, 2012; Lemaur et al., 2003; Tang, Rangayyan, Xu, El-Naqa, & Yang, 2009; Zhang et al., 2013). Machine learning approaches for detection of micro-calcifications (Bocchi, Coppini, Nori, & Valli, 2004; Gurcan et al., 2002; Jiang, Yao, & Wason, 2007; Peng, Yao, & Jiang, 2006).

Calcification and Mass segmentation plays an important role in the medical imaging and diagnosis. Thresholding is one of the approaches for segmentation. Some effective thresholding techniques are proposed such as entropy (Abutaleb, 1989; Gonzalez, Richard, & Woods, 2002; Li, & Lee, 1992; N. R. Pal, & S. K. Pal, 1989; Pratt, 2001), pixel, gradient, geometric structure (Chalana, & Kim, 1997), texture (Gupta, 1995; Gupta, & Undrill, 1997; Hanmandlu, Madasu, & Vasikarla, 2004), edge (Perkins, 1980), region (Zucker, 1976) based that lead to the extraction of masses and calcification. Fisher discriminant analysis (FDA) (Azim, & Abo-Eleneen, 2011) has been widely applied in pattern recognition and classification. For that it is sometime necessary for finding threshold value. In papers (Azim, & Abo-Eleneen, 2011; Shaho, Wang, Deng, & Wang, 2011), FDA is used for selecting threshold value for pattern recognition and classification. Various techniques have been used for image enhancement and restoration, namely, compounding, nonlinear adaptive spatial filter, nonlinear diffusion filter and wavelet based techniques (Achim, Bezerianos, & Tsakalides, 2001; Bamber, & Daft, 1986; Chen, Yin, Flynn, & Broschat, 2003; Dutt, & Greenleaf, 1996; Gupta, Swamy, & Plotkin, 2005; Karaman, Kutay, & Bozdagi, 1995; Koo, & Park, 1991; Lee, 1980, 1983; Perona, & Malik, 1990; Xie, Pierce, & Ulaby, 2002; Yu, & Acton, 2002). The Laplacian pyramid-base nonlinear diffusion (LPND) method (Zhang, Yoo, Koh, & Kim, 2007) can be used for speckle reduction and edge preservation. The automatic determination of the gradient threshold is applied in the LPND. LPND uses the MAD (median absolute deviation) (Black, Sapiro, Marimont, & Heeger, 1998) operator to determine the gradient threshold. An edge sensitive diffusion method (Yu, & Acton, 2002) [i.e. speckle reducing anisotropic diffusion (SRAD)] is a speckle reducing anisotropic nonlinear diffusion filtering approach to spatial adaptive filtering shows effective results of denoising in homogeneous regions. We used for this paper the Extra-Energy Reduction (EER) function

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