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# Breast Tumor Detection Via Fuzzy Morphological Operations

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## ABSTRACT

Breast cancer is one of most dangerous diseases and more common in women. The early detection of cancer is one of the most key factors for possible cure. There are numerous methods of diagnosis amongst which: clinical examination, sonar and mammography, which is the best and more effective in detecting breast cancer. Detection of breast tumors is difficult because of the weak illumination in the image and the overlap between regions. Segmentation is one the crucial steps in locating the tumors, which is an important method of diagnosis of the computer. In this study, segmentation techniques are proposed based on; classic morphology and fuzzy morphology, and a comparison between them. The proposed methods were tested using the database of mini -MIAS, which contains 322 images. After the comparison the statistical results, it shows, the detection of tumor boundary with fuzzy morphology give the higher accuracy than the results in classic morphology. The accuracy is 60.69%, 58.61% respectively due to the high flexibility of foggy logic in dealing with the low lighting in the medical images.

### KEYWORDS

Breast Cancer, Detection, Diagnosis, Fuzzy Morphology, Mammograms, Morphology, Segmentation, Tumor

## 1. INTRODUCTION

Segmentation emerges as the fundamental method towards the image processing. This is an important technique that processes different parts (regions) with homogeneous features. In the segmentation procedure, the image is parceled into different non-overlapping and important homogeneous areas. For normal images, the segmentation depends on unsupervised grouping techniques; however, but it becomes challenging in the event of medical imaging as a result of noise and poor contrast (Chowdhary & Acharjya, 2018). Breast cancer is the most regularly diagnosed cancer kind among ladies (Gu, Ji, Chen, Wang, & Kim, 2015). The early detection of breast cancer is the principle approach to expand the healing rate from an ailment. mammography is one of the ways that identify breast cancer in beginning stages, furthermore, it is the best methods for breast cancer disease diagnose (Liu et al., 2011). Mammography is a standard method to detect cancers at an early time. Unluckily, it is unrealistic for radiologists to investigate many mammograms consistently; the assignment is exhausting and time-consuming, which leads to false negatives or false positives. The utilization of computer-aided diagnosis (CAD) frameworks as a 'second reader opinion' is getting popular because of its reliability, consistency, and speed. In breast CAD, precise breast segmentation is a pivotal pre-processing advance to accelerate the consequent procedures without losing any imperative anatomical data (Mustra & Grgic, 2013). The state of the segmented tumor is a determinant factor in the mammogram analysis. It is identified with the gravity of a tumor and the distinction of a couple

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of centimeters in the maximum diameter can decide whether it is essential to complete a surgical procedure or not. However, it can be exceptionally hard to distinguish the boundary of a tumor precisely relying on various factors, for example, the shape of a tumor, size, density, image quality and location (Raman, Sumari, Then, & Al-Omari, 2011). A few difficulties in tumor segmentation incorporate low contrast images, intensity levels which fluctuate enormously crosswise over various districts, non-characterized contours, poor light, and high noise levels and masses which are not always clearly identified (Cordeiro, Santos, & Silva-Filho, 2016). S.D. Desai, et al. (Desai et al., 2013), proposed an enhanced multi-scale morphological gradient watershed segmentation strategy for method identification of grouped microcalcification in digitized mammograms. For experimental reasons, the dataset is utilized from Mammographic Image (MIAS). The outcome demonstrates the accomplishment of the true positive rate of around 95.3% at the rate of 0.14 false positive for each image. M. d. A. Duarte, et al. (Duarte et al., 2013), A micro-calcification segmentation technique is proposed, in view of morphological operators, radiologists' learning and Otsu's Method. Pre-processing with top-hat operators decreases background noise and enhances contrast. The database is made out of 158 mammograms from 78 patients of the DDSM database. Result considers the radiologist's opinion, the rates of ROIs satisfactorily segmented to build up a finding hypothesis were 97.8% for one radiologist and 97.3% for the other. M. González-Hidalgo and S. Massanet (González-Hidalgo & Massanet, 2014) proposed another way to deal with fuzzy mathematical morphology in view of discrete t-norms is contemplated. The discrete t-norms that must be utilized as a part of a request to protect scaling invariance, monotonicity, among others, are completely decided. L. Caponetti et al. (Caponetti, Castellano, Basile, & Corsini, 2014), proposed an approach based on fuzzy mathematical morphology to segment image of human oocytes so as to separate the oocyte region from the whole image. The approach applies fuzzy morphological operators to distinguish delicate edges in the oocyte image, followed by morphological recreation operators to isolate the oocyte district. B. Sridhar, et al. (Sridhar, Reddy, & Prasad, 2015), proposed a technique that is the cancer discovery in mammogram images in light of fuzzy logic approach and adaptive mathematical morphology. The mathematical morphology is a power apparatus in view of the set hypothesis intended to extract different features from grey level and color images. With a specific end goal to evaluate the execution of the proposed approach the Mammography Image Analysis Society (MIAS) database is applied. The test comes to demonstrate the propelled qualities of cancer images, the proposed technique is shown with different case images and assessed measurements are arranged. M. Y. Kamil (Kamil, 2016), proposed the use of morphological gradient (dilation– erosion) of the fuzzy mathematical morphology in light of Hamacher t-conorm and t-norm and classical morphological slope. The consequences of assessment indicated of the adequacy of the fuzzy morphological approach in brain magnetic resonance imaging contrast with established morphological in view of factual image quality. M. Ciecholewski (Ciecholewski, 2017), proposed the utilization of morphological transformations and divided the work into two sections. The initial segment detects microcalcifications morphologically, in the second section, a watershed segmentation of microcalcifications is done. This examination was conducted on a test group containing 200 ROIs $512 \times 512$ pixels in size taken from mammograms of the Digital Database for Screening Mammography (DDSM). The normal time of executing all means of the techniques utilized for a solitary ROI amounted to 0.83 s. T. Das and C. Chowdhary (Das & Chowdhary, 2017), This paper has utilized a system of the morphological opening in the blend with linear filters and then eliminating the non-uniform relevant light. The logical gauge has been reserved as the norms to restrict the nearby immediacy to the non-uniform contextual abstraction expanding a few practices such as median filtering. Furthermore, the procedure involves morphological processes, successive erosion and dilation studied by disparity improvement for the exact molecule extraction for parallel image processing in link with the median filter. The rudimentary morphological operators are dilation and erosion. Morphology is, at first advanced, gone for binary images and extended to grayscale purposes and image. M. Y. Kamil, et al. (Mohammed & Ali, 2019), proposed of fuzzy c-mean and lazy snapping algorithm to improve the segmentation performance of the detection of abnormal area in mammography images. they used the mini-MIAS database.