

A Comparative Study of Ant and Genetic Algorithms in Digital Mammography

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ABSTRACT

Image processing technique in general, involves the application of signal processing on the input image for isolating the individual color plane of an image. It plays an important role in the image analysis and computer version. This paper compares the efficiency of two approaches in the area of finding breast cancer in medical image processing. The fundamental target is to apply an image mining in the area of medical image handling utilizing grouping guideline created by genetic algorithm. The parameter using extracted border, the border pixels are considered as population strings to genetic algorithm and Ant Colony Optimization, to find out the optimum value from the border pixels. We likewise look at cost of ACO and GA also, endeavors to discover which one gives the better solution to identify an affected area in medical image based on computational time.

Keywords : Digital mammography, Ant colony optimization, Genetic algorithm, mammography, Image pre-processing.

I. INTRODUCTION

Bosom tumor is a sort of disease starting from bosom tissue, most normally from the inward coating of drain conduits or the lobules that supply the pipes with milk. Cancers beginning from channels are known as ducal carcinomas, while those beginning from lobules are known as lobular carcinomas. Bosom malignancy happens in people and different warm blooded creatures. While the mind lion's share of human cases happen in ladies, male bosom growth can likewise happen. The size, organize, rate of development, and different attributes of a bosom tumor decide the sorts of treatment.

Mammography method is best accessible system for bosom disease location. Bosom variations from the norm are characterized over extensive variety of highlights and it might happen that radiologist may be barely noticeable or misconstrued it. [Digital mammography is a method for recording x-beam

image in PC code. The images are shown on a PC screen and can be upgraded (helped or obscured) before they are imprinted on film. Pictures can likewise be controlled; the radiologist can amplify or zoom in on a territory. From the patient's viewpoint, the method for a mammogram with an advanced framework is the same concerning traditional mammography. Genetic are by and large connected to issues for which there is no tasteful issue particular calculation or heuristic; or when it isn't pragmatic to actualize such a technique. Most regularly utilized genetic are focused to combinatorial advancement issues. The Ant-Miner algorithm, first proposed by Parpinelli et al. applies an ant colony optimization heuristic to the classification task of data mining to discover an ordered list of classification rules. In his work, a comparative study on the performance of Ant-Miner and the well-known CN2 algorithm using six public domain data have been done. Ioannis michelakos et al.[2]ACO algorithms are probabilistic techniques for solving computational

problems that are based in finding as good as possible paths through graphs by imitating the ants' search for food. The use of such techniques has been very successful for several problems. Besides, Data Mining (DM), a discipline that consists of techniques for discovering previously unknown, valid patterns and relationships in large data sets, has emerged as an important technology with numerous practical applications, due to wide availability of a vast amount of data.

Like genetic algorithm and reproduced strengthening approaches, the insect calculations additionally encourage its answer technique through utilization of nature representations. The ACO depends on the practices of ants that they show when searching for a way to the upside of their province. This undertaking presents an automatic alignment arrangement for dissecting relating mammogram image utilizing genetic algorithm and ant colony optimization technique .

This paper is organized as follows: Section II deals with Digital mammography. Section III explains image preprocessing concepts Section IV idea about ACO and genetic algorithms, reports the computational results. Section V conclusion.

II. DIGITAL MAMMOGRAPHY

Bosom tumor is a reason for growth passing in ladies. The rates of the bosom tumor have been diminishing by before discovery with particular bosom exam called mammogram. One of the markers of bosom disease are sought in mammograms are bunches shaped by micro calcifications. Wavelet compression is a type of information compression appropriate for picture pressure (some of the time additionally video pressure and sound pressure). Utilizing a wavelet change, the wavelet compression techniques are satisfactory for speaking to homeless people, for

example, percussion sounds in sound, or high-recurrence segments in two-dimensional pictures, for instance a picture of stars on a night sky.

Mammograms are pictures hard to decipher, and a preprocessing period of the pictures is important to enhance the nature of the pictures and make the element extraction stage more solid. In this paper, the broadly utilized histogram evening out strategy has been utilized to improve the pictures. In this investigation, tissue encompassing the suspicious locale is taken for examination. The arrange showing the suspicious region is taken from MIAS after picture preprocessing.

In flag handling, usually attractive to have the capacity to play out some sort of clamor decrease on a picture or flag. The middle channel is a nonlinear computerized sifting strategy, frequently used to expel clamor. Such commotion decrease is a run of the mill pre-handling advance to enhance the consequences of later preparing (for instance, edge location on a picture).

Middle sifting is generally utilized in advanced picture handling in light of the fact that, under specific conditions, it preserves edges while evacuating commotion. The motivation behind smoothing is to decrease commotion and enhance the visual nature of the picture. Frequently, smoothing is alluded to as separating. There are two kinds of channels that have been discovered valuable in atomic pharmaceutical: spatial and transient. Spatial channels are connected to both static and dynamic pictures, while worldly pictures are connected just to dynamic pictures.

The methodology of the asymmetry recognition framework can be depicted as takes after: Given a couple indistinguishable view mammograms of the left and right bosom, recognize every single basic asymmetry between comparing positions in the left

and right bosom. The blend of hereditary administrators (generation, hybrid, change) is connected to distinguish the outskirts of the mammogram picture.

Ant Colony Optimization and Genetic Algorithm are actualized, and analyzed. The pectoral muscle locale is expelled from the bosom area and the mammogram pictures are standardized. Preprocessing and improvement systems, for example, middle separating, evacuation of pectoral muscle and standardization for mammogram pictures. We are utilizing hereditary calculation for bosom visitor recognition.

III. IMAGE PRE-PROCESSING

The following section presents an overview of the Image Preprocessing. Pre handling investigates preprocessing and improvement systems, for example, middle sifting, evacuation of pectoral muscle and standardization for mammogram pictures. Bosom outskirts location presents hereditary calculation for bosom visitor identification. The fringe and areola as references, the correct mammogram is adjusted relating to left mammogram, and left picture is subtracted from right picture to get the asymmetry picture. The trial results demonstrates that the proposed strategy creates better outcomes relatively.

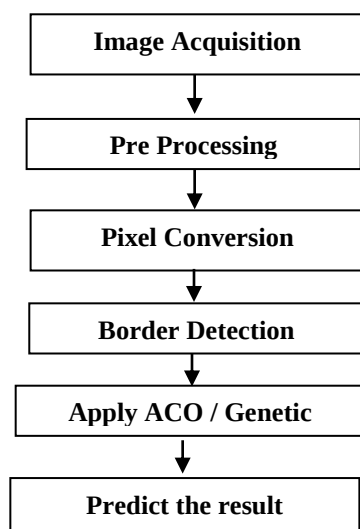


Figure 1. Image preprocessing steps

A. PIXEL CONVERSION

We used free Tissue Blocks downloaded from, <ftp://peipa.essex.ac.uk>

24-bit Color Image to 256-color Gray Image

Take this 24-Bit BMP file as Input file and open the file in

Binary Mode, (Size 1024×1024).

➤ Step 1:

Copy the Image Info (First 54 byte) of the Header from Input 24-Bit Bmp file to a newly created BMP file and edit this Header by changing file size, Bit Depth, Colors to confirm to 8-Bit BMP.

➤ Step 2:

Copy the Color Table from a sample gray scale Image to this newly created BMP at 54th Byte place on words.

➤ Step 3:

Convert the RGB value to Gray Value using the following formula: convert RGB to YIQ (YIQ map is an m-by-3 matrix that contains the NTSC luminance (Y) and chrominance (I and Q) color components as columns that are equivalent to the colors in the RGB color map).

In the NTSC color space, the luminance is the grayscale signal used to display pictures on monochrome (black and white) televisions. The other components carry the hue and saturation information. Rgb2ntsc defines the NTSC components using

$$Y = (\text{float}) (0.299 * R + 0.587 * G + 0.114 * B);$$

$$I = (\text{float}) (0.596 * R - 0.275 * G - 0.321 * B);$$

$$Q = (\text{float}) (0.212 * R - 0.523 * G + 0.311 * B);$$

➤ Step 4:

Write to new BMP file

Take 24-bit BMP color image as input. Then convert it to 256-color Gray Scale image by following this algorithm converted into gray value, stated in Step

This 256-color Gray Scale image is the output of the algorithm. In this algorithm, first read the red, blue and green value of each pixel and then after formulation, three different values are converted into gray value, stated in Step

B. BREAST BORDER DETECTION

Segmentation of the breast region and non-breast region is a necessary prerequisite for further bilateral subtraction. This section presents the border detection method using genetic algorithm. The breast border can be obtained by segmenting the breast region in the image. In border detection, the mammogram image is converted into binary image. From the binary image the border points are extracted and it is mapped with the original image. The extracted border is enhanced using genetic algorithm.

- **Step 1:** Mammogram image has been taken as input.
- **Step 2:** Pre-processed the mammogram (Noise removal by selective median filtering)
- **Step 3:** Applied the proposed edge detection method based on Threshold method
 - 3.1. Chosen the threshold for the image.
 - 3.2. Used the threshold and compared it with each and every pixel available in the image. If the pixel is in the level of threshold, then assigned that as detected edge pixel.
 - 3.3. Checked the neighboring pixels and added them to the boundary region if they are similar to the first edge pixel.
 - 3.4. Checked for all the image pixels and extracted the edge.
- **Step 4:** Repeat step 3.1 to 3.4 until all the edges which are not added to a region of edge be grown.

C. WAVELET TRANSFORM

- Digitized mammograms are decomposed using the wavelet transform without down sampling process at several levels in the transform space.

- In order to improve the contrast enhancement of images, the multi scale adaptive gain as an enhancement method was applied.

E. ANT COLONY ALGORITHM

This algorithm is inspired by observation of real ants. Independently, every subterranean insect is visually impaired, slight and relatively unimportant. However, by having the capacity to co-work with one another, the state of ants exhibits complex conduct. One of these is the capacity to locate the nearest course to a sustenance source or some other fascinating milestone. This is finished by setting down unique synthetic compounds called "pheromones." As more ants utilize a specific trail, the pheromone focus on it increments, thus drawing in more ants. In our model, a fake subterranean insect is put haphazardly in every pixel and, amid every cycle, picks the following advance an incentive to go to.

➤ PROBLEM GRAPH REPRESENTATION

Artificial ants move between discrete states in discrete conditions. Since the Continuous issues comprehended by Ant Colony System calculation are frequently discrete, they can be spoken to by a diagram with N hubs and R courses.

➤ ANTS ALLOCATION INITIALIZING

Various ants are put on the inception hubs. The quantity of ants is regularly characterized dependent on experimentation and number of hubs in the locale.

➤ ANTS POSSIBILITY DISTRIBUTION RULE

Subterranean insect's probabilistic change between hubs can likewise be indicated as hub progress rule as hub progress rule.

➤ UPDATE GLOBAL TRAIL

At the point when each subterranean insect has gathered an answer, toward the finish of each cycle,

the power of pheromone is refreshed by a pheromone trail refreshing principle.

➤ STOPPING PROCEDURE

This procedure is completed by arriving to a predefined number of cycles or the maximum number of cycles between two improvements of the global best solutions.

F. GENETIC ALGORITHM

A genetic algorithm is an iterative technique until a pre-decided halting condition (for the most part the quantity of age). Genetic algorithm includes a populace of people, every one spoken to by a limited series of images, known as the genome, encoding a conceivable arrangement in a given issue space.

Instatement: chromosomes are haphazardly made. Now, it is imperative that the populace is differing. Something else, the calculation may not create great solutions.

Assessment: every chromosome is appraised on how well the chromosome takes care of the current issue. A wellness esteem is allocated to every chromosome.

Determination: the fittest chromosomes are chosen for engendering into the future age dependent on how fit they are.

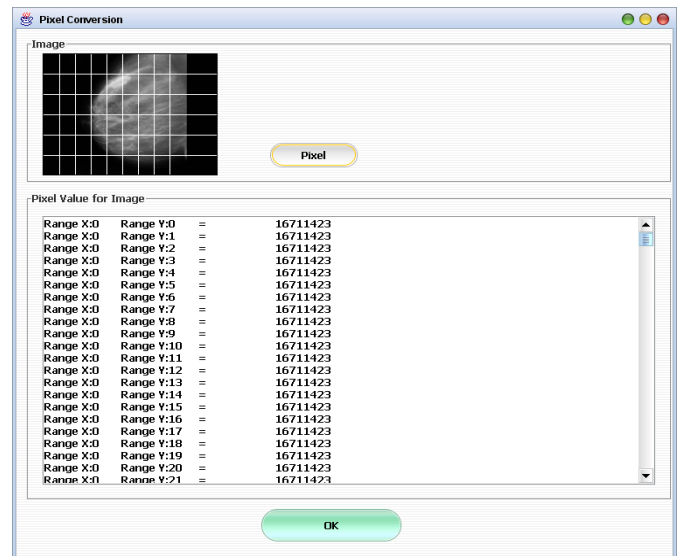
Recombination: singular chromosomes and sets of chromosomes are recombined, adjusted and after that set back into the populace.

IV. EXPERIMENTAL RESULT

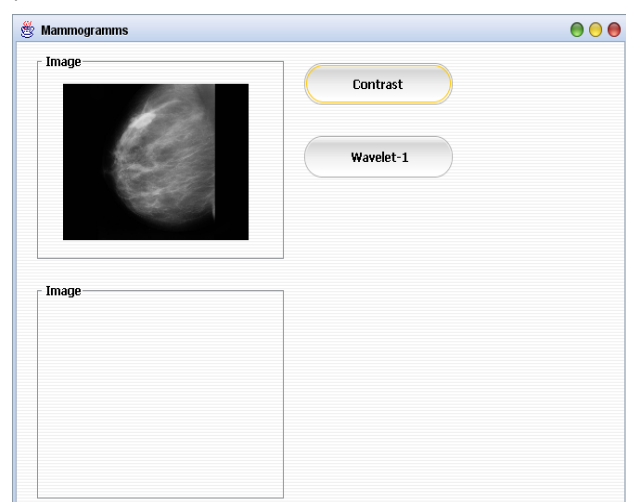
In this experiment, Nowadays we are finding that mammography system is best accessible procedure for bosom malignancy discovery. Bosom irregularities are characterized over extensive variety of highlights

and it might happen that radiologist may be barely noticeable or confused it.

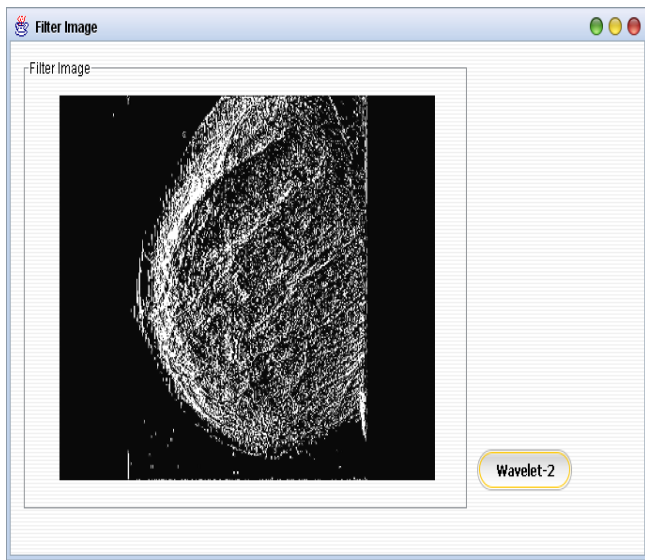
The capacity to enhance demonstrative data from medicinal pictures can be upgraded by planning picture preparing calculations that is the reason we proposed new calculation to distinguish injuries in mammogram bosom malignant growth pictures.



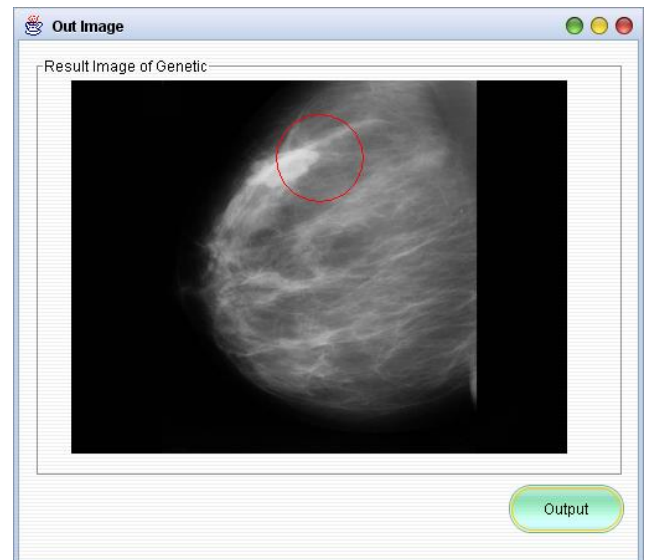
a) Pixel conversion



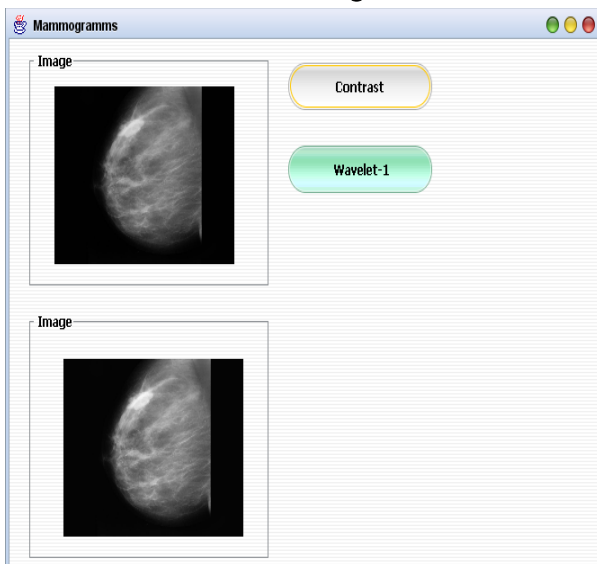
b) Contrast image



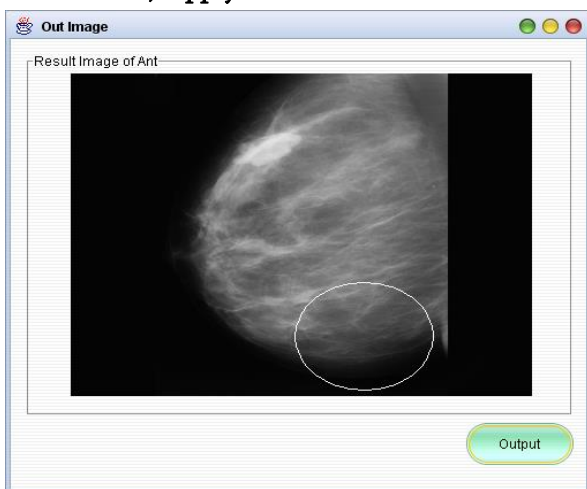
Filter image



f) Apply genetic algorithm



d) Apply wavelet transform



e) Apply ACO algorithm

COMBINATION OF RESULT

In this proposed method, the combination of genetic operators (reproduction, crossover, mutation) is applied to detect the border of the mammogram image. To identify the nipple on digital mammograms a novel method, Ant Colony Optimization and Genetic Algorithm are implemented, and compared. Using the border coordinates and nipple position of left and right mammograms, the images are aligned and subtracted to extract the suspicious regions.

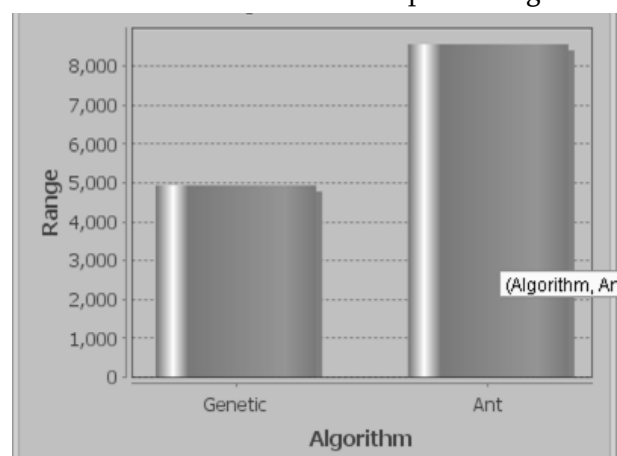


Figure 2 : Comparison diagram for ACO and genetic algorithm

V. CONCLUSION AND FUTURE ENHANCEMENT

In this paper, we have presented the comparative analysis of Ant Colony Optimization and Genetic Algorithm in digital mammography. The proposed work shows that the ACO give better results as compare to the GA[7]. At the last cycle, the fringe pixel, which restores the ideal esteem, is considered as the areola position of the mammogram picture. Utilizing ACO the consequence of the influenced position is superior to anything the outcomes utilizing Genetic Algorithm.

Our future work includes the mammogram image segmentation by combine use of watershed and level set methods. Further work on this hybrid approach is on progress. We are planning to present a fast hybrid segmentation algorithm that integrates watershed transformation and level set method. Here user may select the iteration at which the resulting segmentation is acceptable. It is predicted that the algorithm can provide satisfactory results with respect to both segmentation performance and execution times for 2-D and 3-D cases. We are using 2D and 3D Cases for time consuming and to get the exact result speedily. Also we are planning to develop a CAD system for early detection of cancer.

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