Early Detection of Breast Cancer by Using Handycam Camera Manipulation as Thermal Camera Imaging with Images Processing Method

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Abstract. One important thing to pay attention for detecting breast cancer is breast temperature changes. Indications symptoms of breast tissue abnormalities marked by a rise in temperature of the breast. Handycam in night vision mode interferences by external infrared can penetrate into the skin better and can make an infrared image becomes clearer. The program is capable to changing images from a camcorder into a night vision thermal image by breaking RGB into Grayscale matrix structure. The matrix rearranged in the new matrix with double data type so that it can be processed into contour color chart to differentiate the distribution of body temperature. In this program are also features of contrast scale setting of the image is processed so that the color can be set as desired. There was Also a contrast adjustment feature inverse scale that is useful to reverse the color scale so that colors can be changed opposite. There is improfile function used to retrieves the intensity values of pixels along a line what we want to show the distribution of intensity in a graph of relationship between the intensity and the pixel coordinates.

1. Introduction
Breast cancer is a disease where there is excessive growth or uncontrolled growth of cells of the breast tissue [1]. Breast cancer is a type of cancer that is often found by most women. Even in Indonesia, which suffered the highest cancer Indonesian women is breast cancer [2].

For women under 30 years old, the doctors advised doing the MRI test. MRI (Magnetic Resonance Imaging) does not use X-ray radiation and is suitable for detecting soft tissue. However, imaging with MRI is more expensive that very few women who do the MRI test.

In addition to performing the MRI test, mammogram tests (Mammography) is mostly done by the majority of the women to detect breast cancer. Mammography is the examination of the human breast using low-dose X-rays (usually around 0.7 mSv). However, the various parties still doubt the use of mammography because the error rate is still high and because of radiation used can cause hazards.

In detecting early symptoms of breast cancer, one of the important things to watch out for is the change in temperature of the breast. Rising temperatures breast was an indication of the symptoms of breast tissue abnormalities [8,10]. Therefore, we had the idea to manipulate the camera camcorder as a thermal image camera for the early detection of breast cancer with the method of processing images using Matlab. This system is simpler and more secure than mammography or MRI system.
Measurement or processing and acquisition of temperature information without contact with the object to be in the process [3,4]. The measurement is based the infrared radiation of electromagnetic waves with wavelengths longer than visible light. The object that has a temperature of more than the absolute temperature emit infrared waves [5]. Infrared measurements require the infrared radiation from the object and being transformed into electrical signals. The converters are the basis pyrometer which generates an output signal using a single sensor. More sophisticated tools can generate rows of the measurement results in detail of the image produced. Differences in visible light and infrared readings are from the light source that accompanies it. Figure utilizing infrared cameras change into color images based on the level of infrared energy. Images of the infrared reading are calorimetry [6]. Measurements using radiation to produce temperature readings from radiation generated. The temperature reading has the advantage of direct, no damage, and safe for repeated every time [7].

2. Experimental
The mechanism of manipulation of camera camcorder as a thermal image camera for the early detection of breast cancer with the method of processing images using Matlab little tricky. This is because the process to manipulate the thermal camera Handycam be not easy. Changes function does not do physically, but uses a manipulation on the software, so the infrared image on the.

![Figure 1](a) grayscale (b) polychromatic

The principle of this project camcorder's image can be converted into thermal (temperature) on a new program is to change the image of the infrared form of greyscale (image gray) to image thermal (temperature) in the form polychromatic (colorful), by breaking the grayscale image into a matrix of code per pixel and combines back and displayed in scale color. The process of shooting is done in a dark room in order to avoid interference of light other than infrared light. Patients are not allowed to wear clothing because it will hinder the main object. Once the images are acquired then do image processing.

In principle image of infrared images that form has a level greyscale grayish, so that each point has a value of how the gray pixel. Value grayish was converted into numeric form. So that image data is not garbled, then the identity is given pixel position in the format \{x, y, z\} where x is the position of the pixel on the x-axis, y is the position of pixels on the y-axis, and z is the value of grayish the pixel point. After that, the identity data rearranged in position by providing a color scale based on the value of z[9]. Figure 1 shows the image transformation from gray to polychromatic. The scale can be set based on the desired accuracy. Figure 2 shows a flowchart of this application.
3. Results and Discussion

3.1 Grayscale picture taking with night vision camera

At this stage taking pictures using a Handycam camera in night vision mode, accompanied by an infrared LED. The image is an image formed of gray. In a captured image can also be seen that the infrared can penetrate the outer skin so it looks bundles of the vein after the shooting with a camcorder and a night vision mode with the addition of LED infrared interference. Figure 3 shows the differences in the pictures taken from the camera and the usual mode with an additional mode of night vision infrared LEDs interference.

![Image](image-url)

**Figure 3.** Image results without night vision and infrared mode (left). Image results using night vision and infrared mode (right).

3.2 Making the image processing program using Matlab

Basically, the night vision image taken from the Handycam camera is still a polychromatic image which is a 3-dimensional matrix because they have the format RGB (Red, Green, Blue). Furthermore, the image of polychromatic is converted to a form of grayscale by changing the matrix of three dimensions wherein image RGB totaling three layers will be converted into BW (Black and White) layer which has one layer alone. So the original image is a blend of colors Red, Green, Blue will turn into a two-dimensional image containing greyish level at any point.

Here is a scheme change RGB matrix to Grayscale.

\[
RGB = \begin{bmatrix}
R_{11} & \cdots & R_{ij} \\
\vdots & \ddots & \vdots \\
R_{i1} & \cdots & R_{ij}
\end{bmatrix},
\begin{bmatrix}
G_{11} & \cdots & G_{1j} \\
\vdots & \ddots & \vdots \\
G_{i1} & \cdots & G_{ij}
\end{bmatrix},
\begin{bmatrix}
B_{11} & \cdots & B_{1j} \\
\vdots & \ddots & \vdots \\
B_{i1} & \cdots & B_{ij}
\end{bmatrix}
\]

(1)
\[
BW = \left( \sum_{i=1}^{2} \begin{bmatrix}
RGB_{i1} & \cdots & RGB_{1j} \\
\vdots & \ddots & \vdots \\
RGB_{i1} & \cdots & RGB_{ij}
\end{bmatrix} \right)\cdot 3
\]  (2)

Grayscale = \[
\begin{bmatrix}
BW_{i1} & \cdots & BW_{1j} \\
\vdots & \ddots & \vdots \\
BW_{i1} & \cdots & BW_{1j}
\end{bmatrix}
\]  (3)

In the process of changing the image RGB to Grayscale matrix changes vertically inverted position. To position the matrix can be returned as the starting position, the matrix is reversed vertically using flipup() function in Matlab.

\[
Grayscale = \text{flipup(Grayscale)};
\]  (4)

\[
Grayscale = \begin{bmatrix}
BW_{11} & \cdots & BW_{ij} \\
\vdots & \ddots & \vdots \\
BW_{11} & \cdots & BW_{ij}
\end{bmatrix}
\]  (5)

Furthermore, the matrix will be converted into an image depicting polychromatic contour color based on the level of gray in the image that illustrates the distribution of body heat. Because it is still in the form of a matrix, then the thing to do is change the format of the matrix into a double. This is done so that each coordinate value can be determined by changing the data type to double. Once the data type matrix of gray image has become an array of type double then the next is plotting the array into a color contour graph depicting the distribution of body heat. Figure 4 shows the program display images processing using Matlab.

In Figure 4, a section marked with the number 1 is the original image of the grayscale image obtained from a camcorder with night vision mode. In the section marked with the number 2 is the result of processing images from Matlab which converts the image into a gray image polychromatic to show clearly the distribution of a person's body heat. In the section marked with the number 3 is the result of the image of the image of part 2, which has gone through the process of changing the contrast.
so that the color scale can be changed. Change the contrast serves to reinforce the color so as to facilitate the analysis of doctors about the potential breast cancer.

3.3 The process of contrasting scale changes
In contrast scale, change process is done by changing the intensity of the image matrix which has been converted into contour color chart. The color changes using a slider that will automatically change the image results when the slider is moved.

\[
\text{Contrast}_{\text{value}} = 200 \frac{CV}{100} \quad (6)
\]

\(CV = \) changes value from slider

\[
\text{New Contrast Image} = \text{Grayscale} \times \text{Contrast}_{\text{value}} \quad (7)
\]

In addition contrast changes can also be done with inverse contrast, or alter the contrast by reversing the color scale so that the image of the blue color will be red and vice versa. This is done to resolve when the gradation of an image is not very clear so it is necessary to clarify the scale of another color gradation of the image. In Figure 5 intended result of image processing with the inverse contrast

\[
\text{New Contrast Invers Image} = 128 - (\text{Grayscale} \times \text{Contrast}_{\text{value}}) \quad (8)
\]

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**Figure 5.** Display Breast Cancer Images Processing with inverse contrast scale

3.4 Improfile process
In this process, we try to display data from a row of pixels in the image that has been processed through processing images. The principle of this process is to take the value of a line between the two points. The distribution of line indicated by the following equation.

\[
H_x = \left\{ p \mid p \in \sum_{(x',y')} a_{ij} \right\} \quad (9)
\]
Here used improfile functions on Matlab where the pixel value of the shortest distance the two lines will be displayed in the graph. Figure 6 displays a graph of the intensity distribution of pixels coordinate. Improfile retrieves the intensity values of pixels along a line or a multiline path in the grayscale, binary, or RGB image in the current axes and displays a plot of the intensity values. improfile(n) retrieves the intensity values, where n specifies the number of points to include. improfile(I,xi,yi) retrieves pixel intensity values, where I specifies an image, and xi and yi are equal-length vectors specifying the spatial coordinates of the endpoints of the line segments [11].

4. Conclusion
Handycam in night vision mode by the interference of external infrared can penetrate into the skin better and can make an infrared image becomes clearer. Images from a camcorder can be processed by the CASE Program (Detection of Breast Cancer) with the results of color contrast is pretty clear.

This program is able to change the black and white images from a camcorder into a thermal image by breaking RGB into Grayscale matrix structure. Once the matrix is rearranged in the new matrix with double data type so that it can be processed into contour color chart to differentiate the distribution of body temperature in the processed image. The graphics processing by differentiating levels of gray of the image to obtain different colors. In Case Program are also features of a scale setting the contrast of the image is processed so that the color of detail can be set as desired. There was also a contrast inverse scale feature settings are useful to reverse the color scale so that colors can be changed into its opposite. There is Improfile function used to retrieves the intensity values of pixels along a line that we want to show the distribution of intensity in a graph of relationship between the intensity and the pixel coordinates.

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