



Identification of land and water Centella asiatica leaf herbal plants using digital imagery with the Sobel Edge Detection algorithm

I Gusti Prahmana^{1*}, Kristina Annatasia Br Sitepu²

^{1,2}STMIK Kaputama

igustiprahmana4@gmail.com¹; kannatasia88@gmail.com^{2*}

Abstract

Centella asiatica leaves or gotu kola leaves are wild plants that grow in Asian countries such as China, Indonesia, Japan and India. Since thousands of years ago, this gotu kola leaf has been known to treat various diseases. This plant is even used as a traditional herbal medicine in China and India. Centella asiatica is an annual herbaceous plant that grows and flowers throughout the year. Plants will thrive if the soil and environment are suitable to be used as a ground cover. Types of gotu kola that are often found are red gotu kola and green gotu kola. Centella asiatica is also known as antanan taman or antanan batu because it is found in rocky, dry and open areas. Centella asiatica grows with stolons and has no stems, but has rhizomes (short rhizomes). Meanwhile, green gotu kola is often found in rice fields and on the sidelines of the grass. Based on this problem, a study is needed to develop a system to determine the shape of leaf fiber density with a comparison of ground gotu kola and water gotu kola using image processing techniques to find the diameter. This measurement process uses the Matlab application and tests with the Sobel edge detection method and image processing to see edges that are more clearly visible. The results showed that the developed system was capable of obtaining images and identifying the fiber density of Centella asiatica leaves. The system was designed with Jupyter Notebook Python-based programming language analysis with image data taken via internet sources as research material.

Keywords: Gotu Kola Leaf, Image Processing, Sobel, Leaf Fiber Density, Edge Detection.

1. Introduction

Edge detection is the process of searching for the boundaries of an object in an image. Edge detection is used in image segmentation and data extraction in fields such as image processing, computer vision and machine vision. In the medical field (detection of brain tumors and cancer), the results of edge detection are the basis for determining the decision of a problem. This demands high accuracy of the edge detection algorithm used. Several researchers have conducted research to produce edge detection algorithms with high accuracy [2]. In current technological developments to measure the diameter of the fiber density in Centella asiatica leaves, many still measure it manually to develop a ratio of fibers in land and water Centella asiatica leaves, namely in a less precise way. To find out the density of fiber in Centella asiatica leaves, it can be grouped by the difference in the basic shape of the leaves, compared to the leaves of Centella asiatica leaves, which are wider and rougher, and those on the leaves of Centella asiatica, which have small and finer leaves. Gotu Kola is a type of medicinal plant from the order Umbelliferae [5]. Plants are still the main resource in the search for new drugs. Utilization of medicinal plants or natural materials is still a priority for research. In addition to low toxicity, easy to obtain, the effects are also relatively low [3].

Centella asiatica or gotu kola herb containing the active substance asiaticoside has been widely reported for its efficacy as an anti-cellulite agent. To find out the shape of the leaf to be studied, this research will be made by identifying it based on the shape of the leaf with image processing designed to detect edges. So that the diameter measurement process is accurate [4]. Image is a representation (picture), likeness. Digital image is a combination of dots, lines, planes and colors to create the resemblance of an object to the original object. Images are analog and digital. Digital images can be processed by a computer while analog images cannot be processed by a computer, analog images must be converted to digital so that they can be processed by a computer. Digital image processing is matters related to images, colors, transformations and so on that are processed using a computer [1].

2. Research Methods

2.1 Image

Image is a representation (picture), likeness, or imitation of an object. Image as the output of a data recording system can be optical in the form of photographs, analog in the form of video signals such as images on a television monitor, or digital in nature which is directly stored on a storage medium [1].

2.2 Digital Image Processing

Pengolahan citra digital atau image processing merupakan suatu disiplin ilmu yang mempelajari hal-hal yang berkaitan dengan perbaikan kualitas gambar (peningkatan kontras, transformasi warna, restorasi citra), transformasi gambar (rotasi, translasi, transformasi geometric, skala), agar mudah diinterpretasi oleh manusia/mesin (komputer). Masukannya adalah citra dan keluarannya juga citra tapi dengan kualitas lebih baik dari pada citra masukan misal citra warnanya kurang tajam, kabur (blurring), dan mengandung noise (misal bintik-bintik putih) sehingga perlu ada pemrosesan untuk memperbaiki citra karena citra tersebut menjadi sulit diinterpretasikan karena informasi yang disampaikan menjadi berkurang [1].

2.3 Edge Detection

Edge detection is a process to find changes in intensity that are significantly different in an image field. Edge detection functions to obtain the edges of objects, edge detection takes advantage of drastic changes in intensity values at the boundaries of two areas. The edge is a set of pixels that are connected and located on the boundary of two areas, the edge contains very important information, the information obtained can be in the form of the shape or size of the object. The first few examples of edge detectors are Gradient-based operators (first derivative), namely the robert, sobel, and prewitt operators. The second is the operator based on the second derivative, namely the Laplacian operator and the Gaussian Laplacian operator [1]

2.4 Edge Detection Sobel

Sobel is a convolution process from the specified window to the image to be detected. So that the estimated gradient is right in the middle of the window in the image, in the Sobel convolution using a 3x3 window.

$$G_x = \begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -3 & 0 & 1 \end{bmatrix} \quad G_y = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix}$$

Based on the arrangement of the neighboring pixels, the gradient size calculated using the sobel operator is:

$$|G| = \sqrt{G_x^2 + G_y^2}$$

$$|G| = |G_x| + |G_y|$$

The process of the Sobel method is that the input image will be converted to a grayscale image, then using Sobel edge detection to get the outline. The grayscale results are in the form of grayish color images, while the edge detection is in the form of black and white images.

2.5 Gotu Kola leaves

Gotu Kola leaves (Latin: Centella Asiatica) is a wild plant that grows a lot in plantations, fields, roadsides, and rice field bunds. This plant originates from tropical Asia, spread across Southeast Asia including Indonesia, India, the People's Republic of China, Japan and Australia and then spread to various other countries. The names that are commonly known for this plant besides gotu kola are the leaves of the horse's foot and antanan. Often used as a ground cover, sometimes eaten as a vegetable. Efficacious as a traditional medicine for various diseases. Since ancient times, gotu kola has been used to cure skin (eg keloids), nervous disorders and improve blood circulation. Sundanese people know this plant as one of the plants for fresh vegetables.

Centella asiatica is an annual herbaceous plant that grows and flowers throughout the year. Plants will thrive if the soil and environment are suitable to be used as a ground cover. Types of gotu kola that are often found are red gotu kola and green gotu kola. Centella asiatica is also known as antanan taman or antanan batu because it is found in rocky, dry and open areas. Centella asiatica grows with stolons and has no stems, but has rhizomes (short rhizomes). Meanwhile, green gotu kola is often found in rice fields and on the sidelines of the grass. The place favored by gotu kola is a slightly damp and open or slightly shaded place. In addition, there are four types of plants that are similar to gotu kola or antanan, namely gotu kola, antanan beurit, antanan gunung and antanan air. (<https://id.wikipedia.org/wiki/Pegagan>)



Figure I.1 Water Centella asiatica leaves



Figure I.2 Leaves of Gotu Kola

3. Results And Discussion

Calculating the diameter of Fuji apples using edge detection can simplify the process of calculating the diameter. Edge detection of an image contains important information from the image concerned. The edge of the image can represent the objects contained in the image, their shape and size and sometimes also information about the texture, the edge of the image is the position where the pixel intensity of the image changes from a low value to a high value. high or vice versa, the edge detection process must be able to produce detection with clear and real edges. The Sobel method is an image edge detection method with clearer and more real edge results. So the process of measuring this diameter uses the Matlab application design with the sobel edge detection method and image processing.

The steps for the process of the Sobel method are:

1. The inputted image will be converted to a grayscale image. The grayscale result is a grayish color image.
2. Retrieve the pixel value of the grayscale image.
3. Convolve the grayscale image pixel values with horizontal and vertical split kernels.

First step: Input image is converted to grayscale image

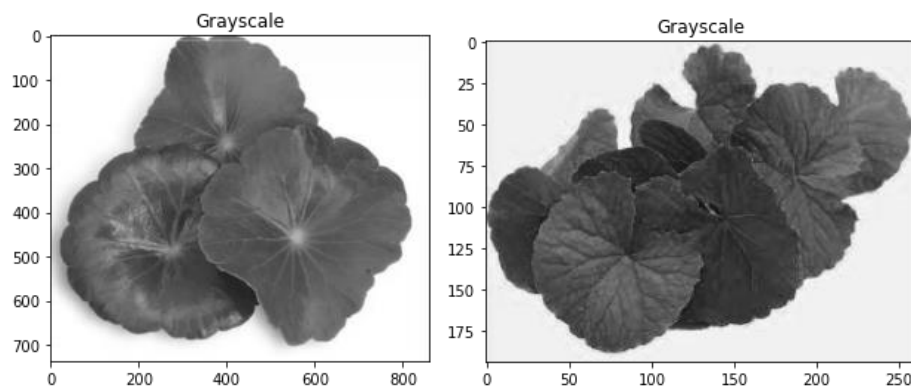


Figure I.3 Grayscale of Ground and Water Centella asiatica Leaves

The second step is to take the grayscale image pixel values with Jupyter Norebook Python, namely.

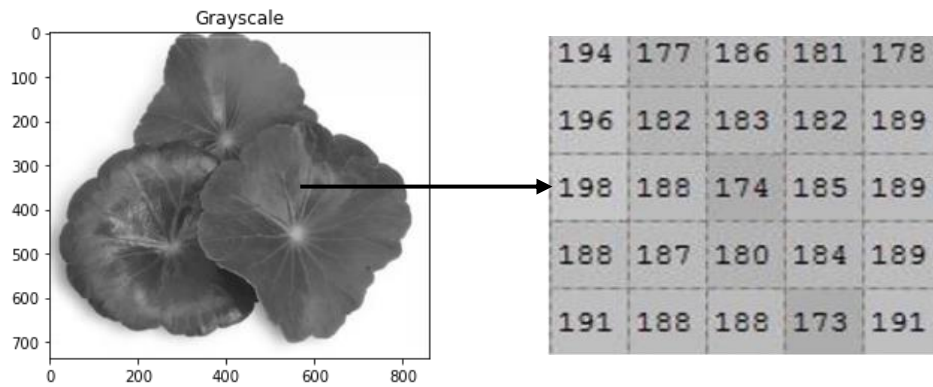


Figure I.4 Pixel Grayscale Image

These pixel values will be processed by the sobel method to detect edges in the image. Pixel value of The above image is processed according to the provisions of the Sobel method. Grayscale image convolution with Sobel kernel horizontal(Gx) and vertical Sobel kernel(Gy).

The results of image edge detection from the Sobel method can be seen as shown below:

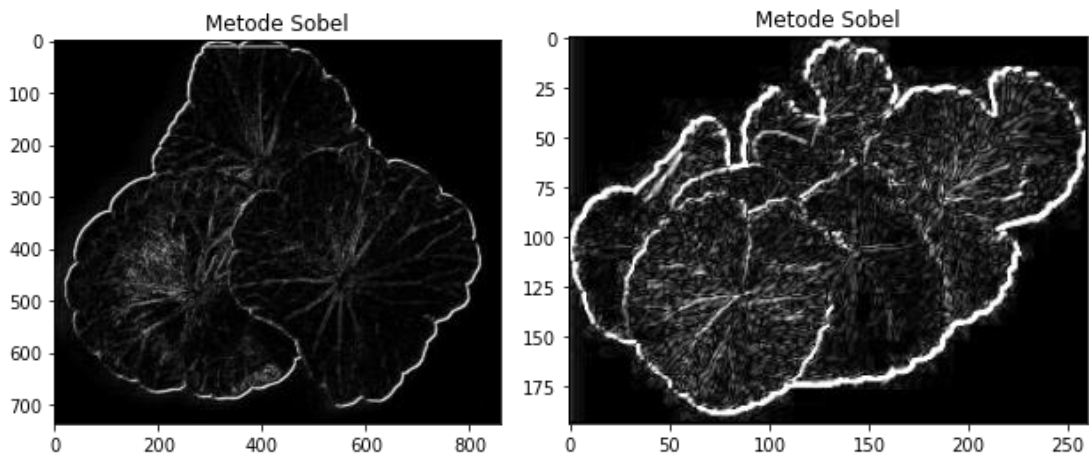
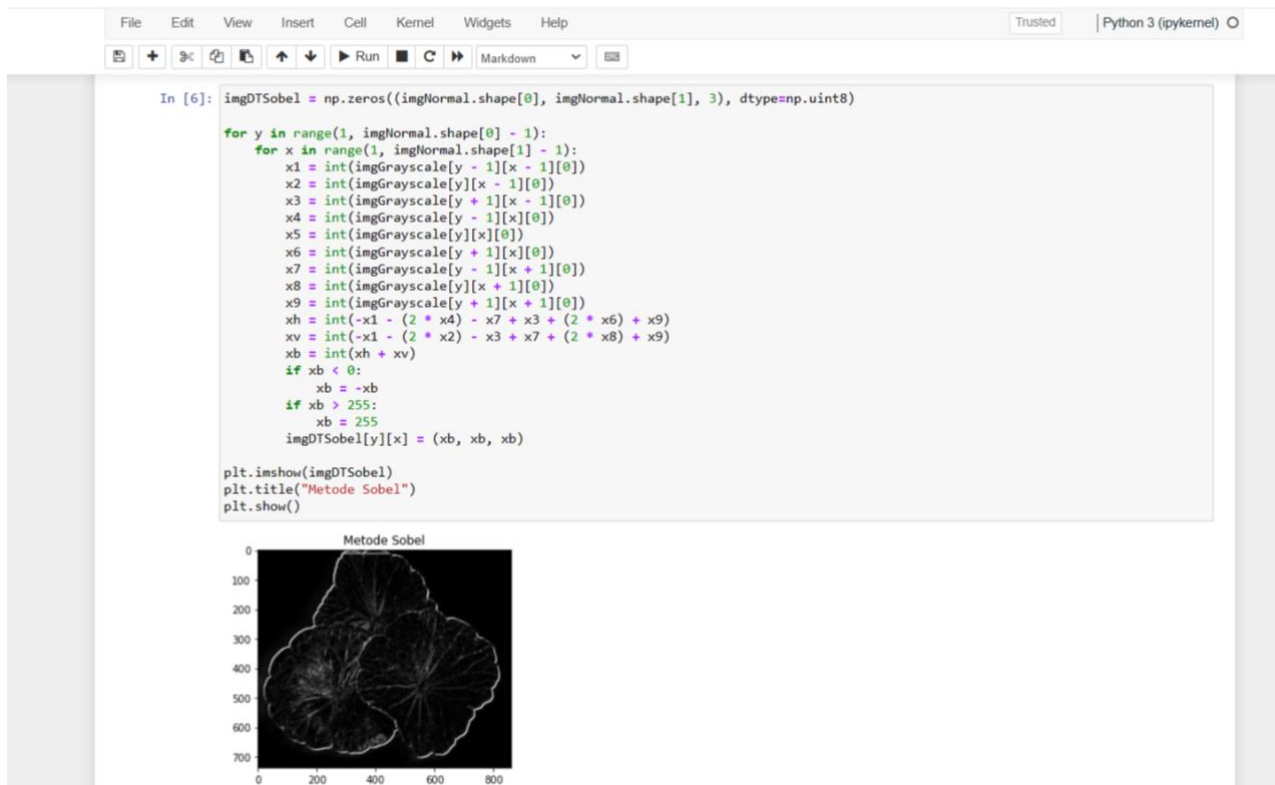


Figure I.5 Edge Detection Sobel Image

Detection results on the edge detection Sobel image above shows fiber density and a larger shape, one of the qualities of these leaves, even though they are the same as useful herbal plants. With the identification results of image processing, it is the leaves of *Centella asiatica* that show more image results with the Sobel edge detection algorithm, which has more edge detection and is more clearly visible.

4. Testing

The results of the program display of the Sobel edge detection algorithm and image processing for detecting the edges of the image on the *Centella asiatica* leaf image can be seen in the image below:



```

In [6]: imgDTSobel = np.zeros((imgNormal.shape[0], imgNormal.shape[1], 3), dtype=np.uint8)

for y in range(1, imgNormal.shape[0] - 1):
    for x in range(1, imgNormal.shape[1] - 1):
        x1 = int(imgGrayscale[y - 1][x - 1][0])
        x2 = int(imgGrayscale[y][x - 1][0])
        x3 = int(imgGrayscale[y + 1][x - 1][0])
        x4 = int(imgGrayscale[y - 1][x][0])
        x5 = int(imgGrayscale[y][x][0])
        x6 = int(imgGrayscale[y + 1][x][0])
        x7 = int(imgGrayscale[y - 1][x + 1][0])
        x8 = int(imgGrayscale[y][x + 1][0])
        x9 = int(imgGrayscale[y + 1][x + 1][0])
        xh = int(-x1 - (2 * x4) - x7 + x3 + (2 * x6) + x9)
        xv = int(-x1 - (2 * x2) - x3 + x7 + (2 * x8) + x9)
        xb = int(xh + xv)
        if xb < 0:
            xb = -xb
        if xb > 255:
            xb = 255
        imgDTSobel[y][x] = (xb, xb, xb)

plt.imshow(imgDTSobel)
plt.title("Metode Sobel")
plt.show()

```

Figure I.6 The Jupyter Notebook Python program

5. Conclusions

A digital image consists of pixels that form a grayscale image on the ground and water images of *Centella asiatica* leaves. The results of edge detection from *Centella asiatica* leaves can be used for other digital image processing applications that require information about the pixel composition of *Centella asiatica* leaves. Application design can be made using the Jupyter Notebook Python programming language with the form of sobel image results and image processing thresholding to determine the diameter of the shape and fiber as well as the size of the leaf which is better known to display more and denser edge shapes. And this research can be further developed with the latest methods and with a better programming language for the future.

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