Thresholding Comparison Display Using Graphical User Interface (GUI) with Mobile Notification

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Abstract. Thresholding is a sort of image division that separates protest apportioning an image into a closer view and foundation. The fundamental utilization of image division are medical imaging, object discovery and recognition tasks, content-based image recovery, video surveillance, and automatic traffic control systems. The objective of the thresholding method is to simplify an image into something that is easier to examine. By using MATLAB R2017b as its core programming software, the image will be separated by unused background with uncertainty. This project will describe a few selected thresholding methods such as Fuzzy C-Mean Algorithm’s method, Wolf’s method, Bradley’s method, Bernsen’s method, Triangle’s Method and Deghost’s Method. Each method will experiment with medical and document images. The thresholding method will undergo image quality analysis such as Sensitivity and Specificity. This process is using Graphical User Interface (GUI) and sending messages to phones with Global System for Mobile Notification (GSM) modems is implemented with the aim of allowing researchers to know the best methods by the ease in a convenient manner. This message can send the receiver any time, users only insert telephone number to send their message.

Keywords: Thresholding ∙ Graphical User Interface ∙ Mobile Notification ∙ Medical ∙ Images

1. Introduction

Thresholding in image processing has been studied over the latest decades because to simplify and change the representation of an image into something that is more meaningful and easier to analyze [1,2]. However, many environmental factors, disgraceful dealing with, and the low quality of the materials utilized as a part of the image creation make it endure a high degree of degradation of different sorts. The research areas of the images from blurry, small and low grains attract researchers because of the challenges of segmentation of the subject from the degraded background [3–6].

The main aim of the image thresholding is to isolate the object to partitioning an image into a foreground and background [7–10]. This project is to apply the comparison thresholding method on medical and document image using a MATLAB software and display in a smartphone. The system also will be able to display sensitivity and specificity analysis [11]. In this undertaking, the
A smartphone will be utilized to show picture quality examination by Graphical User Interface (GUI) utilizing Arduino Uno and Mobile Communications (GSM) to send the information to the smartphone. Smartphones are compact and more important contrasted with alternate interfaces.

2. Methodology

In this paper, a comprehensive review and analysis of different image segmentation techniques especially in the thresholding method have been discussed. The goals of this paper are to explore the advantages and drawback of several image thresholding methods in medical and document images [6,12]. A few selected local threshold methods approach such Fuzzy C-Mean Algorithm’s method [13], Wolf’s method [14], Bradley’s method [15], Bernsen’s method [16], Triangle’s method [17] and Deghost’s method [18] have been tested on the image dataset. The explanations and description of each thresholding method are shortened in Table 1.

Table 1 Summary of the selected thresholding methods.

| Method       | Description                                                                 |
|--------------|------------------------------------------------------------------------------|
| Bradley      | The possibility of the algorithm is that each picture's pixel is established to dark. If its brightness is T percent lower than the normal brilliance of encompassing pixels in the window of the predetermined size, else it is set to white. |
| Fuzzy C Means| The fuzzy c-means algorithm is very alike to the k- means algorithm: Pick a number of clusters. Allocate coefficients casually to each data point for being in the clusters. Recap until the algorithm has congregated. Calculate the centroid for each cluster. For each data point, analyze its coefficients of being in the clusters. |
| Wolf         | To limit simulated content in images and videos utilizing a measure of accumulated inclinations and morphological preparing. The quality of the limited content is enhanced by powerful various casing mix. |
| Deghost      | The technique incorporates estimating no less than one normal for the characteristic of the measurement noise and deghosting the seismic information construct at any rate to a limited extent in light of the evaluated characteristics of the estimation commotion. |
| Bernsen      | Another neighborhood differentiate technique is offered by Bernsen, a two-phase strategy. Differentiation esteem as a distinction between the most extreme and least incentive in the neighborhood is computed amid the first phase of computation. In the second stage, limit esteem is computed as a mean of the base and most extreme incentive in the neighborhood of the examined pixel if the difference esteem was sufficiently high. |
| Triangle     | A line is built between the greatest of the histogram at b on the dim level hub and the most reduced (or most noteworthy relying upon setting) esteem an on the dim level hub where the histogram is altogether bigger than 0. The separation L ordinary to the line and between the line and the histogram is registered for all qualities from a to b. The level where the separation between the histogram and the line is maximal is the edge esteem (level). This strategy is especially compelling when the question pixels deliver a frail top in the histogram. |
2.1 Graphical User Interface (GUI)

The GUI is a short form for Graphical User Interface, allows the use of icons or other visual indicators to interact with electronic devices, rather than using only text via the command line [19,20]. The function of the GUI simplifies the process. MATLAB as a based to create a GUI and it can establish the connection between MATLAB and GSM module. It also can show the whole process of a threshold by use and visual indicator to easily understand. The GUI can send a mobile notification with IQA analysis via SMS. Figure 1 and Figure 2 show as the design of the GUI for medical image and document image system.

Figure 1. Design of GUI for medical images

Figure 2. Design of GUI for document image
2.2 Global System for Mobile Communication (GSM) Module

Global System for Mobile communication (GSM) SIM900A Modem is worked with Dual Band GSM or GPRS based SIM900A modem from SIMCOM. Its functions at frequencies 900 until 1800 MHz. SIM900A can look through these two bands automatically. The frequency band can likewise be set by AT Commands. The baud rate is configurable from 1200-115200 through AT command. The GSM or GPRS Modem is having inward TCP/IP stack to empower to interface with the web by means of GPRS. SIM900A is an ultra-compact and dependable remote module. The part of the hardware is operated without Arduino IDE programming since it straightforwardly direction from MATLAB. The guidance to control the GSM modem utilized AT direction on MATLAB. The order from MATLAB straightforwardly to work without Arduino programming.

![Figure 3. Schematic Diagram of GSM Simulation](image)

Arduino Uno is used to be a center of the connection between GSM and GUI system. GSM is for the process of sending the result of image performance to the mobile phone. At Arduino, Port 11 act as Tx port and port 10 as Rx port. Figure 3 is a schematic diagram for Arduino Uno and GSM connection and Figure 4 is actual hardware connection.
3. Results and Discussion

The Intelligent Diagnostic System was developed by using the Graphical User Interface (GUI) in Matrix Laboratory (MATLAB). This system was build to easier the user to conduct the process without the need to install the MATLAB software in their computer. Figure 5 and 6, the image button function to upload the target image into the system. Benchmark button function to upload the benchmark image. Threshold button function is to trigger the all threshold function and calculate button function to calculating the performance measure of the threshold image. Lastly, send button function is to trigger the GSM to transfer the data to the user via SMS.

![Figure 5. The Intelligent Diagnostic System for medical images.](image1)

![Figure 6. The Intelligent Diagnostic System for document images.](image2)

The GUI is medium to show information to build up a discovery input image. Second, GUI likewise sending an SMS Image Quality Analysis (IQA) through GSM utilizing MATLAB programming to a smartphone. The process of sending SMS to the mobile phone when the result come out was achieved
by a combination of Arduino Uno and SIM900a, the name of Global System Mobile Communication (GSM) was used for this project. The hardware operated directly from Matlab without using Arduino IDE. When the phone number of recipients had been inserted and the send button was pressed, the signal of GSM was active and send the data to the phone notification as shown in Figure 7. Average estimated for the message from system to the cell phone arrived was 30 second depends on the network coverage.

![Image of smartphone](image-url)

**Figure 7.** Result on Smartphone using GUI Display

4. Conclusion

In this system was designed to easier the allowing researchers to know the best methods by the ease in a convenient manner. The Image Quality Analysis (IQA) which consists of specificity and sensitivity. The proposed method is displayed in the GUI. It also performed for sending an SMS using a GSM and Arduino hardware. The Arduino is medium between MATLAB and GSM. Set a command in MATLAB to send Image Quality Analysis (IQA).

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