Intercontinental Geoinformation Days

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Development of a user-friendly program:" Real-Time image properties display"

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Keywords
Photogrammetry
Image Processing
Computer Vision
Feature extraction
MATLAB

ABSTRACT
Image processing is a well-established field with researches involving its numerous applications and techniques constantly updated. However, there exists a gap in knowledge on the processing of images in real-time. Lately, real-time image processing has grown in applications. Applications which include face detection, traffic management, etc. However, processing of real-time images may require two or more of these toolboxes which may not be compiled either because of the complex coding involved or the low technical expertise of the user. Hence, the need for the design of a user-friendly program that can display the properties of digital images in real-time which this research aims to explore. The user-friendly program will require low technical expertise to operate. It will also collate together useful digital image processing toolboxes. To develop the above program, MATLAB software was used. The program was then compiled and tested with images acquired from various sources, the results of which successfully displayed various properties of images through operations like object detection and face detection in real-time.

1. Introduction

Digital image processing consists of the manipulation of digital images using digital computers (Silva & Mendonca, 2005). It typically involves filtering or enhancing an image using various types of functions in addition to other techniques to extract information from the images (Padmappriya & Sumalatha, 2018).

Some of the important applications of digital image processing include remote sensing, face detection, edge detection, feature extraction, computer vision, forecasting, optical character recognition (Padmappriya & Sumalatha, 2018). Even the multimedia system heavily relies on digital image processing. Despite growing applications of real-time image processing like face recognition, object detection. There exists a gap in knowledge on the processing of images in real-time. Also, processing of real-time images may require two or more of these toolboxes which may not be easily together easily accessed either because of the complex coding involved or the low technical expertise of the user. Hence, the need for the design of a user-friendly program that will display the properties of digital images in real-time which this project aims to explore. The user-friendly program will require low technical expertise to operate. It will also collate together useful digital image processing toolboxes.

During the time of the growth of image processing, programmers were working on designing a system that would process images mathematically (in form of vectors and matrices) in a simple, interactive way. Quite a few programming languages were developed for this purpose, but the MATLAB programming language gained global recognition, especially among teaching facilities for its ease of use and wide range of applications. Many libraries were then developed on MATLAB for image processing-related tasks; among them is the Image Processing Toolbox (Kalevo, 2019).

2. Method

The vital points considered when designing a software tool are that it functions. It can easily be read and understood, as these aid its systematic modifications when required. For a program to function properly, certain conditions and requirements associated with the

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problem or class of problems they are intended to solve must be satisfied. Likewise, the specifications which include a detailed description of the purpose, or function, inputs, method of processing, outputs, and any other special requirements) must be known to design an effective algorithm or computer program, which must work completely, correctly, and adequately well.

The steps taken in the design process are listed as follows:

Step 1 Problem analysis:

The research in context entails the development of a user-friendly program that will display the properties of an image in real-time.

Step 2 Problem statement

The research which aims to develop a user-friendly program that will display the properties of an image in real-time revolves around image processing and image analysis.

According to professionals like Stipanicev and Alasdair, digital image processing involves changing the nature of images either to improve their pictorial content for human interpretation or to make it more suitable for autonomous machine detection.

Digital image analysis is the extraction of meaningful information from digital images utilizing digital image processing techniques. Image analysis tasks range from the simple task of reading bar-coded tags to sophisticated ones such as face recognition from images.

Step 3 Processing Statement

The required input for the user-friendly program is a digital image (geospatial or non-geospatial). The outputs of the user-friendly program are information, geometric properties of the inputted digital image, and likewise a transformed and processed digital image.

Step 4 Flow chart

Fig. 1 shows the flowchart of the workflows of the processes adopted in the program design.
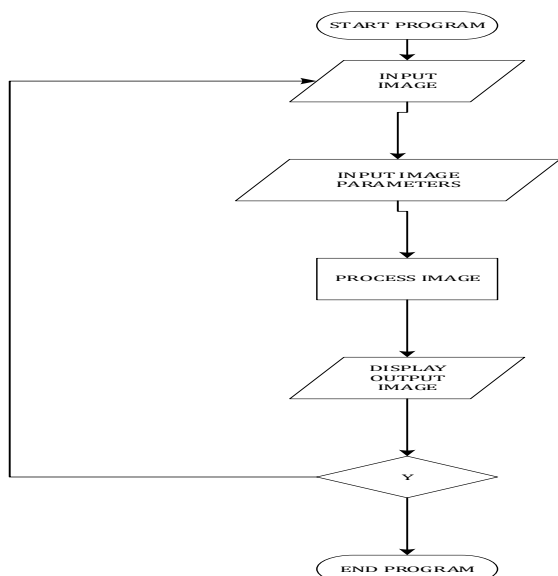
Figure 1. Flowchart of the workflows adopted in the program design

Step 5 Program algorithm

In designing a GUI, the proper visual composition is a must to give the user an aesthetically pleasing working environment. Colours, alignment, and simplicity of look should be chosen carefully. Every function, button, or any other object should have its meaning, simple and understandable by an average program user. Similar components should have conforming looks and usage. Functions ought to produce results quickly and with ease.
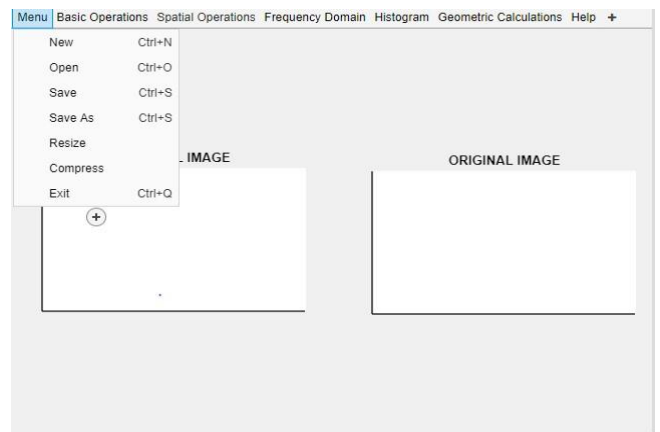
3. Results

3.1. Graphical user interface design implementation (GUI)

For the project, the GUI was designed using app designer. The components used are text boxes, push buttons, pop-up menu, static text, axes. Push buttons generate actions when clicked. For example, a clicked OK button might apply settings and close a dialog box. When you click a push button, it appears depressed; and raised when you release the mouse button.

The Graphical user interface was designed with a menu bar consisting of 7 menus with each of their respective submenus (see Fig. 2). The list of menus included in the menu bar was:
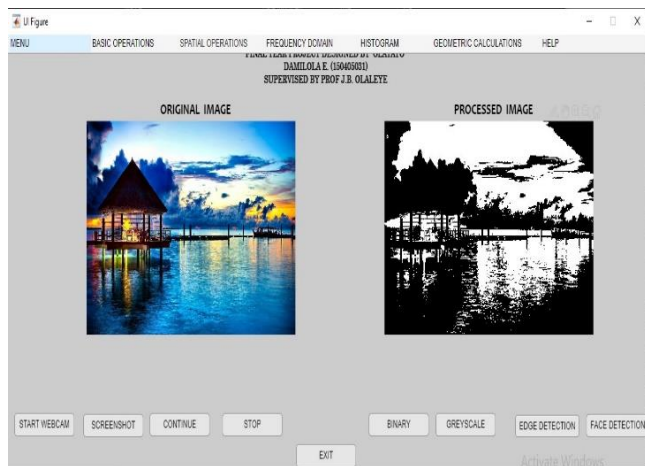
i.   Menu – The menu tab was designed with a drop-down list of submenus – New, Open, Save, Save As, Resize, Compress, and Exit.

ii.   Basıc Operatıons – The Properties, Pixel info, Thresholding, Image Negative, Bit Plane, Binary, Greyscale, Red Band, Green Band, Blue Band, and Brightness tab were included as submenus of the Basic Operations tab.

iii.   Spatıal Operatıons – Laplacian, Sobel, Prewitt, Median filter, Averaging, and Weighted Averaging were included as submenus of the Spatial operations tab.

iv.   Frequency Domaın – Gaussian Low pass, Gaussian High pass, Butterworth Lowpass, Butterworth High pass.

v.   Hıstogram – Image Histogram, Histogram Equalizations

vi.   Geometrıc Calculatıons – Coordinates, Distance, Area.

vii.   Help – About, Instructions.

Figure 2. This is a screenshot of the interface of the user-friendly program designed with MATLAB

3.2 Program testing and debugging

Various operations were performed on test images using the user-friendly program. Results obtained are shown in Fig. 3 and 4. Properties of a test image derived by the program are shown in Fig. 4. Properties that can be extracted from the properties table are highlighted under the name column. For this particular image. The file format of the image is jpg i.e the image is a jpg file while the spatial resolution of the image is 144 by 144 and the image is a truecolour image.

Figure 3. Image conversion to binary

Figure 4. Image properties generated with the user-friendly program

3.3. Real-Time image processing

The real-time images were gotten from a phone camera connected to the user-friendly program on the computer through the IP address of the phone. The videos are displayed on the interface of the program as a set of running frames with various operations like face detection (see figure 5) and edge detection performed on the frames of the videos with high accuracy

Figure 5. Screenshot of the face detected with the user-friendly program

4. Discussion

After conceptualization and design, the graphic user interfaces of each component program were the output/result of the program development. Each of these programs combined MATLAB app development components and data was passed efficiently through these development objects.

Real-time image processing operations like edge detection, face recognition were carried on real-time images gotten from cameras connected to the MATLAB GUI via IP address.

The final result of the development was a standalone application compiled through the MATLAB deploy tool, which can be used on any computer even if it does not have MATLAB installed on it.

5. Conclusion

This research paper outlines the use of MATLAB software to develop a program that displays image properties in real-time. It has been defined that the value and quality of information obtained through image processing is a function of the methods and software that are used, and is the fundamental benchmark of precision and accuracy on which any project is based on. Hence, an attempt was made to develop a program that can handle image processing in real-time.

This paper also includes the methodological adoption of the use of MATLAB program to design a graphical user interface, which is user-friendly and flexible.

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