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Design of Graphical User Interface for Image Enhancement

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***Abstract*—** Image processing operations can be roughly divided into three major categories, Image Compression, Image Enhancement and Restoration, and Measurement Extraction. Image compression is familiar to most people. It involves reducing the amount of memory needed to store a digital image. Image defects which could be caused by the digitization process or by faults in the imaging set-up (for example, bad lighting) can be corrected using Image Enhancement techniques. Once the image is in good condition, the Measurement Extraction operations can be used to obtain useful information from the image. Image Enhancement is of utmost importance in the field of Digital Image Processing (DIP). The use of Image Enhancement techniques has allowed a high mode of endurance in the field of digital photography and image acquisition and image analysis. The MATLAB has evolved as a major Digital Image Processing Tool over the years. The use of MATLAB as a Digital Image Processing Tool has made the development of many applications which incorporate different Image Enhancement function. This paper discusses the development of a MATLAB application Graphical User Interface (GUI) with many such basic Image Enhancement Functions.

***Keywords*—**Image, digital image processing, image enhancement, MATLAB, GUI.

I. Introduction

The image is digitized to convert it to a form which can be stored in a computer's memory or on some form of storage media such as a hard disk or CD-ROM. This digitization procedure can be done by a scanner, or by a video camera connected to a frame grabber board in a computer. Once the image has been digitized, it can be operated upon by various image processing operations.

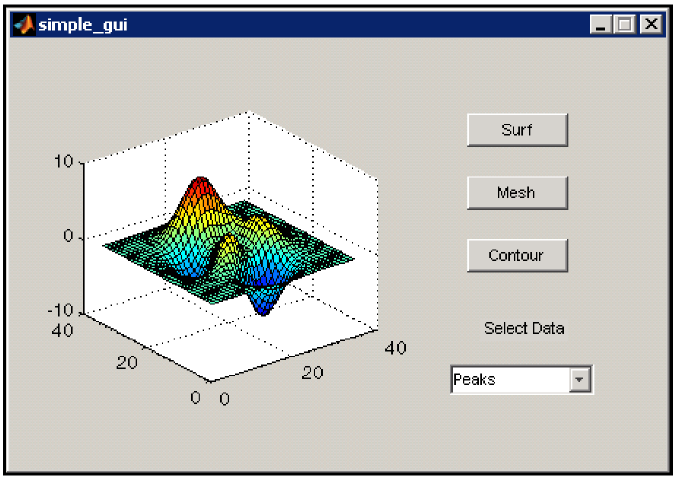

Fig. 1.A Simple MATLAB GUI

There are many examples of Image Enhancement and Measurement Extraction. The examples mainly all, operate on 256 grey-scale images. This means that each pixel in the image is stored as a number between 0 and 255, where 0 represents a black pixel and 255 represents a white pixel and values in-between represent shades of grey. These operations can be extended to operate on color images. A graphical user interface (GUI) is a graphical display in one or more windows containing controls, called components that enable a user to perform interactive tasks. The user of the GUI does not have to create a script or type commands at the command line to accomplish the tasks. Unlike coding pro-grams to accomplish tasks, the user of a GUI need not under-stand the details of how the tasks are performed. GUI components can include menus, toolbars, push buttons, radio buttons, list boxes, and sliders—just to name a few. GUIs created using MATLAB® tools can also perform any type of computation, read and write data files, communicate with other GUIs, and display data as tables or as plots. The Fig. 1 below illustrates a simple GUI.

II. Literature Review

This section presents the review of techniques implemented for image enhancement. The application of histograms in imaging dates to the modern era. The latest works include Mila Nikolova France „A fast algorithm for exact histogram specification. Simple extension to color images"[1] have shown to use histogram technique to enable exact histogram specification outperforming the state-of-the-art methods in terms of faithful total strict ordering. They need to be computed with a high numerical precision. However the relevant functional are difficult to minimize using standard tools because their gradient is nearly flat over vast regions. The method is extended to color images where the luminance channel is exactly fitted to a prescribed histogram to modified color values which preserves the hue and do not yield gamut problem. The importance of gray scale imaging is of great relevance in recent image processing applications in many different fields. In "10 AND 12-BIT GRAYSCALE technology" [2] nVIDIA discusses the advances in Gray Scale Imaging with advances in sensor technology and image

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acquisition techniques in the field of radiology are producing high bit depth grayscale im-ages in the range of 12 to 16-bit per pixel. At the same time, the adoption of displays with native support for 10 and 12-bit grayscale is growing. These affordable displays are DICOM conformant to preserve image quality and consistency. The paper discusses “Pixel Packing” where the 10-bit or 12-bit grayscale data is transmitted from the Quadro graphics board to a high grayscale density display using a standard DVI cable. Instead of the standard three 8-bit color components per pixel, the pixel packing allows two 10 or 12-bit pixels to be transmitted, providing higher spatial resolution and grayscale pixel depth as compared to an 8-bit system. In recent driers, this pixel packing is done by driver transparent to the application when 10-bit per component pixel formats are used. This greatly simplifies programming in addition to making the application portable across multiple vendor hardware. Also, Using 10-bit pixel formats over a VESA® DisplayPort™ output connection. No pixel packing is required as Display Port has sufficient bandwidth to transfer 5 MPixels with full 10-bit RGB color channels. Median Filtering has been one of the most prominent image filtering techniques from many years and it has found its uses in many different fields of image processing and analysis. The most recent works on median filtering in images include “A Survey on Various Median Filtering Techniques for Removal of Impulse Noise from Digital Images” by Ms. Rohini R. Varade, Prof. M. R. Dhotre, Ms. Archana B. Pahurkar Department of Electronics and Telecommunication, Government College of Engineering, Jalgaon (Maharashtra), India, February. The work summarizes the existence of impulse noise is one of the most frequent problems in many digital image processing applications. So for the removal of such impulse noise median based filter becomes widely used. However, there are many variations of median filter in literature. In addition to standard median filter, there are weighted median filter, recursive median filter, iterative median filter, direction-al median filter, adaptive median filter and switching median filter.

Applying image masks for image sharpening are one of the most important processes involved in image processing. Image masks play a very important role in the modern image processing technique of HDR (High Dynamic Range) Imaging. In “High Dynamic Range (HDR) Imaging, A New Era of Digital Imaging” by Qual-Comm Research Technologie [4] state that Digital imaging is entering a new era where the quality of the camera on the mobile phones is now one of the biggest differentiating factors for today’s mobile phones. In the past, larger resolution of camera sensors implied better cameras. However many smartphone cameras today offer high resolutions including over 10 megapixels. Dynamic Range measures the brightness variation of a scene and in the real world spans ten orders of values ranging from candle-lit rooms to sun-lit ski resorts. Dynamic range is by far the most significant capability where human eyes are far superior to cameras. When a scene in front of us has very high dynamic range i.e., has very bright areas (e.g., direct sunlight) along with very dark areas (e.g., shadow), our eyes adapt quickly to such a scene. However, when we try to capture it with our conventional camera, we end up either capturing the bright areas well or the dark areas well. The dynamic range of the cameras can be significantly increased by feature known as High Dynamic Range (HDR) imaging capability. HDR imaging solves this problem of simultaneously capturing the details of both bright and dark shadows in a single photograph. This enables the consumers to appreciate the fine differences in the scene both in the dark and the bright areas, similar to human eyes. High dynamic range (HDR) imaging feature captures multiple images with exposure bracketing and fuses them to form a single image of higher dynamic range. HDR imaging is achieved by shooting multiple images at bracketed exposures. In the under-exposed image captures, bright areas of the scene are captured well. In over-exposed captures, dark areas of the scene are captured well. These images are then combined to create an image with significantly enhanced dynamic range that captures both bright and dark areas of the scene well. HDR imaging in the recent past has quickly become one of the most desirable features on the camera phones and brings conventional cameras one step closer to human eyes. The generation of an appropriate motion mask is one of the most important steps in creating a image with ghostly free artifacts. Qualcomm’s algorithms precisely capture the motion mask by carefully identifying regions in motion based on variation in pixel irradiance levels across the image stack. This motion mask generation algorithm is designed to perform efficiently across various scenarios. It is Important to note that the motion mask is generated while keeping in view variations in exposure time, saturation levels of the pixels of the images in the stack to produce a single ghost-free HDR image. The Image Sharpening, Contrasting, altering ?Image Brightness, Inverting Colors and manipulating RGB Components of the image are among some important and basic Image Processing Modalities without which the HDR Imaging cannot be accomplished.

III. Objectives

The GUI has been designed in MATLAB and the following functionalities are provided via the GUI buttons.

Load File: Use this button to load an image file. In the developed GUI only JPEG, GIF, TIFF and BMP image formats are supported.

Save File: Use this button to save the current secondary image.

Copy: This button copies the original image in the secondary one.

Graysacle: This button generates the grayscale version of the original (loaded) image.

Median: This button applies a median filtering in the original image. Towards this end, the Matlab build-in function medfilt2 is called. Also, the user is asked to provide the filter mask size, not in pixels, but in percentage of the original image's dimensions (e.g. 2 of the width by 3 of the height).

Motion: This functionality applies a filter that approximates the linear motion of the camera. For generating the appropriate filter mask, the function fspecial is called, with the "motion\ property value. This time, the user has to provide the motion direction (in degrees, [0::360]), along with the motion length (not in pixels, but in percentage of the image's larger dimension). For applying the generated mask, the imfilter function is used.

Sharp: This button executes a sharpening of the original image. In order to generate the sharpening mask, the fspecial function has been used. Furthermore, the imfilter function is used for applying the adopted image filter.

Filter Colors: This functionality creates a gray-scaled version of the original image with colored areas. When the respective button is pressed, the user is asked to provide 3 thresholds (in the range [0::255]) for each one of the R, G and B coefficients. The larger the thresholds are, the "looser" the color thresholding becomes (i.e., in general, larger thresholds lead to more colored areas in the image). Then, the user is prompt with a copy of the original image and is asked to select 5 points on the image using the mouse. Then, the average color of these colors is computed and a simple thresholding step (using the thresholds provided in the beginning of the procedure) is applied on the image.

Color Emphasis: This functionality lets the user emphasize particular coefficients of the RGB space.

Invert Colors: This button is used for inverting the colors of the image.

Change Contrast and Brightness: Use this button after having set the contrast and brightness factors (using the provided sliders).

IV. METHODOLOGY

The GUI developed is the accessed by MATLAB file imageProc.m for figure imageProc.fig which handles all the major operations in the application along with two associated Matlab files filter Colors.m and change Brightness.m.

Phase 1: MATLAB Implementation

The different processes fulfill the objectives using MATLAB and combining them under the one application. The image processing techniques are implemented using image processing functions in MATLAB Image Processing Toolbox. Image Processing Toolbox™ provides a comprehensive set of reference-standard algorithms and graphical tools for image processing, analysis, visualization, and algorithm development. You can perform image enhancement, image de-blurring, feature detection, noise reduction, image segmentation, geometric transformations, and image registration. Many toolbox functions are multithreaded to take advantage of multi-core and multiprocessor computers. Image Processing Toolbox supports a diverse set of image types, including high dynamic range, giga pixel resolution, embedded ICC profile, and homographic. Graphical tools let you explore an image, examine a region of pixels, ad-just the contrast, create contours or histograms, and manipulate regions of interest (ROIs). With toolbox algorithms you can restore degraded images, detect and measure features, analyze shapes and textures, and adjust color balance.

Phase 2: MATLAB Implementation

The next line of work will include the creation of the final GUI for the designed application using the Matlab Guide. Along with the testing the different processes in the finally designed UI system A graphical user interface (GUI) is a graphical display in one or more windows containing controls, called *components*, that enable a user to perform interactive tasks. The user of the GUI does not have to create a script or type commands at the command line to accomplish the tasks. GUI components can include menus, toolbars, push buttons, radio buttons, list boxes, and sliders—just to name a few. GUIs created using MATLAB® tools can also perform any type of computation, read and write data files, communicate with other GUIs, and display data as tables or as plots.

V. RESULTS

The results obtained are discussed in this section along with the implementation of a new Graphical User Interface in MATLAB.

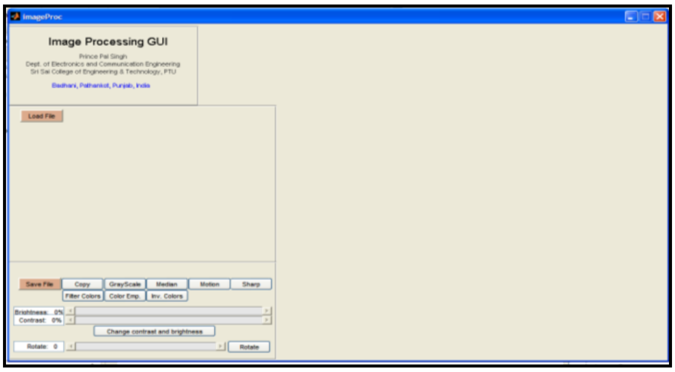

Fig. 2. MATLAB GUI for Image Enhancement with all functional buttons

A. *Output 1: the user-interface designed in MATLAB*

The designed user interface for Iris Enhancement in Matlab is shown in Fig.2.

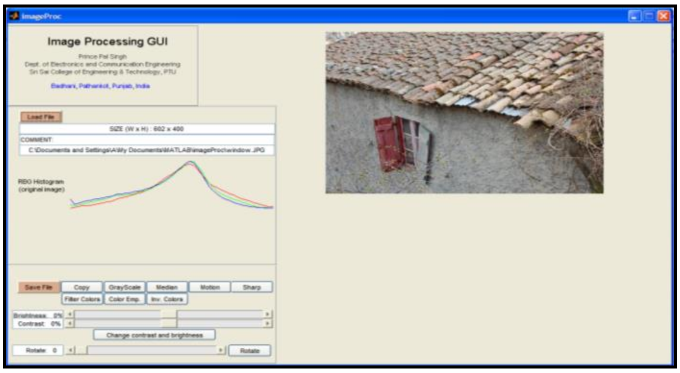

Fig. 3. The input image to be processed with RGB Histogram.

B. *Output 2: Original Input Image*

The original input image is shown in Fig.3. The image is selected by clicking in the "**Load File**" button on the GUI and the output is shown as under.

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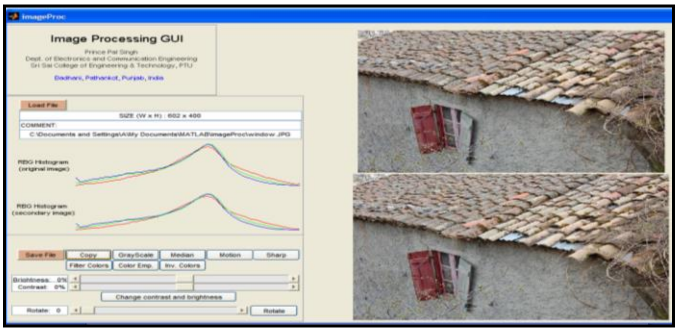

Fig. 4. The input image copied along with RGB Histogram.

C. *Output 3: Copy Image*

The original image is copied to secondary image using Copy button on GUI (Fig. 4).

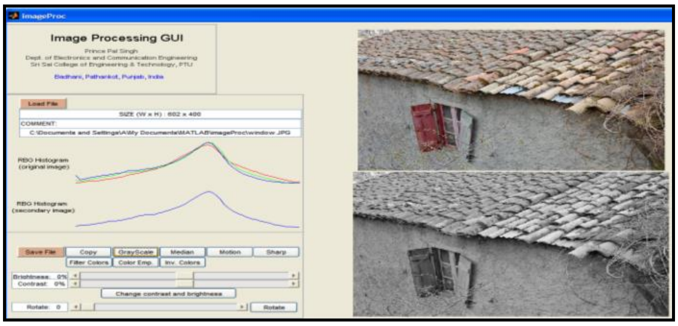

Fig. 5. Grayscale Image with RGB Histogram.

D. *Output 4: GrayScale Operation*

The function produces a secondary grayscale image from input primary image by pressing Grayscale button on GUI (Fig, 5).

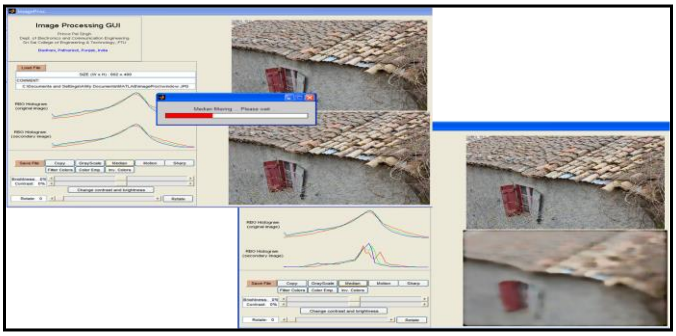

Fig. 6. Median Filter Output

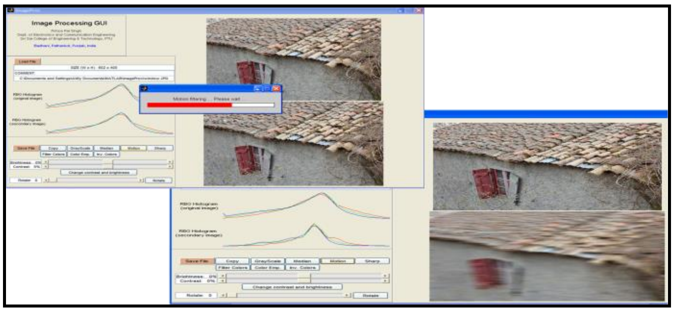

Fig. 7. Motion Filter Output

E. *Output 5: Median Filtering & Motion Filtering*

The outputs of median and motion filtering are shown in Fig. 6 & Fig. 7 respectively. The operation is done by pressing Median Button and Motion Button on GUI.

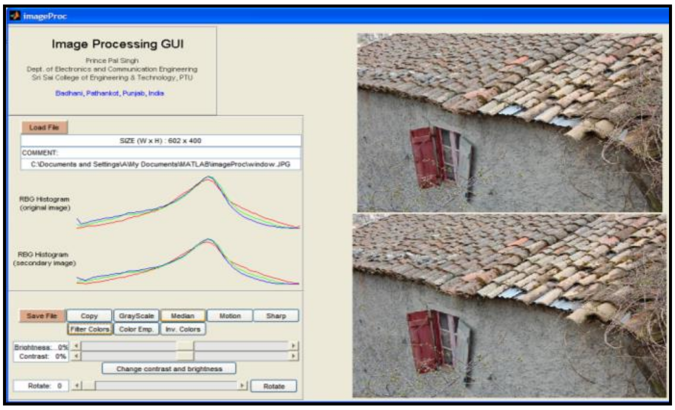

Fig. 8. Sharpened Image Output

F. *Output 6: Image Sharpening*

The sharpened image output is shown in Fig. 8. The operation is done by pressing Sharp Button on GUI.

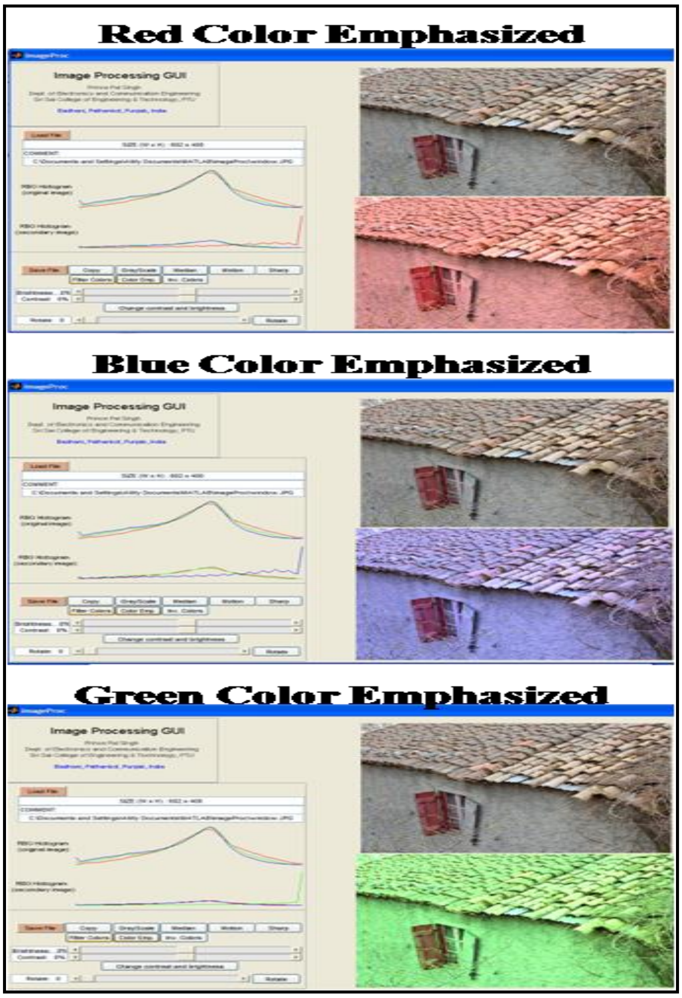

Fig. 9. RGB Color Emphasized Image Outputs

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G. Output 7: Color Emphasis

The operation executes on pressing Color Emp. Button and emphasizes RGB colors in input image (Fig. 9).

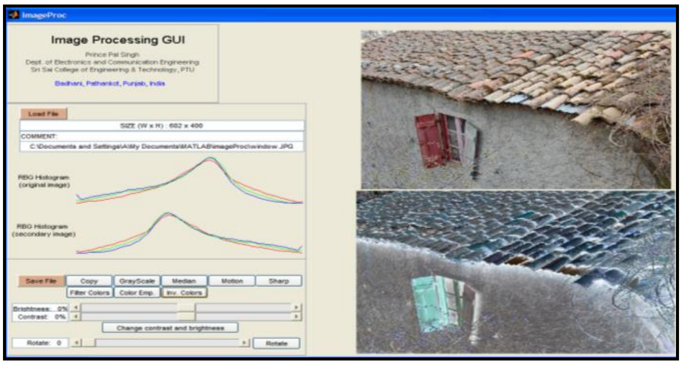

Fig. 10. Color Inversion Output

H. Output 8: Color Inversion

The GUI executes the operation on pressing Inv. Colors Button. The output image is shown in Fig. 10.

I. Output 8: Contrast, Brightness and Rotation

The GUI incorporates slider controls to set the contrast, brightness and rotation angles of the image. The set values are applied to generate a new secondary image by pressing Change Contrast and Brightness Button and Rotate Button respectively on the GUI.

VI. Conclusion

The paper defines clear objectives for development of a good Image Enhancement GUI Application System and also provides a directional path and methodology for the same. The results of the implemented functions in the GUI are also shown. The implementation of such a GUI will be a step towards combining many different and basic image processing functions under one application which is an important requirement in the field of Digital Image Processing. The success and efficiency of such a proposed system can only be tested by real-time applications. The success of such an application will be a boon for both professional applications and academic studies of basic image enhancement functions in Digital Image Processing.

References

[1] Mila Nikolova, "A fast algorithm for exact histogram specification. Simple extension to color images," *in proc. of 4th International Conference on Scale Space and Variation Methods in Computer Vision*, Austria, pp. 174-185, June 2-6, 2013.

[2] *10 and 12-bit grayscale Technology*, nVIDIA, TB-04631-001_v04, April 2013.

[3] Rohini R. Varade, M. R. Dhotre, Archana B. Pahurkar, "A Survey on Various Median Filtering Techniques for Removal of Impulse Noise from Digital Images," *International Journal of Advanced Research in Computer Engineering & Technology*, vol. 2, no. 2, pp. 606-609, 2013.

[4] *High Dynamic Range (HDR) Imaging: A New Era of Digital Imaging*, QualComm Research Technologies, July 2013.

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