

Image Enhancement Techniques using Partial Image Enhancement by Re-sampling of Pixels

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I. ABSTRACT:

With the advent of modern Technologies in the field of Photography, Photographs are playing an eminent role in our lives. But as the time rolls, Photographs gets antiquated and vile. So there is a need to enhance the Photographs such that they render the desired characteristics. Sometimes there may be a case where there is a need to render manipulations to a specific portion of the Image without disturbing the remaining part of the image. This paper operates on this issue and presents a reliable solution so that modifications are rendered to a specific part of an image. This paper focuses on choosing the portion of the image where the manipulations are to be furnished, applying the Image Enhancement Techniques to that portion of the image and Re-sampling the pixel values of the original image with the pixel values of that enhanced image at the exact coordinates where the portion of the image has been chosen. The resultant Image will be an image similar to the original image other than the modifications made to the specific part of the image. Rather than as a Digital Image Editor, this paper would be well exploited when you want to render modifications to the specific part of an image, while the remaining portion of the image is unaltered.

Index Terms—Digital Image Editor, Image Enhancement Techniques, Image Filters, Pixel values, Photography, Re-sampling.

Digital Image Processor is the collection of the various Image Processing operations that are used to enhance images on the fly. The purpose of using Image Enhancement Techniques is to refine the visual quality of images such that the result is more desirable than the original image. There are many

Applications which manipulate the whole Image, but when there is a need to change only a specific part of the image, we cannot do that with the existing applications. So this paper addresses that problem and establishes the reliable solution.

This paper comprises three main functionalities.

- A. Image Crop Functionality
- B. Image Enhancement Techniques
- C. Re-sampling Images

A. Image Crop Functionality

Cropping is the powerful image editing tool that trims off the unwanted portion of the Images. Cropping Functionality creates a new image based on the rectangular selection of the original image using the crop box. Cropping Functionality does not alter the Resolution of the Image. The methodology involved in Cropping an Image is to eliminate distractions, improve the composition and to fit into the layout.

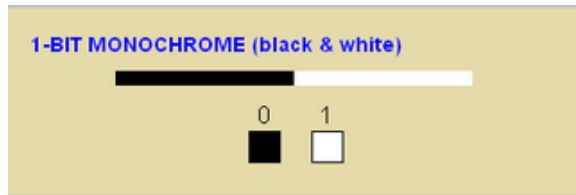
B. Image Enhancement Techniques

There are many Image Enhancement Techniques that can be implemented to enhance the characteristics of the image. This paper focuses on manipulating the attributes of an image by changing its pixel values.

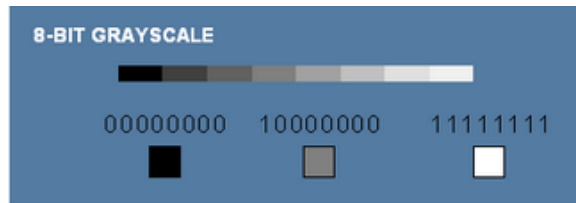
Each pixel is illustrated as a sequence of bits. The count of bits can be varied based on the number of colors that can be displayed using the image, which is usually known as the bit depth (b). 16M colors are required for the

photorealistic images and video.

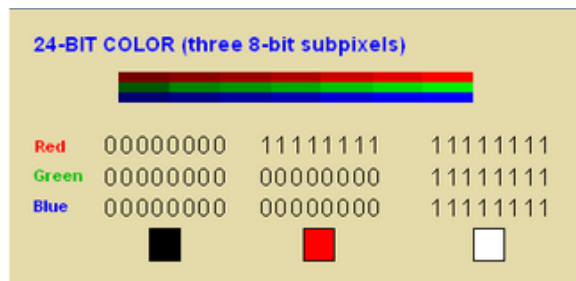
If the bit depth (b) = 1, the images displayed are Monochrome (Black and White).



If $b=8$, then the images are displayed as shades of grey.



We get the True Color Images when $b=24$. We can even alter the alpha channel of the Image when $b=32$ i.e., the True Color + alpha channel.



We can get different Colors by changing the RGB components of the Pixels in an Image.

With this Terminology, there are different Enhancement Techniques, i.e., by rendering changes to the RGB components of the Image, we get different images as the Output.

Various Image Enhancement Operations addressed in this paper include Brightness, Hue, Saturation, Edge-enhance, Emboss, Sepia, Colorize, Blur, Contrast, Negative and Vibrance.

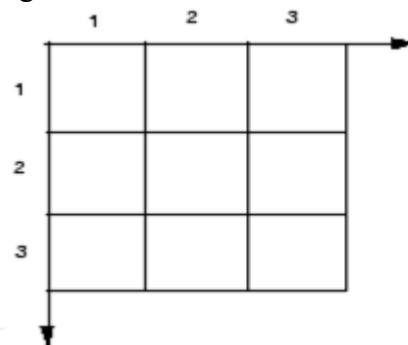
C. Re-sampling Images

A Digital image is a rectangular grid of pixels that

are spaced evenly. Each pixel is the sample of light from the subject. Re-sampling is the process in which, the pixel values of the source image are being copied onto the destination image at the specified coordinates.

Pixel Indices:

Pixel Indices are used to represent the location of the pixels in the Image. These pixel indices are discrete elements, ordered in both directions, from left to right and top to bottom, as illustrated by the following figure.



With respect to the User requirement, pixel values are copied from one image onto other. If the re-sampling of the cropped image is to be applied to the original image, then the pixel values of Cropped Image are being re-sampled at the exact pixel indices from where the image has been cropped.

II. ANALYSIS

There are many applications through which we can crop the image and enhance the properties of the images. In existing applications, manipulations can be rendered to the cropped images and these manipulations cannot be reciprocated into the original image from which it is cropped. Using existing applications, once the image is cropped, that is final and it is no way concerned with the original image. However, we can implement all the image enhancement operations to the cropped image.

This paper proposes a reliable Architecture where we can crop the image and apply the image enhancement operations to the image. This system also supports the feature of re-sampling, which

means that the pixel values of an image can be copied onto another image based on the re-sample coordinates. Re-sample coordinates specify the where to initiate and terminate the copy of pixel values from the source image and to merge onto the destination image.

Existing System

There are many applications through which we can crop the image and enhance the properties of the images. In the existing applications, manipulations can be rendered to the cropped images and these manipulations cannot be reciprocated into the original image from which it is cropped.

This states that once the image is cropped, that is final and it is no way concerned with the original image. However we can implement all the image enhancement operations to the cropped image.

Disadvantages

Existing approaches cannot Re-sample the Cropped images onto the original image, i.e., whatever modifications are done to the Cropped Image, those manipulations would pertain to that image itself and does not reflect in the Original Image from which it is being cropped.

Proposed System

This project proposes a reliable Architecture where we can crop the image and apply the image enhancement operations to the image. This system also supports the feature of resampling, which means that the pixel values of an image can be copied onto another image based on the resample coordinates.

Resample coordinates specify the where to initiate and terminate the copy of pixel values from source image and to merge onto destination image. This

states that the enhanced image can be copied onto the Original image.

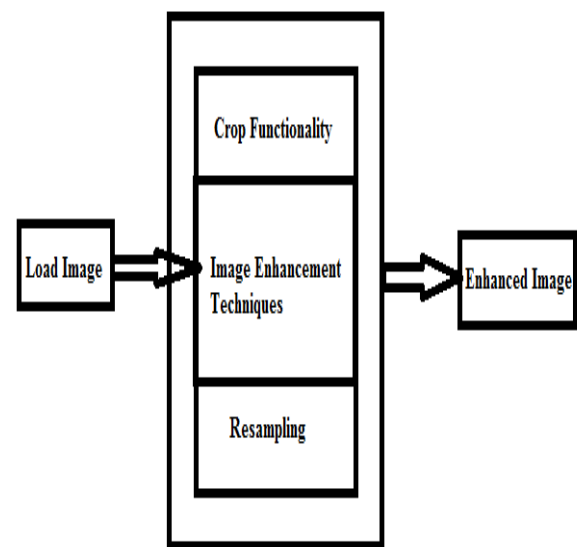
Advantages

- Enhanced part of the image can be Re-sampled onto the Original Image.
- Improving the efficiency of Image Enhancement Techniques.

III. ARCHITECTURE

Architecture of Digital Image Processor for Partial Image Enhancement by Re-sampling constitutes Digital Image Processor as the main block constituting the whole functionality.

Digital Image Processor constitutes three main functionalities: Cropping Functionality, Applying Image Enhancement Techniques, Re-sampling the Images.



Digital Image Processor

Fig.1. Architecture of Digital Image Processor for partial Image Enhancement by Re-sampling

When the user selects an image, it is loaded into Digital Image Processor. The Image Processor previews the crop region of the image. When the user selects the crop region, the image is saved. Required Enhancement techniques are applied to the cropped Image. The cropped image with

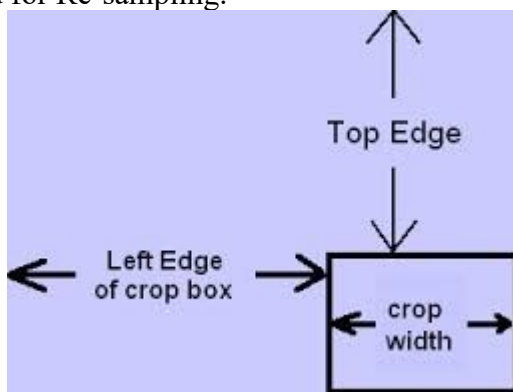
necessary manipulations is saved and then re-sampled onto the original image.

IV. METHODOLOGY

A. Cropping Functionality:

This Crop function creates an interface to crop an image. Crop Function generates the cropped image along with the pixel indices from where it is cropped. These pixel indices are with respect to the Original Image, so that these indices can be

Used for Re-sampling.



A typical workflow for cropping functionality looks like this:

- 1) Upload an image to the cropping function.
- 2) Display the cropping interface i.e., Crop region with the rectangular Crop grid which can be enlarged based on the portion of the image selected. (As shown in fig)
- 3) Capture the pixel indices of the selected crop grid.
- 4) On capturing, Crop function performs image cropping and generates the resultant (Cropped) Image.

B. Image Enhancement Techniques

This paper addresses the following image operations that can be rendered by manipulating the RGB Components of the pixels of an image.

- 1) Blur: By altering the pixel values with the average value of all the neighboring pixels, blurring an image is furnished.
- 2) Brightness: Brightness can be manipulated by increasing the RGB Components of the pixels with

the same percentage and inspect that the RGB values range between 0-255.

3) Colorize: Select a color and shift the pixels towards that color. The range should be between 0 and 100. The higher the range, the closer the colors will shift towards the selected color.

4) Edge-Enhance: For each pixel, the pixel values are replaced by subtracting itself from the neighboring pixels.

5) Emboss: Embossing an image can be achieved by taking a pixel on one side of the center, and subtracting one of the other side from the center of the image.

6) Hue: Modifies the RGB values to the HSL(Hue, Saturation, Lightness) values temporarily, Adds the degree of hue to the values and then convert back to RGB.

7) Negate: Inverses the values of the RGB components of the Image.

8) Noise: For each pixel, Noise is removed by calculating the median of the current pixel value and its neighboring pixel values.

9) Saturation: The pixel values are altered to S_{min} , if their value is lower than S_{min} , to S_{max} if their value is higher than S_{max} . Whereas S_{min} and S_{max} are the Saturation extremities.

10) Sepia: By multiplying a constant value with the RGB components of the pixel, the Sepia effect is rendered.

11) Vibrance: Vibrance changes all the lower-saturated colors with less effect on higher-saturated colors.

C. Re-sampling Images

Re-sampling is the process that is used mathematically to create a different version of the image.

This Re-sample functionality is responsible for copying the selected rectangular portion of one image onto another image.

Copies the enhanced part of an image to the original image at the original position or at the user specified coordinates.

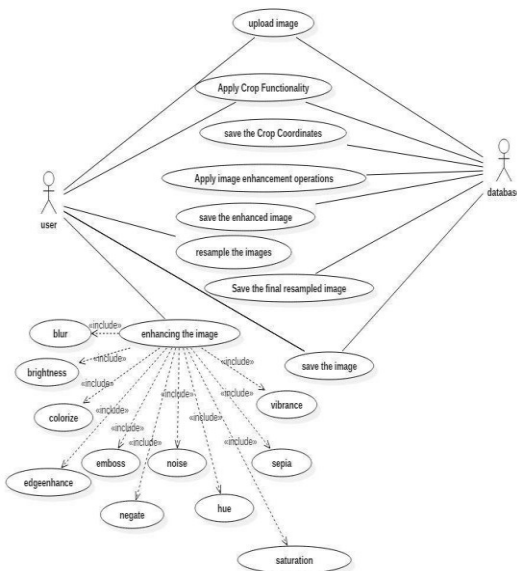
Consider an example, as shown in the fig. below, the source image has to be merged onto the

destination image. This can be done using the Re-sampling Function.

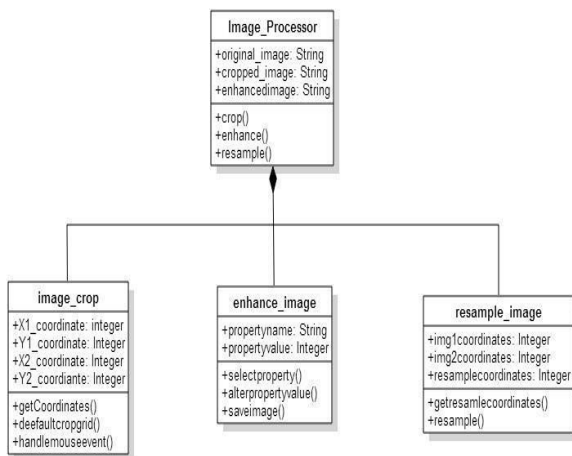
After Re-sampling the Source image at the desired coordinates of the Destination image, the output (rendered manipulations to pixel values) is saved.

Re-sampling Function creates a new Image without altering the resolution of the image except that the pixel values of the source image are being copied onto the destination image.

Use Case diagram:



Class diagram:



Digital image processor for partial Enhancement of images by Re-sampling is implemented through

three functions: Crop Function, Filter Function and Re-sample Function.

A. Crop Function

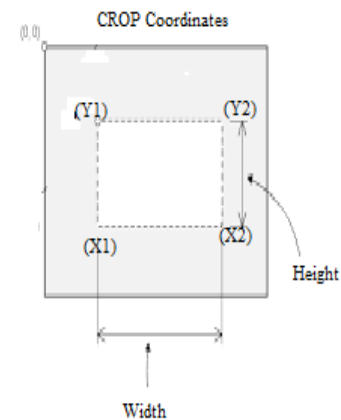
This function takes the image as input, according to the crop area selected by the user, the coordinates are stored in the database, and generates the cropped image.

CROP ALGORITHM:

Crop algorithm has three parameters, Source Image, Coordinates of Cropping, Destination Image (Cropped Image)

//Algorithm Image Crop (src, coordinates, dest)

- 1) Import Image
- 2) Load Image onto crop region with the default rectangular crop box.
- 3) Capture the crop box coordinates of user selection.
- 4) Store the coordinates of the crop box. (In case of Re-sampling, these coordinates are applied as the pixel indices)



5) Save the Image by capturing the crop box coordinates and its pixel values.

6) Save the Output of the Crop function. The Size of the cropped image is equal to the crop box size.

$Img.width = cropbox.width$

$Img.Height = cropbox.height$

This algorithm displays the portion of the image selected by the user using the cropbox.

B. Image Enhancement Operations

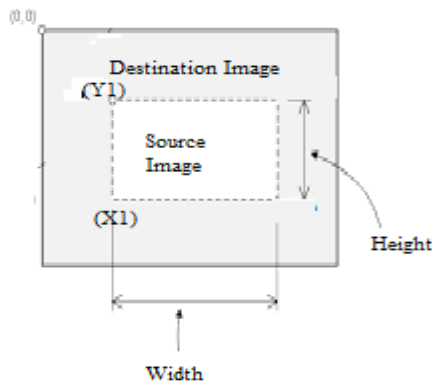
This Function takes the input image to be enhanced, applies the selected operation and generates the enhanced image.

The input to this function can be the cropped image or it can be an original image. From the list of operations specified in section IV B, any number of operations can be applied to the selected image.

After choosing the operation, the image after implementing the enhancement operation is to be saved.

C. Re-sample Function

Re-sampling is the process in which, the pixel values of the source image are being copied onto the destination image at the specified coordinates. Re-sample function is used to re-sample the images.



Re-sample function copies the selected part of the source image to the destination image starting at the 'x', 'y' re-sample coordinates of the destination image with a width 'w' and height 'h' of the source image. The portion interpreted will be copied onto the 'x1', 'y1', the coordinates of the destination image.

When you want to re-sample the whole source image to the destination image then the starting coordinates are 'x'=0, 'y'=0.

If you want to re-sample the Cropped Image to the original image at the exact position from where it is cropped, then X1, Y1 becomes the Coordinates from where the image has been cropped.

This implies that the manipulations are done to the specific part of the image while the remaining portion of the image is unaltered.

VI. EXPERIMENTAL RESULTS

Consider an image, where the image has been distorted at one end, then a part of the image from

the other end can be copied and can be pasted at the position where the image has been distorted.

Consider the Image, shown in the following figure (Source: Internet), the image has been damaged at the top left end. The damaged part has been indicated with the red sketch. The similar part from the Image has been cropped from that Image. This Cropped part is re-sampled onto the Original Image.

The Original Image is sent to Image_Cropfunction; it crops the similar part of the image, as shown in fig 2.b. This cropped part is re-sampled at the top left end of the Original Image. This creates the final image as shown in the fig 2(c) which is the enhanced image.

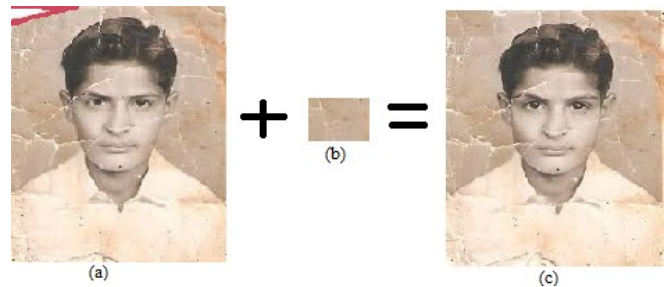


Fig.2. Re-sampling Functionality
(A): Original Image (b): Cropped Part of the Original Image (c): After re-sampling the cropped part to the Original Image.

Various image enhancement techniques can be applied to the image as shown in the figure below.

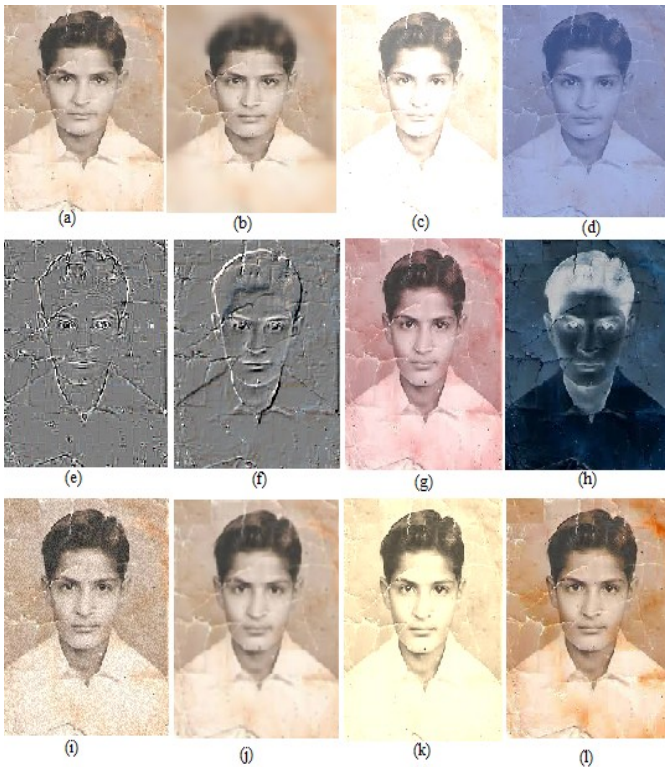


Fig.3. Image Enhancement Techniques

(a): Re-sampled Image (b) Blur effect (c) Brightness effect (d) Colorize effect (e) Edge-enhance effect (f) Emboss effect (g) hue effect (h) Negate effect (i) Noise effect (j) Saturation effect (k) Sepia effect (l) Vibrance effect

The Image Enhancement operations can be applied any number of times and in any order. If the operations are performed on the image without resetting, then the enhancement operation will be rendered over the effect of the previously applied enhancement operation.

For instance, consider the re-sampled image as shown in the fig.3.a. To this image, contrast, colorize, and the saturation image enhancement operations are applied. Then the image would be rendered with the applied image enhancement operations as shown in the following figure.

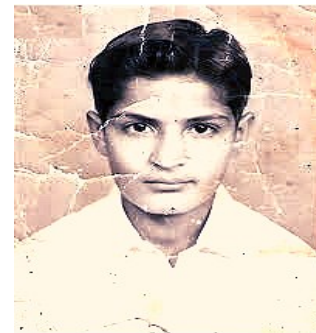


Fig.4. Applying multiple Enhancement Operations On the image.

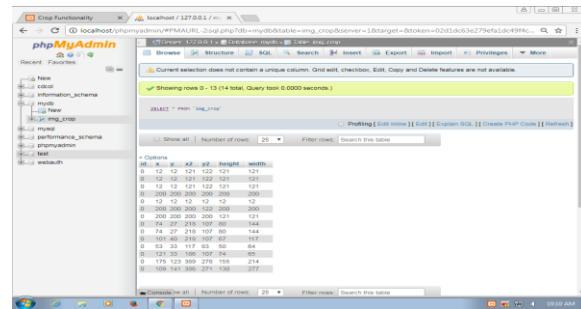
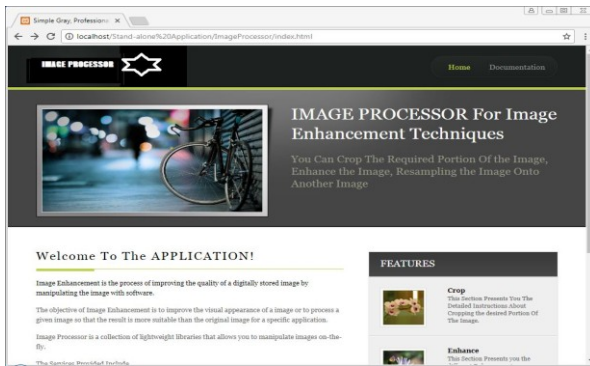
Similarly, Partial Image Enhancement by Re-sampling can also be implemented when you want to render modifications to the specific part of an Image.

This could be done by enhancing the Cropped Image using the Image Enhancement Operations and re-sampling this enhanced cropped image onto the original image at the exact coordinates from where it is cropped. Therefore, modifications are rendered only to the specific part of the image leaving the rest of image unaltered.

VII. CONCLUSION

DIGITAL IMAGE PROCESSOR FOR PARTIAL ENHANCEMENT OF IMAGES BY RE-SAMPLING USING IMAGE ENHANCEMENT TECHNIQUES is the efficient and reliable software for manipulating images on the fly. This Project focuses on rendering manipulations to the specific part of an image. This Application is well exploited when there is a requirement to render modifications to a specific part of an image without disturbing the other parts of the image.

This paper can be further enhanced by adding some more enhancement techniques like adding text to the images, rotating, adding frames, painting something on the images just like the perfect Image Editor.



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