
Image Processing of Two Identical and Similar Photos

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Abstract

This paper aims to find the differences between two perfect identical and similar photos using image processing principles, the method depends on constructing the histogram of the two images and using what is called image registration, and also using Matlab image processing system with suitable code the system can easily discover the main difference points between the two images. This technique helps in medical applications: in surgery and bones x-ray images.

Keywords: image-processing, photos, Matlab, histogram, medical applications.

1. Introduction

In many image applications we need to compare between two images specially in medical applications, before surgery operations and after, between two similar persons or between any two photos. The main objective of this paper is to construct a Matlab code which can be used to compare between two identical images. Image registration is a process of comparing two or more images of the same scene taken at different times, from different sides with different sensors. The principle of work: is by making geometrically aligns the two processed images—the reference and sensed images. The present differences between images are introduced due to different imaging conditions. Image registration can be considered as a crucial step in all image analysis tasks in which the final information is gained from the combination of various data sources like in image fusion, change detection, and multichannel image restoration. Image registration is required in remote sensing, medical applications, and forecasting, in medical applications it depends on combining computer tomography (CT) and NMR data to obtain more complete information about the patient, monitoring tumor growth, treatment verification, comparison of the patient's data with anatomical atlases, in cartography (map updating), and in computer vision (target localization, automatic quality control), to name a few. Little related works were interested in such issue, Chenyang X., 1998, used Snakes, or active contours, extensively in computer vision and image processing applications, particularly he used this principle to locate object boundaries. Problems associated with initialization and poor convergence to boundary concavities, however, have limited their utility. The author presented a new external force for active contours, largely solving both problems. This external force, which we call gradient vector flow (GVF), is computed as a diffusion of the gradient vectors of a gray-level or binary edge map derived from the image. Barbara Z. 2003, presented a review of recent as well as classic image registration methods. Image registration is the process of overlaying images (two or more) of the same scene taken at different times, from different viewpoints, and/or by different sensors. The registration geometrically align two images (the reference and sensed images). The reviewed approaches are classified according to their nature (area based and feature-based) and according to four basic steps of image registration procedure: feature detection, feature matching, mapping function design, and image transformation and resampling. Problematic issues of image registration and outlook for the future research are discussed too. The major goal of the paper is to provide a comprehensive reference source for the researchers involved in image registration, regardless of particular application areas.

2. Methods and materials

Image Processing is a technique to enhance raw images received from cameras/sensors placed on satellites, space probes and aircrafts or pictures taken in normal day-to-day life for various applications. Various techniques have been developed in Image Processing during the last four to five decades. Most of the techniques are developed for enhancing images obtained from unmanned spacecrafts, space probes and military reconnaissance flights. Image Processing systems are becoming popular due to easy availability of powerful personnel computers, large size

memory devices graphics software.. etc. Image Processing is used in various applications such as, Remote Sensing, Medical Imaging ,Non-destructive Evaluation ,Forensic Studies ,Textiles ,Material Science, Military ,Film industry .Document processing ,Graphic arts , Printing Industry

The common steps in image processing are image scanning, storing, enhancing and interpretation. There are two methods available in Image Processing

3. Analog Image Processing

Analog Image Processing refers to the alteration of image through electrical means . The most common example is the television image the television signal is a voltage level which varies in amplitude to represent brightness through the image. By electrically varying the Signal, the displayed image appearance is altered. The brightness and contrast controls on a TV set serve to adjust the amplitude and Reference of the video signal, resulting in the brightening, darkening and alteration of the brightness range of the displayed image.

4. Digital Image Processing

In this case, digital computers are used to process the image. The image will be converted to digital form using a scanner digitizer and then process it. It is defined as the subjecting numerical representations of objects to a series of operations in order to obtain a desired result. It starts with one image and produces a modified version of the same. It is therefore a process that takes an image into another.

The term digital image processing generally refers to processing of a two-dimensional picture by a digital computer. In a broader context, it implies digital processing of any two-dimensional data. A digital image is an array of real numbers represented by a finite number of bits. The principle advantage of Digital Image Processing methods is its versatility, repeatability and the preservation of original data precision. There various Image Processing techniques: Image representation, Image preprocessing ,Image enhancement, Image restoration, Image analysis ,Image reconstruction , Image data compression

5. Results and discussion: Mathematical model

The trial to find the similarity of 2 images by measuring the histogram error between them, the smaller, and the better similar using MARLAB. The method depends on finding the normalized histogram of both two images and calculate the sum of the squared differences between the normalized histogram. It plots the number of pixels for each tonal value. Image histograms are applied on many digital cameras

The histogram can be calculated by using the function

$$h(v) = \text{round} \left(\frac{cdf(v) - cdf_{min}}{(M \times N) - cdf_{min}} \times (L - 1) \right) \quad (1)$$

where cdf_{min}: is the minimum value of the cumulative distribution function (here is =1), $M \times N$: is the image's number of pixels where M is width and N the height, and L is the number of grey levels used which considered here is 516. If $M \times N$ is taken as 128 then equation (1) becomes:

$$h(v) = \text{round} \left(\frac{cdf(v) - 1}{127} \times 515 \right) \quad (2)$$

Any of two images are divided into rows and columns and then equation 2 is used to calculate the histogram values for each point on the images to get finally two different histogram values for the same point which represents the difference. For example, the cdf of 78 is 46. (The value of 78 is used in the bottom row of the 7th column.) The normalized value becomes by completing the calculations of histogram values a histogram matrix is resulted like that in the following matrix.

$$\begin{bmatrix} 0 & 12 & 53 & 93 & 146 & 53 & 73 & 166 \\ 65 & 32 & 12 & 215 & 235 & 202 & 130 & 158 \\ 57 & 32 & 117 & 239 & 251 & 227 & 93 & 166 \\ 65 & 20 & 154 & 243 & 255 & 231 & 146 & 130 \\ 97 & 53 & 117 & 227 & 247 & 210 & 117 & 146 \\ 190 & 85 & 36 & 146 & 178 & 117 & 20 & 170 \\ 202 & 154 & 73 & 32 & 12 & 53 & 85 & 194 \\ 206 & 190 & 130 & 117 & 85 & 174 & 182 & 219 \end{bmatrix} \quad (3)$$

The Matlab code can be used to calculate the histogram and then find the differences between two identical images:

```
% read two images
```

```
Im1 = imread('image1.bmp');
```

```
Im2 = imread('image2.bmp');
```

```
% convert images to type double (range from from 0 to 1 instead of from 0 to 255)
```

```
Im1 = im2double(Im1);
```

```
Im2 = im2double(Im2);
```

```
% Calculate the Normalized Histogram of Image 1 and Image 2
```

```
hn1 = imhist(Im1)./numel(Im1);
```

```
hn2 = imhist(Im2)./numel(Im2);
```

```
% Calculate the histogram error
```

```
f = sum((hn1 - hn2).^2);
```

```
f %display the result to console
```

The following two photos have just one difference. By applying the Matlab code and call up the two images the program gives the difference: which appears on the figure.



Figure (1) two identical images having only one difference.

Figure 2 shows the relation between histogram values and cdf of the points of images.

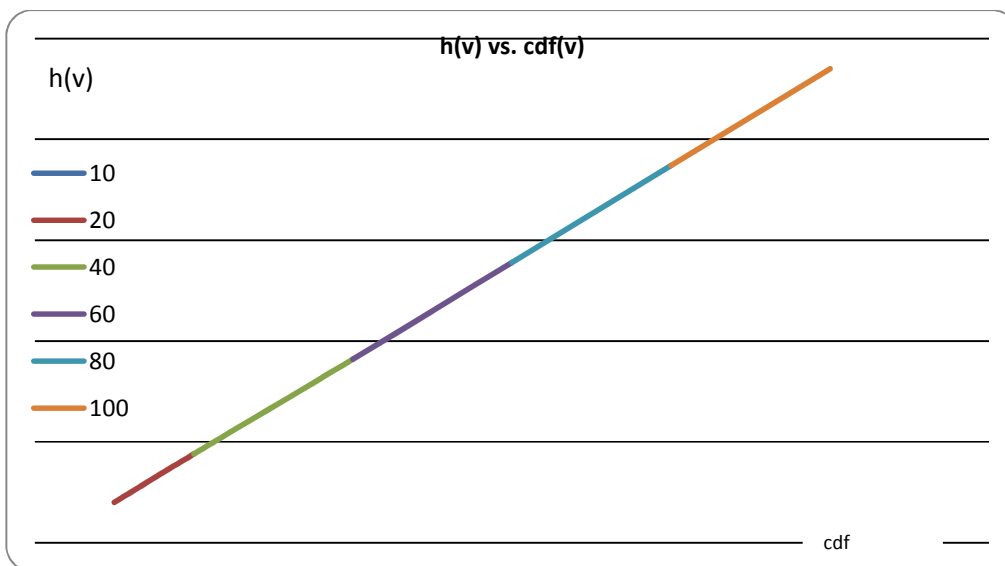


Fig.2 histogram values as a function with $cdf(v)$

Figure 3 shows the relation between histogram values and $M \times N$. This value ($M \times N$) represents the number of points can the image be divided or meshing point.

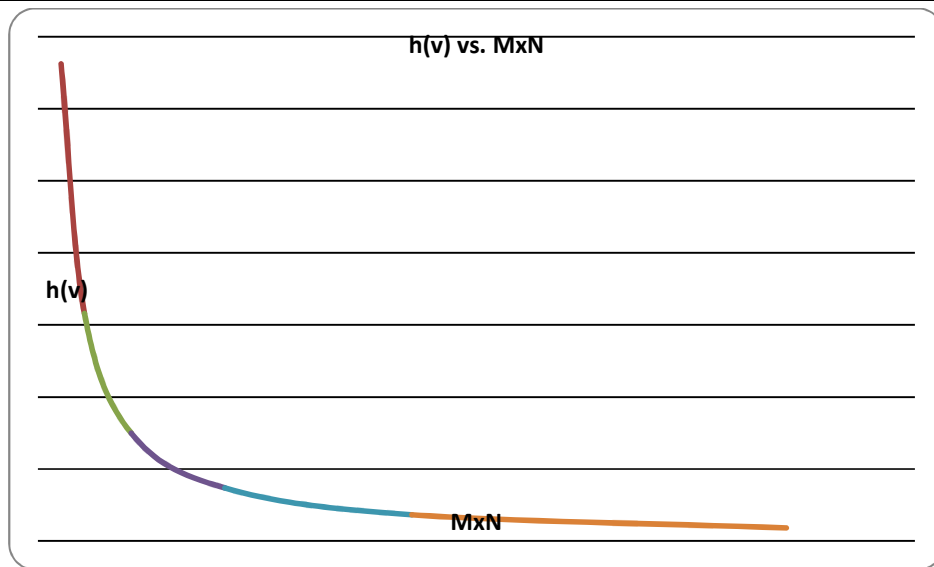


Fig. 3 histogram value vs. MxN.

6. Conclusion

Finding the differences between two similar or identical images can be noticed by eye, but sometimes those differences are embedded and takes a lot of time to be discovered, using some developed Matlab code may make such operation rapid and accurate. The program depends mainly on using histogram values to make the comparison and then specified the differences.

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