Content Based Image Retrieval Using Image Preprocessing Techniques

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ABSTRACT:

Image retrieval is very fatten epidemic on daily basis growing area of the computer vision applications. The digital images are constitute, the major role in retrieval of the image and multimedia dataset. The Content Based Image Retrieval (CBIR) is the one technique of image retrieval which used for feature like the color, shape and texture in order to search the image from the huge amount of the digital image processing dataset. The CBIR is rest on the features of images which are pictorial features are learn by the deep learning automatically. Image preprocessing is used to improve the quality of the image and remove the unsolicited distortions from the image or enhanced the significant feature in image. This paper is focused on performance of three preprocessing methods are compared namely contrast adjustment, intensity adjustment and histogram equalization.

Keywords: Image processing, Preprocessing, Image enhancement, Content based image retrieval.

I. INTRODUCTION:

In last two decades the entanglement of image retrieval [16], principally the images are uploaded at divergent accounts like WhatsApp, Twitter, Instagram and Facebook [7]. Images are searching from the divergent is the demanding and challenging research task. Primarily the search engines retrieve images on the basis of old traditional text based and query based approaches that depend on the caption and metadata. In last era, substantial research is reported for CBIR image classification and analysis [6]. CBIR is depends on the feature extraction of the image which are the visual features. To improve the quality of image and enhanced noteworthy feature of image and remove unwanted distortion from image using image preprocessing techniques [8].

The image processing is basely used to process the digital images form large amount of the database [11]. Processing the images means removing noise and unsolicited distortion from the images. Image preprocessing methods can improve the performance of image processing like image segmentation, transform, feature extraction and finally fault detection from the images [4] [9].
A preliminary processing of data from the image in sequence to prepare it for the processing or future analysis. This paper, basely used preprocessing techniques are Contrast adjustment, Intensity adjustment and Histogram equalization [2] [13].

II. NEED FOR PREPROCESSING:

Image acquisition is very imperative step for supervisory the input data for comprehensive process. The digital image acquisition is creation of the encoded representation of the visual characteristics of the object such as interior structure of the object. Acquisition of image is directly connected to the quality of local illumination variances of the images.

Due to the image preprocessing, quality and contrast of image pixel will improved and gives the better resolution superiority of image [10]. Good quality of image given decent results in image visualization process such as computer vision, image retrieval from large amount of database [14]. Compressing huge amount data using image compression using wavelet techniques [5].

III. PREPROCESSING METHODS FOR COLOR FEATURE IN CBIR:

Preprocessing is very significant factor of the image processing system [15], it gives the relevant quality of the image for future processing of the image data. CBIR is based on the feature of the image such as shape, color and texture of the image [3]. The following are preprocessing methods under study for color feature from image:

a) Contrast adjustment
b) Intensity adjustment
c) Histogram equalization

a) Contrast adjustment:

The contrast of an image is the circulation of its dark and light pixels. A low-contrast image shows little contrasts between its light and dark pixel esteems. The histogram of a low-
contrast image is narrow. Since the human eye is sensitive to contrast rather than absolute pixel intensities, a perceptually better image could be acquired by extending the histogram of an image with the goal that the full dynamic range of image is filled. Figure 2 (a) shows the original image and 2 (b) shows image after contrast adjustment.

![Original image](image1) ![Contrast adjustment image](image2)

**Figure 2**

### b) Intensity adjustment:

Image enhancement methods are utilized to improve an image, where "improve" is in sometimes characterized as objectively (e.g., increment the sign to-noise proportion), sometimes subjectively (e.g., make certain highlights simpler to see by changing the colors or intensities). Intensity adjustment is an image enhancement procedure that maps the image intensity value to new range. The low-contrast images with its histogram and all the qualities accumulate gather in the center of the intensity range. Figure 3 (a) shows the original image and 3 (b) shows image after intensity adjustment.

![Original image](image3) ![Intensity adjustment image](image4)

**Figure 3**

### c) Histogram equalization:

The histogram equalization uniformly distributes the occurrence of pixel intensities so that the entire range of intensities is considered. This technique typically expands the global contrast of images, especially when the usable data of the image is represented by close contrast values [1].

Through this adjustment, the intensities can be better distributed on the histogram. This allows for areas of lower local contrast to gain a higher contrast. Histogram equalization accomplishes this by effectively spreading out the most frequent intensity values. Then probability density function (pdf) is calculated for the histogram. Figure 4 (a) original image and 4 (b) shows image after histogram equalization.
IV. EXPERIMENTAL ASSESSMENT:

To test the exactness of preprocessing calculations, the complementary three stages are used.

- A color image is taken as input.
- Preprocessing algorithm is applied for color image.
- The MSE and PSNR esteem is determined for various algorithm.

The PSNR and MSE performances display the presentation of preprocessing algorithm [2]. To assess the nature of the reproduced images, following boundaries are used.

1. Peak Signal to Noise Ratio [PSNR]

   The PSNR matrix is defined by formula,
   \[ \text{PSNR} = 10 \cdot \log_{10} \left( \frac{\text{MAX}_I^2}{\text{MSE}} \right) \]  
   \[ \text{equation} \ (1) \]
   \[ \text{PSNR} = 20 \cdot \log_{10} \left( \frac{\text{MAX}_I^2}{\sqrt{\text{MSE}}} \right) \]  
   \[ \text{equation} \ (2) \]

   The PSNR is characterized in logarithmic scale, in dB. It is the proportion of pinnacle signal power to noise power. Since the MSE represents to the noise power and the pinnacle signal power, it is arise an occurrence of standardized image signal.

   The Max (i) values of PSNR with different preprocessing algorithm is analyzed in following figure 5.

![Figure 4(a) Original image](image1) ![Figure 4(b) Histogram equalization image](image2)

**Figure 4(b) Histogram equalization image**

**Figure 5. Analysis of different algorithm with PSNR value**
Preprocessing analysis of different PSNR values. In figure it is clearly, express that contrast adjustment is having the good PSNR value compare to other preprocessing algorithm.

2. **Mean Square Error [MSE]**

The MSE matrix is defined by formula,

\[
\text{MSE} = \frac{1}{mn} \sum_{i=0}^{m-1} \sum_{j=0}^{n-1} (I(i, j) - K(i, j))^2 \quad \text{equation(3)}
\]

For two mxn monochrome pictures I and K, one of the pictures is viewed as noisy approximation of the other. Different measurements like Root Mean Square Deviation (RMSE), Mean Absolute Error (MAE) and PSNR are characterized utilizing MSE.

![Image Metric(dB) Preprocessing Algorithms](image)

**Figure 6. Analysis of different algorithm with MSE Values**

The figure. 6 shows the different preprocessing algorithm with different MSE values. In figure it is clearly, shows that contrast adjustment is having the minimum error value compare to other preprocessing algorithm.

<table>
<thead>
<tr>
<th>Image</th>
<th>Metric(dB)</th>
<th>Preprocessing Algorithms</th>
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<tbody>
<tr>
<td></td>
<td>PSNR</td>
<td>Contrast adjustment</td>
</tr>
<tr>
<td>Deer</td>
<td>16.56</td>
<td>14.29</td>
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<tr>
<td></td>
<td>MSE</td>
<td>2.04</td>
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<td></td>
<td></td>
<td>2.83</td>
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<tr>
<td>Flower</td>
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<tr>
<td></td>
<td>MSE</td>
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<td></td>
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<td>2.71</td>
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<td>Dog</td>
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<tr>
<td></td>
<td>MSE</td>
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<tr>
<td></td>
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**Table 1. Comparison of PSNR and MSE values on different preprocessing algorithms**
Based on the different matric values of PSNR and MSE is tested on different preprocessing algorithm such as contrast adjustment, intensity adjustment and histogram equalization to different set of images. The contrast adjustment is having comparable worthy result compare to other preprocessing techniques. From table. 1 it is concluded that, contrast adjustment is having grater PSNR and least MSE matric values. This technique is very helpful for retrieving significant quality of the image from the larger database though CBIR method.

V. CONCLUSION:

This paper is focused on performance of three preprocessing methods are compared contrast adjustment, intensity adjustment and histogram equalization. In CBIR, programmed continuous quality control so as to order finished results deserts in a brisk and proficient way. Manual control is not efficient, for searching large amount of data. On other hand programmed quality control is substantially more productive, in light of the fact that it is constant and autonomous from manual efficiency. For searching or retrieving data for images it is very helpful for content based image retrieval for extracting color feature from the image. Even good quality cameras are used with an adequate artificial illumination it is necessary to pre-process those images before applying image processing methods. The diverse preprocessing procedures like contrast adjustment, intensity adjustment and histogram balance are applied. These algorithms are assessed utilizing PSNR and MSE. The contrast adjustment gives reasonable outcomes and it is concluded that, contrast adjustment is having grater PSNR and least MSE matric values.

REFERENCES:


