An Image Resolution: A Survey

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Abstract: *Resolution can be calculated by counting the pixels that are present in an image.It can be also calculated by counting the image width and height. Our system's screen is also set at a particular resolution as well as our television screen is also set at a particular resolution. In order to adjust the screen the option of zoom in and zoom out are used.As large as the screen is available, then the larger resolution is being set. File size can be reduced when you select the image as JPG file, and select the amount of compression before saving. In this paper we will look on the different resolution techniques and also its types. Survey has been done from different research papers.*

Keywords: Adjacent Pixel Algorithm, Discrete Wavelet Trasnsform, Interpolation, Spatial Resolution, Spectral Resolution, Stationary Wavelet Transform, Super Image Resolution

1. Introduction

Number of pixels can refer as resolution. Resolution is all about pixels. It can be measured by counting the number of pixel or can be measured by identifying its width and height of any picture. For example- An image i.e 2102 pixels wide and 1011 pixels high (2102*1011) have 2, 125, 122 pixels (or 2.1 mega pixels).

We can read it as 2102*1011 or a 2.1 megapixel image. The clarity of the image is depend on the megapixel of your device, which means that a 16 mega pixel camera can capture more clear image than a camera with 2 or 5 megapixel.[1]

2. Types of Image Resolution

2.1 Pixel Resolution

Pixel resolution is all about pixels. Resolution and pixel are much differ from each other. Pixel can be defined as a unit of digital image. The digital resolution is depend on the number of pixel. There is a close relation between pixel and resolution. The less pixel in an image, the clarity of the image will be more.
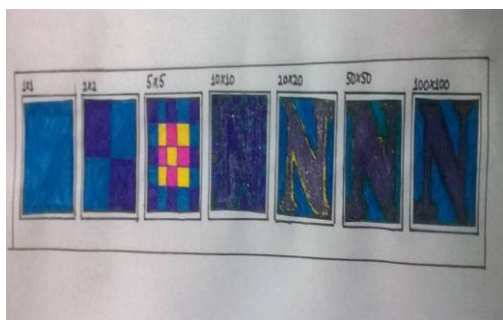

Figure 1: Clarity of an image depends on number of pixels

2.2 Spatial Resolution

Spatial Resolution is those that are not only depend on the pixels but also on the features of the system. Spatial resolution is used for distinguishing between two objects. Low spatial resolution faces difficulties in distinguishing between two objects.

(a)

(b)

Figure 2: (a) Image with less pixel count compared to figure (b), **(b)** Image has higher pixel count

2.3 Spectral Resolution

Spectral Resolution is the process of resolve spectral features and bands into their different components. Spectral image is all about colured spectral images. Colour ful images are the combination of different lights and these images distinguish light of different spectra. Normal colour image have lower spectral resolution as compared to multi spectral images.

2.4 Temporal Resolution

Temporal resolution refers to a measurement with respect to time or duration of time. Usually 24 to 48 frames per second time resolution are used for movies as they have large bandwidth.

2.5 Radiometric Resolution

Radiometric resolution is dependent on intensity. As the radiometric resolution is increasd, the intensity of system become fine.

3. Survey

1. Elham Karimi, Kaueh Kangarloo and Shahram Javedi (2014) [2]"A survey on super resolution methods for image construction". The survey has been done on super resolution. The super resolution classifies the high resolution image as well as low-resolution from the picture. Several techniques are used in order to remove the noise and blur from the picture, so as to make it clear and high quality. In this paper different super resolution techniques are used so as to distinguish between high resolution image as well as low resolution image. According to this paper there are group resolution techniques such as image Frequency domain method, spatial domain method and techniques wavelet domains. Every domain methods have their own characteristics and comparison between these methods has been done by using a special index in the domain. From the low resolution image the high resolution image can be formed and the process of converting low resolution to high resolution image is called super resolution.

2. A.J den Dekker and A.Van Den Bos (1997) [3] "Past and present approaches to the concept of optical resolution are reviewed" The whole paper is based on optical resolution and optical images. The difference between ethereal images, calculated images and detected image has been done by Ronchi. According to him, the physical nature of the image is shown in ethereal images i.e the real representation of the image. Some calculations have been done to give it a countable representation as in geometrically and algebraically. Thus according to Ronchi, those ethereal images on which calculations have been performed are called calculated images.

3. Kulwinder Kaur, Indrapreet Kaur and Jaspreet Kaur (2016)[4]"Survey on Interpolation". Every digital image is formed by addition of pixels. Resolution is the main characteristics of digital image. Although, resolution can be defined by the total number of pixel in an image. More resolution image has more cleared image. Interpolation is the technique of enlarging of image. Methods like bi-linear interpolation, nearest neighbor interpolation and bi-cubic interpolation. According to them, nearest neighbor value algorithm is used to create high resolution image in the nearest neighbor. Bi-cubic interpolation is the best way of enlarging an image; they have high quality and smooth image. Bi-linear and nearest neighbor images don't have high quality and smooth images as compared to cubic interpolation.

4. Image Resolution Technique

There are many techniques used for image resolution. But some important image resolution techniques are as follows.

A.   Discreete Wavelet Transform Technique(DWT

 DWT uses wavelwt co-efficients.in DWT The information of an image is captured by DWT Technique. In satellite images, resolution plays an important role. Satellite images have both high and low frequency content. Images have more chances of losing high frequency contents. So, discrete wavelet transform technique is used in order to maintain a high frequency contents. In the DWT Technique the satellite images will be divided into four sub-bands that is low-low (LL), low-high (LH), high-low (HL) and high-high (HH). Interpolation is done between the high frequency sub-bands images and low resolution input images, and then making the inverse of DWT by which we get the enhanced image. The high frequency content of any image can be reduced by the process called as interpolation. DWT Technique is used to create an image sharper and finer.[5]

B.   Stationary Wavelet Transform Technique(SWT)

In SWT the major drawback is the lack of translation-varience. In order to over come this drawback, the stationary wavelet transform is used. The process of SWT is similar with the DWT. SWT as like DWT, the image will divided four sub-bands that is low-low (LL), low-high (LH), high-low (HL) and high-high (HH). The method of SWT is somehow similar to the DWT. In SWT the image will divide into four sub-bands i.e low-low (LL), low-high (LH), high-low (HL) and high-high (HH), and again those sub bands will divide into another sub-bands i.e LLLL, LLLH, LLHL, LLHH and so on. After division, the high frequency of SWT & DWT is added together. Then the checking of the interpolation correction is done by SWT & DWT. Then the inverse form is applied and the images get combined together. So, the technique creates a super resolution pictures.[6]

C.   Adjacent Pixel Algorithm(APA)

The Adjacent Pixel Algorithm is basically used to produce clearer and crispier images. In this method the pixels are increased in numbers. In APA, firstly the image will divide into four sub-bands i.e. low-low (LL), low-high (LH), high-low (HL) and high-high (HH), and again those sub bands will divide into another sub-bands i.e. LLLL, LLLH, LLHL, LLHH and so on. After those pixels values are formed. But unfortunately the LL sub-band will have low pixel values. In order to overcome with this problem, an average value of neighboring pixels, are assigned in extra column which is added to the LL sub-band. Hence the pixel values are increased in numbers regarding LL sub-band, due to which finally image will become clear. The more will be pixel values in an image, the clearer image will get. We can say that the clarity of an image will depend on the pixel values [7].

5. Conclusion

The basic conclusion of image resolution is introduced in this paper. Many things are remain to discuss in detail but the overview of all has been discussed. We have in traduced the important parts in this section. Many techniques are used in image resolution .aim of every technique is to provide the crispy and enhanced image. Although every technique has some drawback as well but also has advantages which are heavier than drawbacks. The main drawback of discrete wavelet transform (DWT) is that it losses high frequency content from image due to which blurred images is formed. In stationary wavelet transform (SWT) technique, the main disadvantage is that distortion may occur to the image as well as in adjacent pixel algorithm (APA) technique, it losses linear features. In future some techniques like multi wavelet transform may be used to create an image which has fewer artifacts as compared to others.

Acknowledgment

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