Articles ~ Ghost hunting and beyond ~ Analyzing Digital Photographs, Getting the data

Digital cameras are principally characterized by their image resolution or mega-pixel capacities; from low-resolution (less than 1 mega-pixel) to high-resolution (greater than 1 mega-pixel) to advanced high-resolution (4 mega-pixels or more). The camera's resolution is the most critical feature in producing high-quality photographs.

The computer is the central component in digital photography. It stores and displays the digital images from the digital camera and enables those images to be printed on a variety of digital printers. Because of the huge amount of data contained in high-resolution digital images, the computer should have adequate memory and storage capacities. In addition to these two key elements, the computer should have high-speed interfaces to the camera and printer, as well as a fast CPU to control the image processing functions. The recommended computer configuration for processing digital images is provided below:

* CPU Speed: 1.4 GHz
* Main Memory: 128 MB RAM
* Hard Drive Storage: 20 GB
* Interfaces: High-speed interfaces to match your camera and printer, such as Firewire or USB 2.0

Using Photoshop to compare the density levels of selected objects

The Histogram dialog gives you everything you want to know, and then some.
First, you should convert the image to grayscale. This rules out color variations from skewing the results.
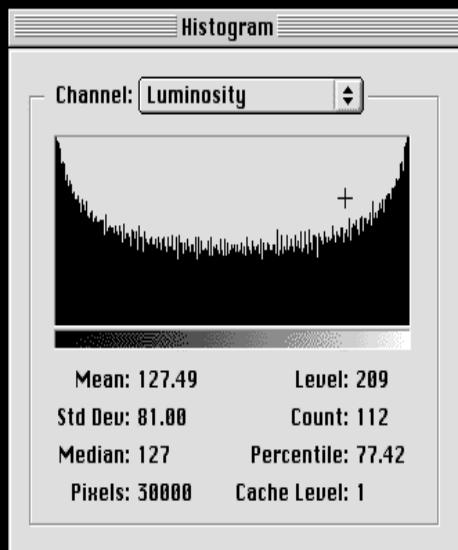
First figure out what particular pixel you plan to sample, and what range of similar pixels is appropriate to include in the sampling. Set the Wand tool appropriately.
You click on a particular gray area with the wand, then pull up the Image > Histogram dialog to get the statistics.

Move your mouse very slowly over the lines and you'll see that each vertical row of pixels represents a single level in the selected group of pixels. Theoretically you could assign specific "ailment" to a certain level or groups of levels.

1. Mean: the average brightness level for all the pixels in the selection
2. Std Dv: the average difference between the highest and lowest levels
3. Median: where the exact "middle" of the selected range occurs
4. Pixels: how many pixels are actually included in that selection
5. Level: gives you the numeric "level" of any line you hold the cursor over
6. Count: gives you the number of pixels in the selection which match the selected level
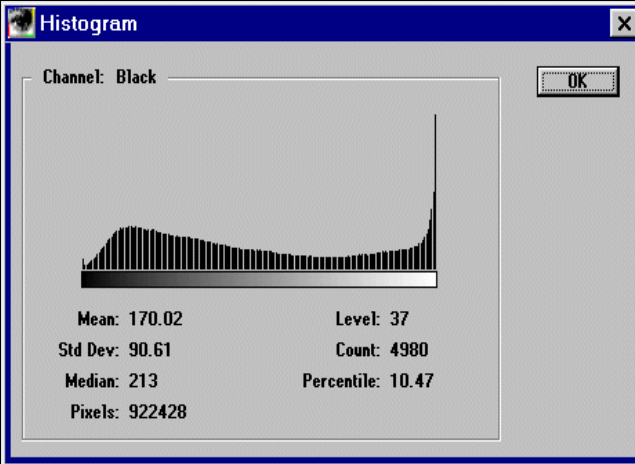7. Percentile: how many pixels possess a value darker than the selected one

From that information you could (again, theoretically) build some fairly sophisticated analysis criteria for analyzing objects in your photographs. But there's so much more information there as well.

Suppose you've designated which specific levels or ranges of levels represent an ailment or condition or feature in the suspected object, mass for example.
Now you can use the Select > By Color command and select those levels (colors) which stand for the specific data searched for and the Histogram will give you the statistics of the selection. You could fine-tune that to a single value if you wanted to, then run the Histogram for the whole file.
Once you start playing around with the feature, and doing 'what-if' scenarios it becomes quite interesting.

A Spectral Selectivity Metric

Histogram

Channel: Black

OK

Mean: 170.02   Level: 37
Std Dev: 90.61   Count: 4980
Median: 213   Percentile: 10.47
Pixels: 922428

A digital image can be treated as a data set to extract information. Each pixel's intensity value is a measure of how much energy was used to generate it within the band of spectrum used to produce the image.

The sum of the pixel intensities is a measure of the total energy used to create the whole image. Most digital imaging programs provide a histogram utility which can be used to examine the data set of an image.

The usefulness of these histogram utilities varies. Unfortunately, none of them seem to provide clipboard, copy and paste into a spreadsheet. Adobe Photoshop's histogram dialog is better than most. The illustration on the left is of the Photoshop v3 histogram and shows what data is available.

In some applications it is useful to obtain a single value which represents the sum of the energies used to create an image. The following equation is one way to accomplish this. When the exponent w is set to a value of 1, this equation will produce a result in the range of 0.00 to 100.00.

This is a linearly weighted percentage of possible energy. If every pixel in the measured area had a maximum intensity value of 255, the SensiMetric value would be 100. The exponent w can be used to weight the curve for a particular imaging application.

$$SensiMetric = \frac{\sum_{i=1}^{255} i^{w} * value\_count[i]}{2.55 * \sum_{i=1}^{255} value\_count[i]}$$

where:
i = color palette index (0..255)
w = weighting factor
$value\_count$ = histogram data (pixel counts)

The denominator is the equivalent of 2.55 times total number of non zero valued pixels. For some applications, 2.55 times total number of pixels might be a better choice (sum from i=0 to 255). This equation is just a suggestion to get you started thinking about what is possible.

This concept of generating a numeric value need not always be applied to the entire image. For some applications it may be useful to break the image up into segments and calculate numeric values for each segment.

Some applications will need to compare values from different images shot over a period of time. Certain elements of the image may have changed position over this period of time. Partitioning the image into small sections allows these elements to be floated to obtain better image correlation. Software may need to be written for handling such tasks.

Computers create many possibilities for extracting information from images created with the methods of spectral selectivity. Each application for imaging using spectral selectivity will have its own characteristics and requirements. Careful evaluation of these will allow generation of useful methods.

Adobe Photoshop Raster Ops

The following table describes the raster ops (or combine and apply modes) available in Adobe Photoshop which are useful for spectral selection operations.

Raster Op	Description	Equation
Normal	Regular pixel *assignment*	P = A
Difference	*Absolute value difference* of image A pixel and image B pixel	P = abs(A-B)+abs(B-A)
Add	*Sum* of image A pixel and image B pixel, overflow is truncated	P = A+B
Subtract	*Subtraction* of image B pixel from image A pixel, underflow is truncated	P = A-B
Multiply	*Normalized multiplication* of image A pixel with image B pixel	P = normalize (A*B)
Darker	*Maximum* of image A pixel and image B pixel	P = max(A,B)

Lighter	*Minimum* of image A pixel and image B pixel	P = min(A,B)

IR Film Photoshop plug-in

The plug-in emulates the look of the infra-red film and it's designed to be usable with the landscape photos as well as portraits. Often unseen data in a unusual image can be brought out by using this plug in.
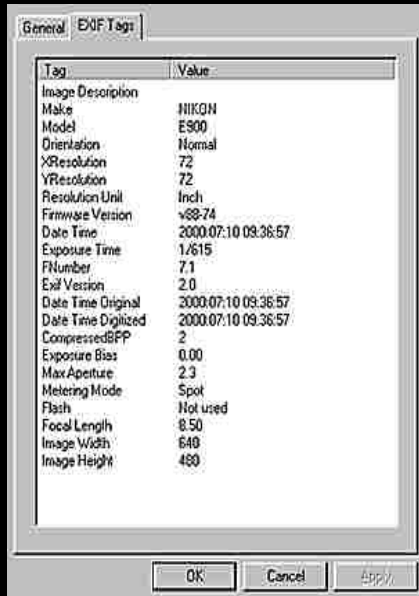
Features

- Live preview of the final image
- Innovative 'IR Bias' slider that makes the image look 'more' or 'less' 'infra-red' - useful for portraits
- Ability to save and load settings
- Full featured demo available

Technical details

- Product supports both 8 and 16 bit RGB images
- Photoshop 6 and up or Elements required
- PC version available

Reading EXIF Image Data

EXIF stands for Exchangeable Image File Format, and is a standard for storing interchange information in image files, especially those using JPEG compression. Most digital cameras now use the EXIF format. The format is part of the DCF standard created by JEITA to encourage interoperability between imaging devices.

Digital camera owners study EXIF data to compare successful photos to those that are not. The information provides insight about how camera settings affect photo characteristics such as exposure, depth-of-field and subject movement.

EXIF data can be read by applications that support JPEG including web browsers, image editing and organizing programs, and some printer drivers. The drivers use the information to automatically enhance images, often resulting in a better looking prints. If an edited image is saved correctly, the data can be viewed online at photo hosting sites.

When photo editing, EXIF data can be lost if an image file is not saved correctly. EXIF refers to settings and scene information recorded by a digital camera and embedded within each file.

The method to preserve EXIF data varies among image editing programs, so.

check your manual. Photoshop 7 was used for to illustrate the correct way to save EXIF data in a jpeg

1- To preserve EXIF after editing an image, use the Save AS command (not Save or Save for Web) from the File menu. The Save As dialog window opens.

2- Next, select JPEG from the Format drop down menu, give the file a new name, then click the Save button.

3- When the next window opens, select quality settings between one and 12 (1= Lowest quality/most compression - 12 = Highest quality/lease compression). Select a number that gives you a good balance between image quality and file size.

The EXIF data will be embedded in the new file. As a reminder, always edit copies of originals. If you goof, you can start again using another copy of the original. EXIF data can also tell you if a image was manipulated using a image editor such as Photoshop.

Sources: http://www.photo.net/, http://www.exif.org/

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