

Supplement to Chapter 2 of *The Science of Digital Media* – Digital Image Representation

Worksheet – Digital Imaging > Pixel Dimensions, Resolution, and Image Size¹

Introduction:

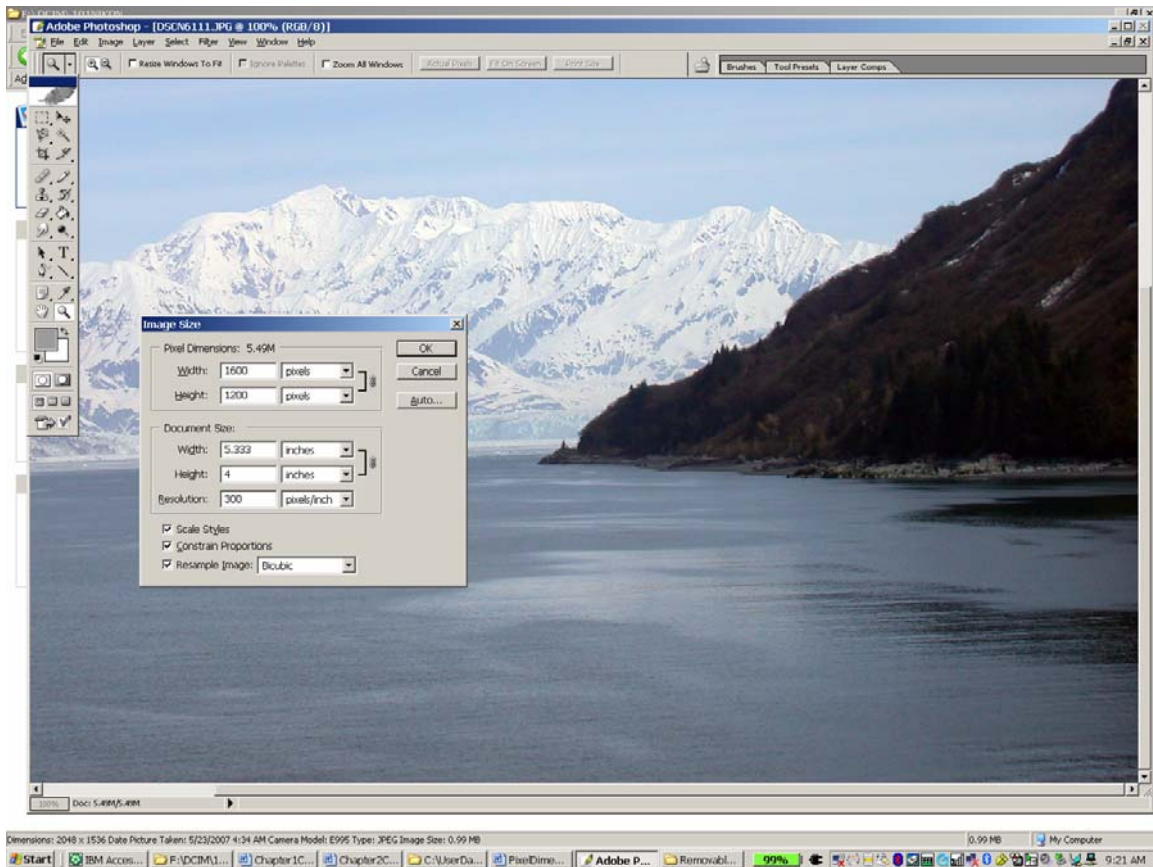
When you take a picture with a digital camera, you first must choose the pixel dimensions and image quality (if your camera offers such choices). Sometimes the setting for pixel dimensions is referred to as "image size." Actually, the concepts are clearer if you use the terminology as follows:

- *pixel dimensions* – the number of pixels in a digital image in the horizontal and vertical directions, e.g. 1024 X 768 or 1400 X 1050. Often, the aspect ratio is 4:3, as it is in the two examples given. You choose the pixel dimensions when you take a picture with a digital camera (unless the camera has only one setting). The pixel dimensions of an image are what determine how big an image looks on a computer screen – but note that you must also take into consideration how many physical pixels there are per inch on the computer screen.
- *resolution* – the number of pixels per inch chosen for a digital image. When you put a digital image on a computer and look at it with some type of digital image processing software (e.g., Photoshop), you can set the resolution to a certain number of pixels in the horizontal and vertical directions. For example, if you choose 200 ppi (pixel per inch), there will be 200 X 200 pixels of the image used to print out each square inch block in the picture. Resolution in the sense of ppi has no effect on how big an image looks when you display it on a computer. It pertains to the physical size of the printed image.
- *image size* – Image size is a function of both the pixel dimensions and the resolution. If you choose 200 ppi for a 1400 X 1050 pixel image, it will print out to be 7 X 5.25 inches when you print it out. If you use 300 ppi for the same image and don't resample it, the picture will be smaller because you'll use up more of the total pixels in each inch.

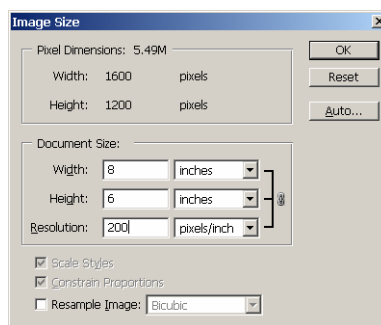
In image processing programs like Photoshop, you can open digital photographs and change the image size. If you select "Resample Image" when you change the image size, the program will try to retain its resolution – e.g., the number of pixels per inch – which means that the number of pixels can change. If you deselect "Resample Image," the pixel dimensions are frozen, and the program will have to use the pixels it currently has, spread evenly over your chosen physical size.

¹This material is based on work supported by the National Science Foundation under Grant No. DUE-0340969. This worksheet was written by Dr. Jennifer Burg, burg@wfu.edu.

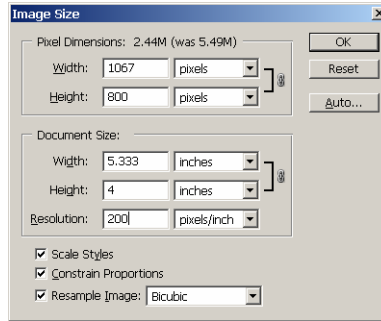
For example, the image below is initially 1600 x 1200, as you can see in the Image Size window (which pops open when you select Image Size from the Image menu).



If you deselect "Resample Image" and reduce the resolution to 200 ppi, you'll keep the pixel dimensions at 1600 x 1200. Thus, the printable image will be 8" X 6", as shown below.



If you leave "Resample Image" selected and set the resolution to 200 ppi, the image will be resampled, changing the number of pixels to 1067 x 800, as shown below. Notice that the image document size doesn't change from what it was originally (5.333" x 4", as seen in the first figure).



If you need to adjust the aspect ratio or select only a portion of the image, you use the crop tool. The crop tool allows you to set the pixel dimensions and/or resolution you want for cropping.



Settings for crop tool look like this:



You can fill in the width and height in inches, centimeters, or pixels. You can fill in the resolution in pixels/inch or cm/inch. Or you can leave all these fields blank, in which case the crop tool doesn't resample the image.

See if you understand these concepts and tools by answering the following questions:

1. How do you determine how big an 800 X 600 pixel digital image will look on a given computer display? What information do you need? Give an example to illustrate, using two different displays with different specifications.
2. Say that you have a digital image that has pixel dimensions of 1600 X 1200. You want to print it out as a 4" X 3" print. What should you do?
3. What if you want to print the 1600 X 1200 image out as a size of 7" X 5"?
4. What if you have a digital photograph with pixel dimensions of 480 X 640 and you want to print it out as an 8" X 10" photograph. What should you do?