Topic 42

Digital Imaging Files

Pixel: In digital imaging, a pixel, pel, or picture element is a physical point in a raster image, or the smallest addressable element in an all points addressable display device; so it is the smallest controllable element of a picture represented on the screen. The address of a pixel corresponds to its physical coordinates. LCD pixels are manufactured in a two-dimensional grid, and are often represented using dots or squares, but CRT pixels correspond to their timing mechanisms and sweep rates.

Each pixel is a sample of an original image; more samples typically provide more accurate representations of the original. The intensity of each pixel is variable. In color image systems, a color is typically represented by three or four component intensities such as red, green, and blue, or cyan, magenta, yellow, and black.

In some contexts (such as descriptions of camera sensors), the term *pixel* is used to refer to a single scalar element of a multi-component representation (more precisely called a *photosite* in the camera sensor context, although the neologism *sensel* is sometimes used to describe the elements of a digital camera's sensor), while in others the term may refer to the entire set of such component intensities for a spatial position. In color systems that use chroma subsampling, the multi-component concept of a pixel can become difficult to apply, since the intensity measures for the different color components correspond to different spatial areas in such a representation.

The word *pixel* is based on a contraction of *pix* (pictures) and *el* (element); similar formations with *el* for "element" include the words voxel and texel.

Resolution of computer monitors: Computers can use pixels to display an image, often an abstract image that represents a GUI. The resolution of this image is called the display resolution and is determined by the video card of the computer. LCD monitors also use pixels to display an image, and have a native resolution. Each pixel is made up of triads, with the number of these triads determining the native resolution. On some CRT monitors, the beam sweep rate may be fixed, resulting in a fixed native resolution. Most CRT monitors do not have a fixed beam sweep rate, meaning they do not have a native resolution at all - instead they have a set of resolutions

that are equally well supported. To produce the sharpest images possible on an LCD, the user must ensure the display resolution of the computer matches the native resolution of the monitor.

Bits per pixel: A bit is the basic unit of information in computing and digital communications. A bit can have only one of two values, and may therefore be physically implemented with a two-state device. These values are most commonly represented as either a 0or1. The term *bit* is a combination of binary digit.

The number of distinct colors that can be represented by a pixel depends on the number of bits per pixel (bpp). A 1 bpp image uses 1-bit for each pixel, so each pixel can be either on or off. Each additional bit doubles the number of colors available, so a 2 bpp image can have 4 colors, and a 3 bpp image can have 8 colors:

- 1 bpp, 2^1 = 2 colors (monochrome)
- 2 bpp, 2^2 = 4 colors
- 3 bpp, 2^3 = 8 colors

- 8 bpp, 2^8 = 256 colors
- 16 bpp, 2^{16} = 65,536 colors (Highcolor)
- 24 bpp, 2^{24} = 16,777,216 colors (Truecolor)

The Byte: Byte is a unit of digital information in computing and telecommunications that most commonly consists of eight bits. Historically, the byte was the number of bits used to encode a single character of text in a computer and for this reason it is the smallest addressable unit of memory in many computer architectures. The size of the byte has historically been hardware dependent and no definitive standards existed that mandated the size. The *de facto* standard of eight bits is a convenient power of two permitting the values 0 through 255 for one byte. The international standard IEC 80000-13 codified this common meaning. Many types of applications use information representable in eight or fewer bits and processor designers optimize for this common usage. The popularity of major commercial computing architectures has aided in the ubiquitous acceptance of the 8-bit size.

The unit **Octet** was defined to explicitly denote a sequence of 8 bits because of the ambiguity associated at the time with the byte.