Effective Number of Pixels

A distinction should be made between the number of pixels in a digital image and the number of sensor pixel measurements that were used to produce that image. In conventional sensors, each pixel has one photodiode which corresponds with one pixel in the image. A conventional sensor for instance in a 5 megapixel camera which outputs 2,560 x 1,920 images has an equal number of "effective" pixels, 4.9 million to be precise.

Additional pixels surrounding the effective area are used for demosaicing the edge pixels, to determine "what black is", etc. Sometimes not even all sensor pixels are used.

A classical example was Sony's DSC-F505V which effectively used only 2.6 megapixel (1,856 x 1,392) out of the 3.34 megapixel available on the sensor. This was because Sony fitted the then new 3.34 sensor into the body of the previous model. As the sensor was slightly larger, the lens was not able to cover the whole sensor.

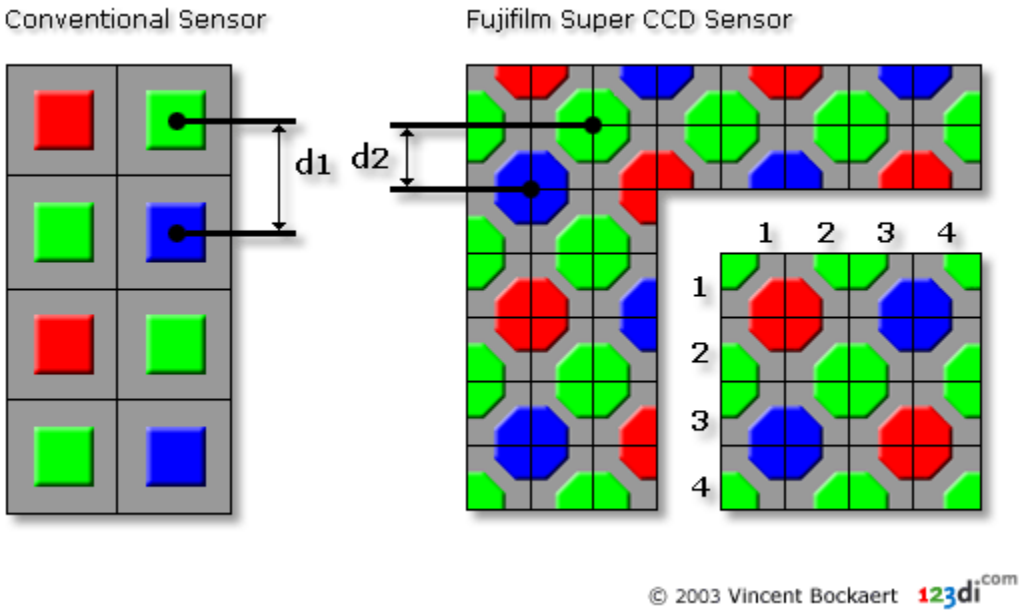
So the total number of pixels on the sensor is larger than the effective number of pixels used to create the output image. Often this higher number is preferred to specify the resolution of the camera for marketing purposes.

Interpolated Number of Sensor Pixels

Normally, each pixel in the image is based on the measurement in one pixel location. For instance, a 5 megapixel image is based on 5 million pixel measurements, give and take the use of some pixels surrounding the effective area. Sometimes a camera with, for instance, a 3 megapixel sensor, is able to create 6 megapixel images. Here, the camera calculates, or interpolates, 6 million pixels of information based on the measurement of 3 million effective pixels on sensor. When shooting in JPEG mode, this in-camera enlargement is of better quality than those performed on your computer because it is done before JPEG compression is applied. Enlarging JPEG images on your computer also makes the undesirable JPEG compression artifacts more visible. However, the quality difference is marginal and you are basically dealing with a slower 3 megapixel camera which fills up your memory cards twice as fast—not a good trade-off. It is similar to what happens when you use a digital zoom. Interpolation cannot create detail you did not capture.

Fujifilm's Super CCD Sensors

Normally sensor pixels are square. Fujifilm's Super CCD sensors have octagonal pixels, as shown in this diagram. Therefore, the distance "d2" between the centers of two octagonal pixels is smaller than the distance "d1" between two conventional square pixels, resulting in larger (better) pixels.



However, the information has to be converted to a digital image with square pixels. From the diagram you can see that, for a 4 x 4 area of 16 square pixels, only 8 octagonal pixel measurements were used: 2 red pixels, 2 blue pixels, and 4 green pixels (1 full, 4 half, and 4 quarter green pixels). In other words, 6 megapixel Super CCD images are based on the measurement by only 3 million effective pixels, similar to the above interpolated example, but with the advantage of larger pixels. In practice the resulting image quality is equivalent to about 4 megapixel. The drawback is that you have to deal with double the file size (leading to more storage and slower processing), while enjoying a quality improvement equivalent to only 33% more pixels.

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