

Lecture 16: Image Processing

CS442: Great Insights in Computer Science
Michael L. Littman, Spring 2006

Do you see what I see?

- ⇒ “To see only what is there is to be as blind as the night.” - Annalyn Joie Tran
- ⇒ What are images?

Zero's and Ones!

- ⇒ Digital Images are merely numbers.
- ⇒ The colors and shapes within any image can be represented by numbers.
- ⇒ While two images can be completely different, Their fundamental representation is quite similar.

Connect the Dots

- ⇒ Take any image. Look closer. Closer!
- ⇒ What do you see? Dots!
- ⇒ From far enough away, the dots are Indistinguishable to the average human eye.
- ⇒ Called pixels, each are an individual color

Pixels

- ⇒ Pixels are the smallest sample of an image.
- ⇒ Generally, more pixels translate to increased detail

Pixels and Depth

- ⇒ 8 bpp [$2^8=256$; (256 colours)],
- ⇒ 16 bpp [$2^{16}=65536$; (65,536 colours, known as [Highcolour](#))],
- ⇒ 24 bpp [$2^{24}=16777216$; (16,777,216 colours, known as [Truecolour](#))].
- ⇒ 48 bpp [$2^{48}=281474976710656$; (281,474,976,710,656 colors, used in many flatbed scanners and for professional work)]

MegaPixels

- ⇒ A common phrase with digital cameras
- ⇒ One megapixel = 1 million pixels
- ⇒ A camera that can take pictures with a resolution of 2048×1536 pixels is commonly said to have "3.1 megapixels" ($2048 \times 1536 = 3,145,728$).

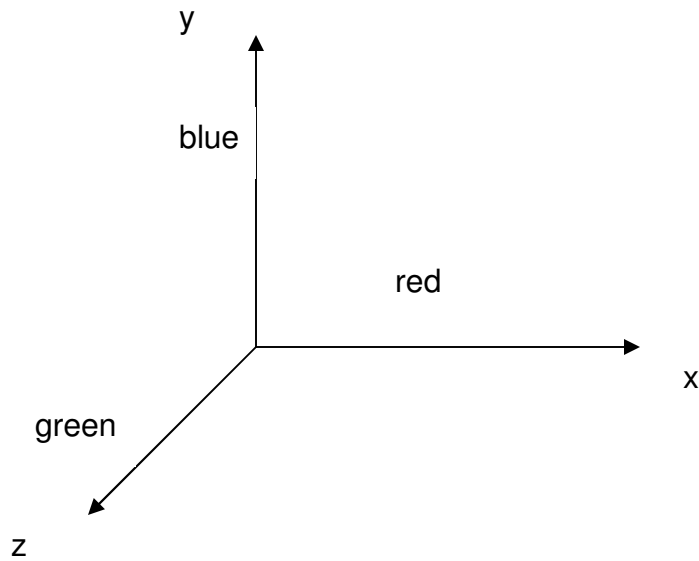
Many Megapixels

- ⇒ **640x480** - This is the low end on most "real" cameras. This resolution is ideal for e-mailing pictures or posting pictures on a Web site.
- ⇒ **1600x1200** - With almost 2 million total pixels, this is "high resolution." You can print a 4x5 inch print taken at this resolution with the same quality that you would get from a photo lab.
- ⇒ **2240x1680** - Found on 4 megapixel cameras -- the current standard -- this allows even larger printed photos, with good quality for prints up to 16x20 inches.

Color Space

- ⇒ The color in each pixel is composed of a mixture, or combination of RED, GREEN, & BLUE.
- ⇒ Additive primary colors.
- ⇒ 0 indicates black
- ⇒ 255 indicates white

All Colors in a Cube?



Triples

⇒ Representation of one black dot, or pixel:
(0, 0, 0)

⇒ Representation of one white dot, or pixel:
(255, 255, 255)

Many Triples

⇒ How many triples are there in an image with
640x480 resolution?

Alter image or data?

- ⇒ By altering the data itself, the image is altered.
- ⇒ If we took an image's data, and multiplied each triple's values by .07, what would occur?
- ⇒ Many camera settings, like indoor, outdoor, sepia, underwater, are algorithms adjusting the data to provide the visual effect.

Digital Cameras

Cool Facts

- With a 3-megapixel camera, you can take a higher-resolution picture than most computer monitors can display.
- You can use your Web browser to view digital pictures taken using the JPEG format.
- The first consumer-oriented digital cameras were sold by Kodak and Apple in 1994.
- In 1998, Sony inadvertently sold more than 700,000 camcorders with a limited ability to see through clothes.

Don't Forget

Have a great spring break!!