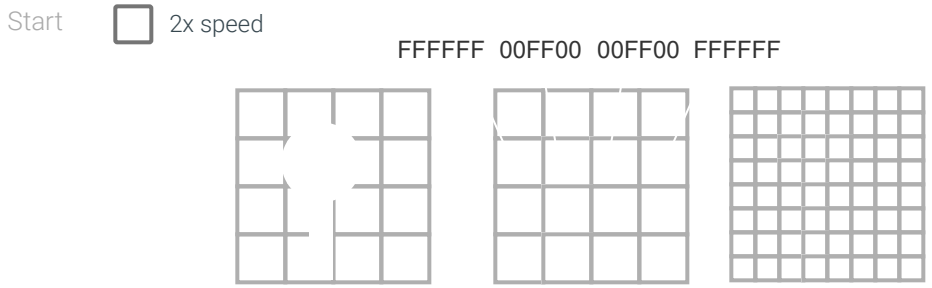
2.5 Image and video data

Images

An image is a depiction of a visual scene, typically composed of regions of varying colors. In the physical world, an image is with continuous colors. Some forms of capturing an image use analog means, such as film. In contrast, a ***digital image*** is grid of picture elements, ***pixels*** for short, with each pixel having one color. Each pixel's color is represented by a number, so numbers represents an image. Each pixel's color number represents some combination of red, green, and blue, such as bri a darker red (990000), or brown (663300 is a particular shade of brown).

PARTICIPATION ACTIVITY 2.5.1: Digitized images are represented by pixels. Each pixel's color is represented by a number. The more pixels, the better the image quality.

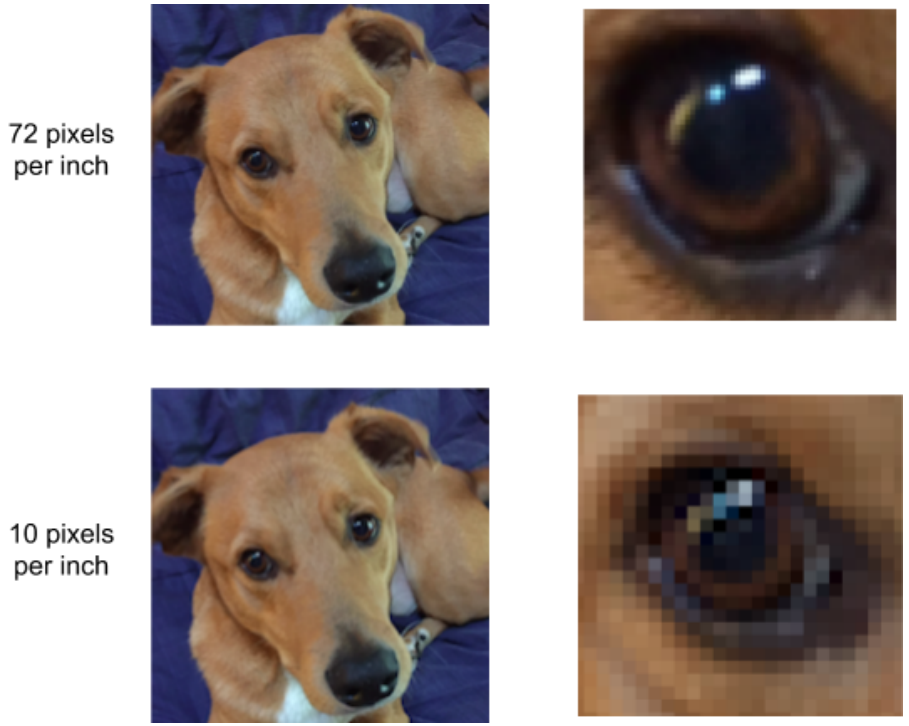


For illustration purposes, the above image uses only about 8 pixels per inch (so 8 × 8 = 64 pixels per square inch). In reality, requires perhaps 50 pixels per inch to look decent to the human eye.

A typical camera digitizes images using more pixels per inch than needed for typical viewing sizes, just in case a user wish blow up the image. Below, a photo taken with 72 pixels per inch can be zoomed into and still look OK, but a photo taken wit inch shows obvious poor quality when zoomed in.

A digital image file is a sequence of pixel color numbers. Due to the amount of pixels, a digital image may be large. For exa has 800 x 600 = 480,000 pixels, and each pixel color number requires 3 bytes, then the image may require 480,000 pixels × 1,440,000 bytes or 1.4 megabytes. A megabyte is one million (1,000,000) bytes. Images are thus usually compressed to re some image quality. ***JPEG*** is a common image compression standard.

Figure 2.5.1: Cameras typically digitize images using more pixels per inch than needed for typical sizes, to support zooming or blowing up.



PARTICIPATION ACTIVITY 2.5.2: Digital images.

Consider the above animation.

1) For the image with 4 pixels per inch, the first row's pixel numbers would be FFFFFF, FFFFFF, FFFFFF, and FFFFFF.
   - ○ True
   - ○ False

2) For the image with 4 pixels per inch, the second row's pixel values are shown. The third row's pixel values would be FFFFFF, 00FF00, FFFFFF, and FFFFFF.
   - ○ True
   - ○ False

3) For the image with 4 pixels per inch, how many total pixels exist in one square inch?
   - ○ 8
   - ○ 16

4) For the image with 8 pixels per inch, how many total pixels exist in one square inch?
   - ○ 16
   - ○ 64

5) For an image with 200 pixels per inch, how many total pixels would exist in one square inch?
   - ○ 40,000
   - ○

- 4 million

6) If an image has 300 pixels per inch, then a square inch has 300 × 300 = 90,000 pixels. If each image's color number uses 3 bytes, how many bytes are needed to represent a 2 inch by 3 inch image?

- 270,000
- 1.6 million

7) An photo is taken with a smart phone using 200 pixels per inch. The photo is "blown up" to be printed as a poster, such that each square inch of the poster will have 5 pixels. Can the poster be expected to be good quality?

- Yes
- No

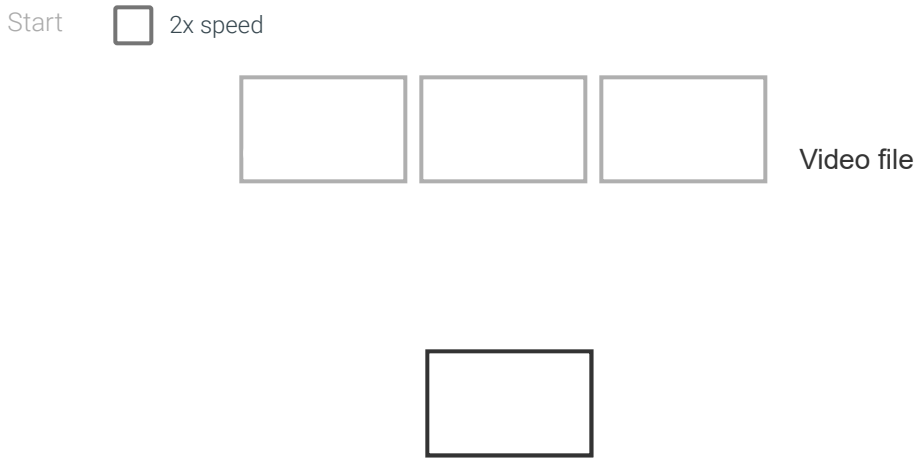
Video

Video is a series of slightly-differing images shown fast enough to appear continuous to humans. Each image in video is kr and the number of frames per second (fps) is the ***frame rate***. Standard video uses about 24 frames per second, and each ir pixel rows (known as lines). Compared to standard video, ***high-definition video*** uses more frames per second (like 60) and 1080), as well as wider lines.

Video files can be quite large. If a single image required 1 MB, then at 30 frames per second, 100 minutes (a common mov would require 100 min × 60 sec / min × 30 frame / sec × 1 MB / frame = 180,000 MB or 180 GB. Common video file format ***H.264***, or ***MOV***, differ in how compression is used to reduce video file size. The key idea of video compression is to only stc completely, with most other frames stored as the difference from the previous frame (in a video, such differences between

frames are typically tiny). Video compression usually loses some quality. After compression, a 100 minute movie may only GB. Most devices that record video do compression while recording, and devices that play video automatically decompress

PARTICIPATION ACTIVITY 2.5.3: Video is just a series of slightly-differing images shown fast enough to appear continuous to humans.



PARTICIPATION ACTIVITY 2.5.4: Video basics.

1) Video consists of a series of images known as _____ .
   - photos
   - frames

2) For a human to not notice each frame in

a video, the frame rate should be at least _____ frames per second.

- 5
- 24
- 500

3) Because video files could be large, compression is used. The main idea of compression is to only store the _____ a frame and the previous frame.

- difference between
- name of
- size of

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