Images are Data!

DSC 96

Colin Jemmott

Colors

To human:

To computer: 255, 0, 0 (in decimal) or #FF0000 (in hexadecimal)

Computer can see more: http://www.rapidtables.com/web/color/red-color.htm

Slide from Janine Tiefenbruck and Marina Langlois

Pixels

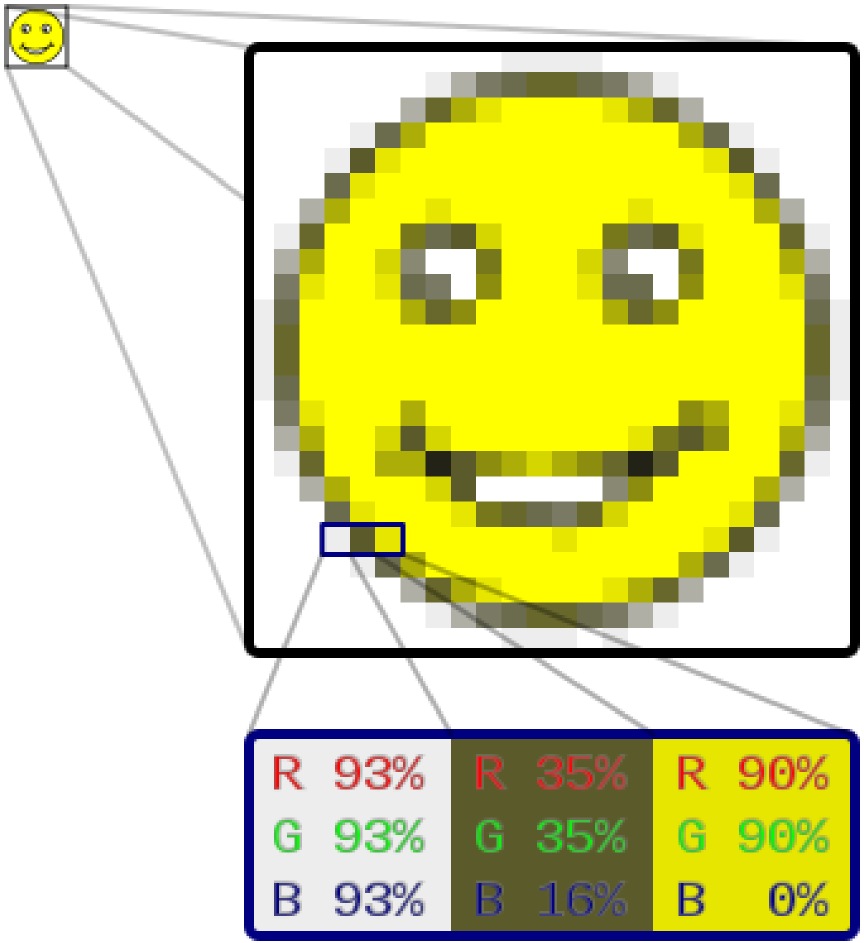

Image from https://en.wikipedia.org/wiki/Raster_graphics

Image is data

Data We have three values per pixel (RGB)

Pixel [0,0]
R = 174
G = 198
B = 234

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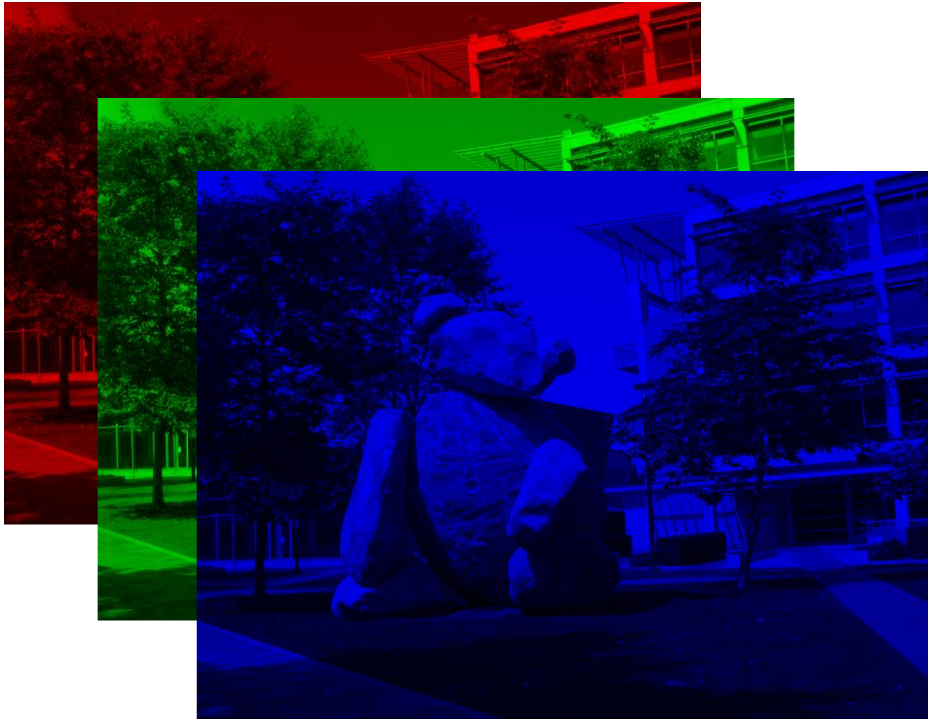

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R = 174
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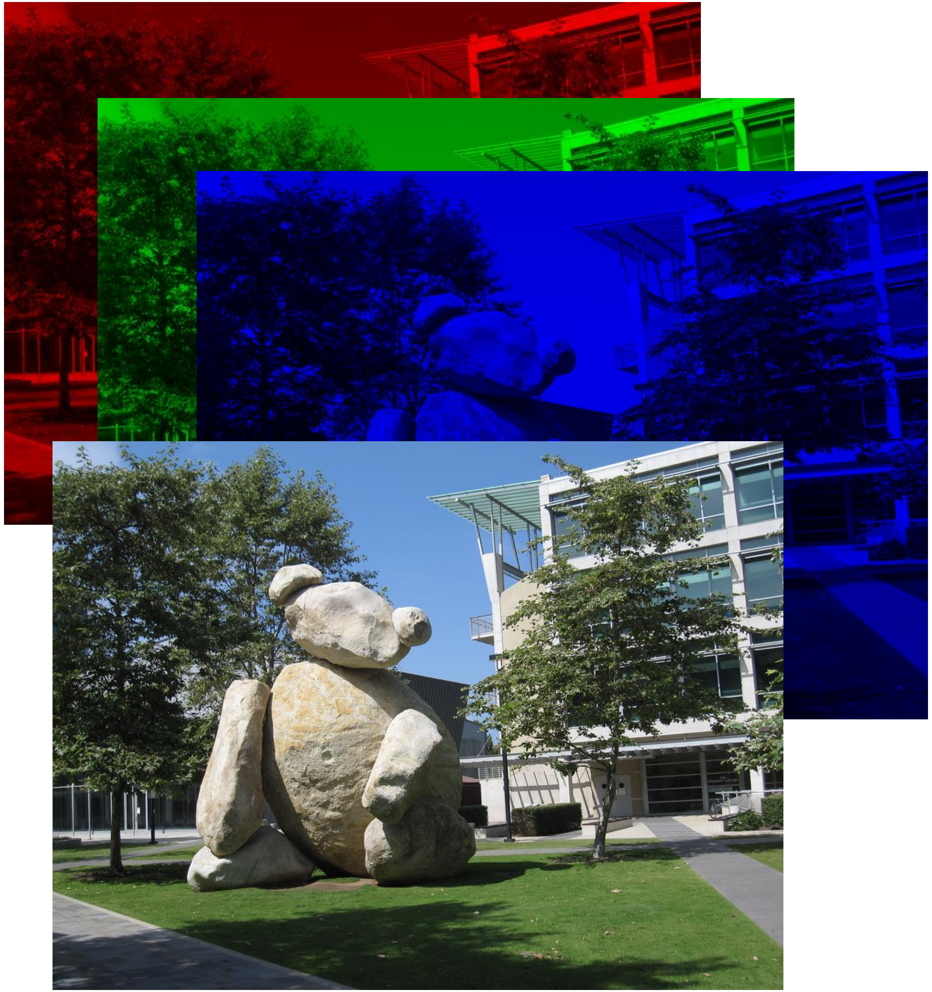

Data and Information

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Data This is a 700x629 RGB image (700x629x3 = 1,320,900 points!)

Pixel RGB = 236, 34, 50

Information
what information is really inside that image?

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Image .jpg
700x629 pixels
all pixels = 236, 34, 50

Resolution

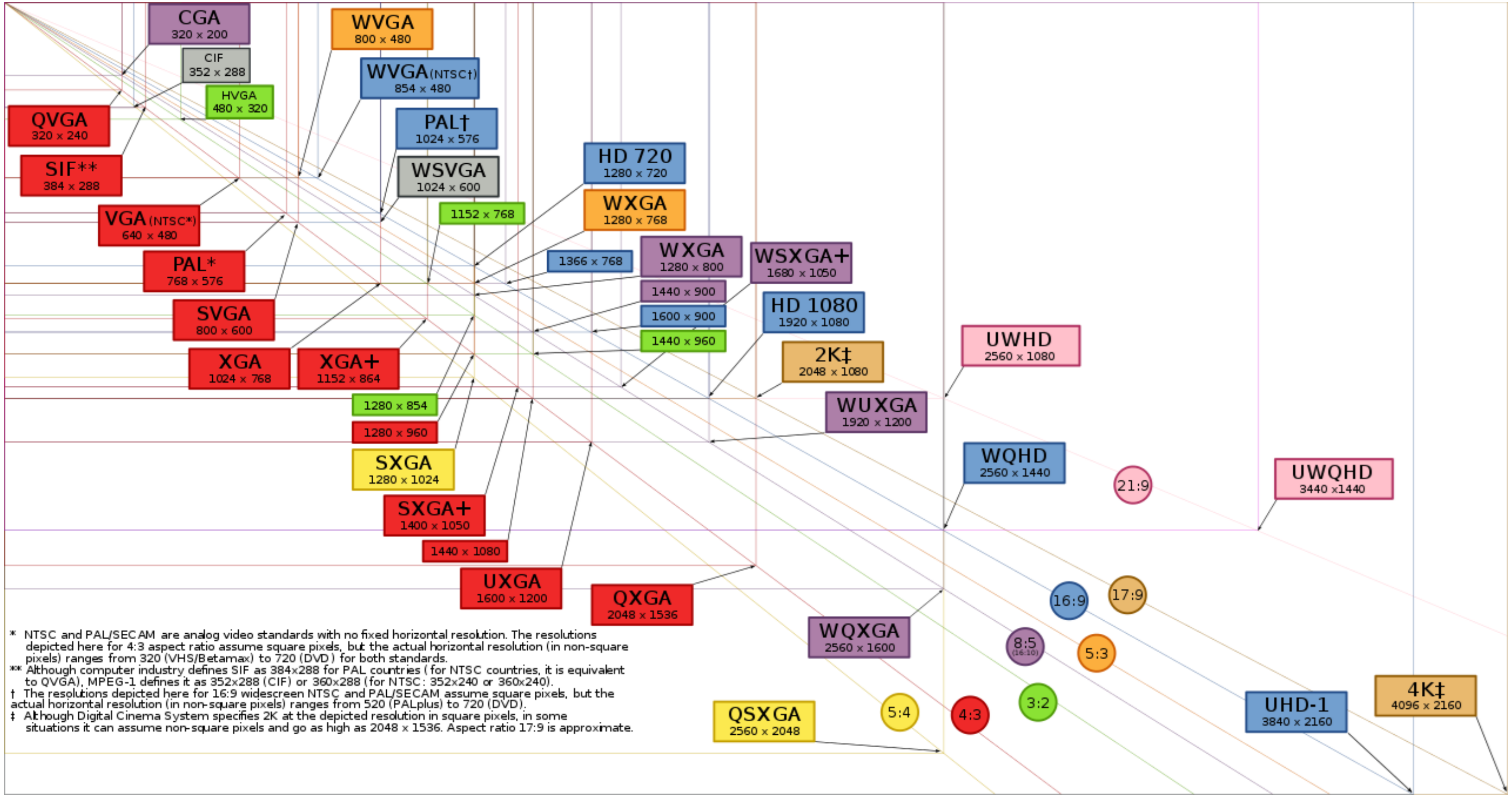
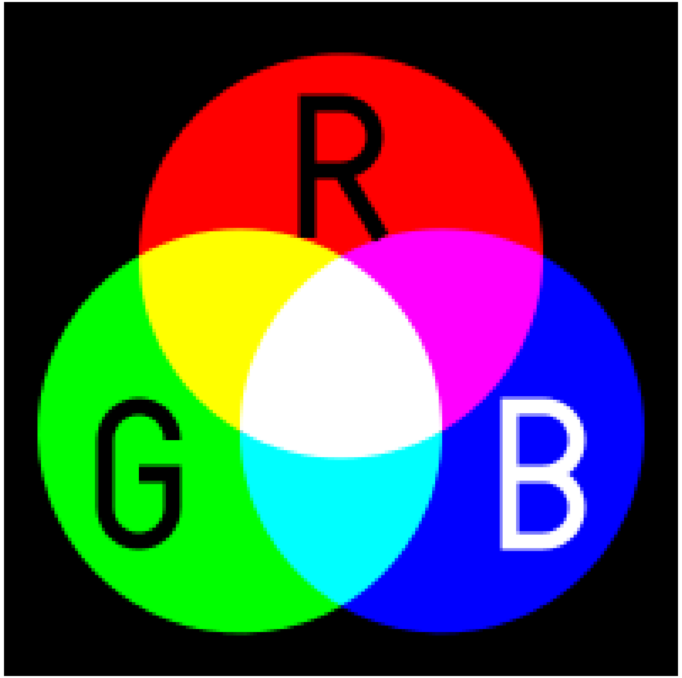


Image from https://en.wikipedia.org/wiki/Display_resolution

16 color vs 256 color

Image from https://en.wikipedia.org/wiki/Display_resolution

Colorspace



Images from https://en.wikipedia.org/wiki/Color_space

Image Processing

Original

$$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

Gaussian Blur

$$\frac{1}{16}\begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{bmatrix}$$

Sharpen

$$\begin{bmatrix} 0 & -1 & 0 \\ -1 & 5 & -1 \\ 0 & -1 & 0 \end{bmatrix}$$

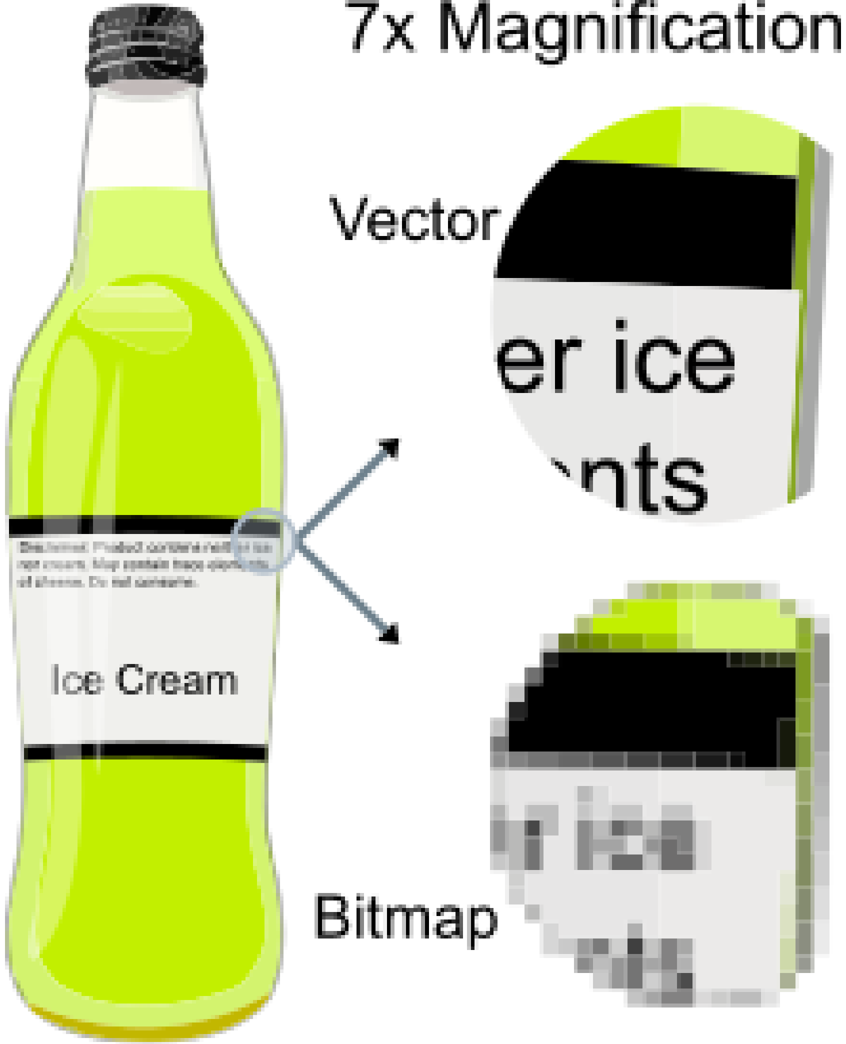
Images from https://en.wikipedia.org/wiki/Kernel_(image_

Image Processing

Edge Detection

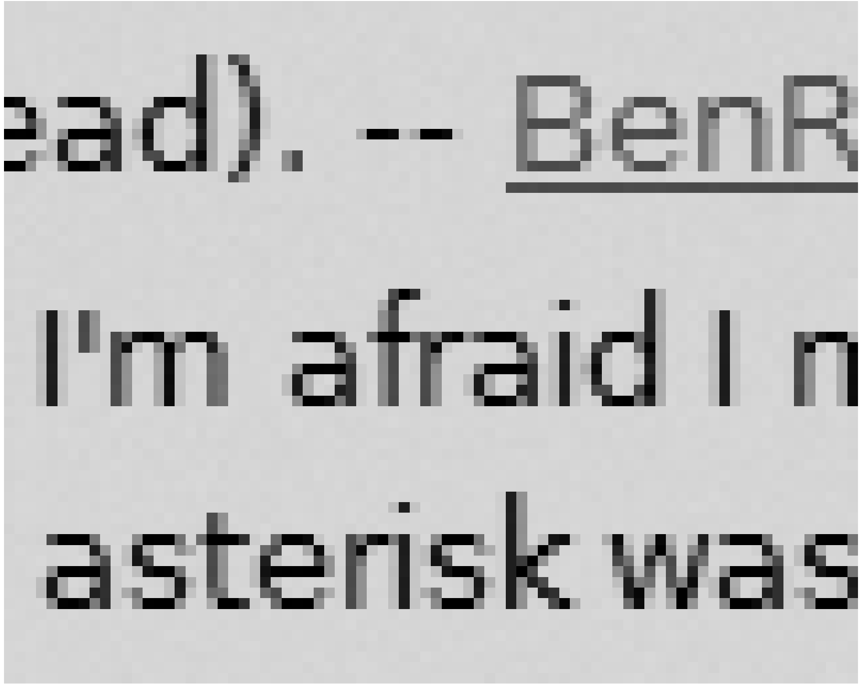
Images from https://en.wikipedia.org/wiki/Edge_detection

Vector Images



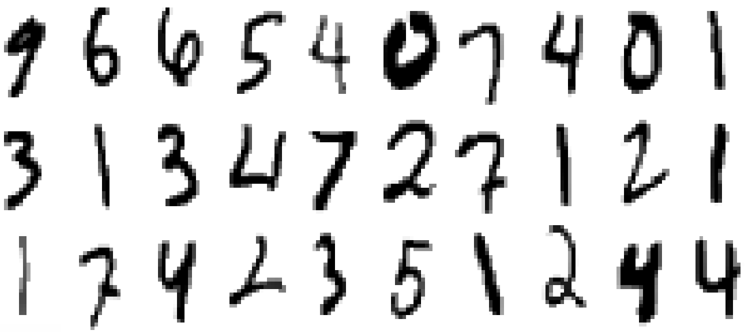
Images from https://en.wikipedia.org/wiki/Vector_graphics

Compression Artifacts



https://en.wikipedia.org/wiki/Compression_artifact

Digit Recognition & OCR



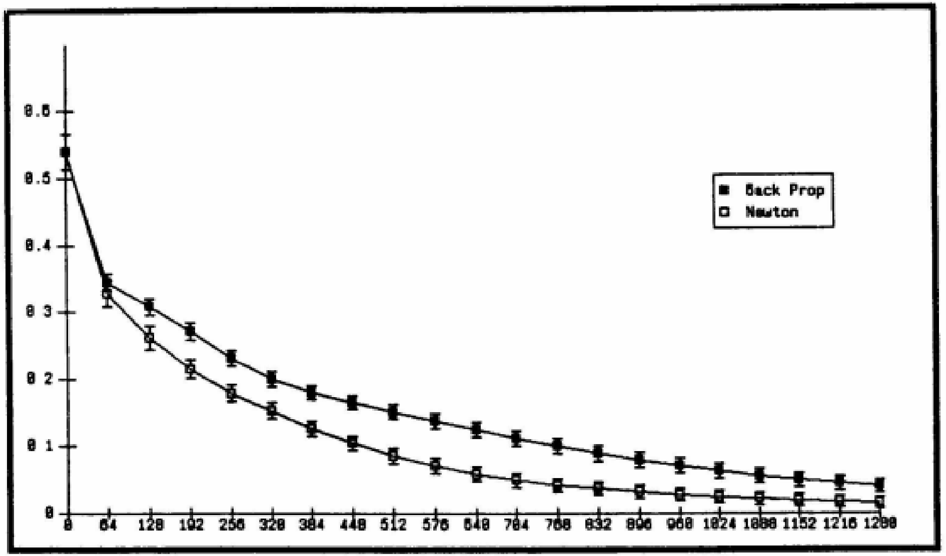


Figure 3: Mean error and standard deviation for 100 repetitions of 1280 pattern presentations with Batch Back Propagation versus Pseudo-Newton learning.

Improving the Convergence of Back-Propagation Learning with Second Order Methods

Sue Becker & Yann le Cun
Department of Computer Science, University of Toronto

Technical Report CRG-TR-88-5
Sept 1988

MNIST https://www.kaggle.com/c/digit-recognizer

Facial Recognition

Face detection

Detect one or more human faces in an image and get back face rectangles for where in the image the faces are, along with face attributes which contain machine learning-based predictions of facial features. The face attribute features available are: Age, Emotion, Gender, Pose, Smile, and Facial Hair along with 27 landmarks for each face in the image.

See it in action


```
Detection result:
JSON:
 [
  {
    "faceId": "da5a0f39-d2bc-4c4b-83ba-41f62e555b4d",
    "faceRectangle": {
      "top": 115,
      "left": 265,
      "width": 140,
      "height": 140
    },
    "faceAttributes": {
      "hair": {
        "bald": 0.06,
        "invisible": false,
        "hairColor": [
          {
            "color": "black",
            "confidence": 1.0
          },
          {
            "color": "brown",
            "confidence": 0.95
          },
          {
            "color": "gray",
            "confidence": 0.43
          }
```