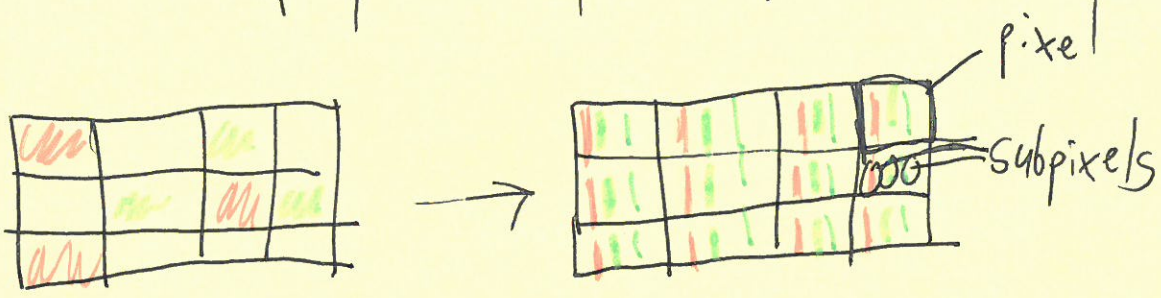
Rasters, Colors, & Coordinates

18 Jan

def Pixel - short for picture element

def Raster display - array of pixels



As input device

- Camera Ex Bayer mosaic

G B G B G B
R G R G R G
G B G B G B
⋮

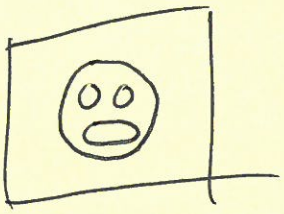
- Raster is ~~device~~ id device independent description of an image

Vector images

- description of how to draw image

Circle .5 .5 .25

circle c_x c_y r



Why is vector good: Scale well

Why use vector images: independent of scale

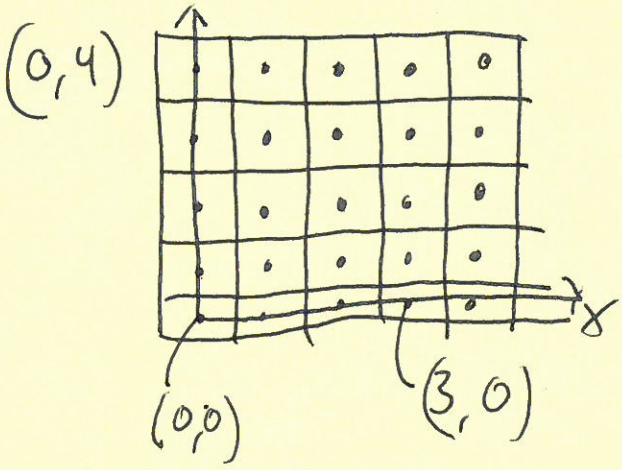
- text/fonts
- high precison is important

Images, Pixels & Geometry

w/ $R \subset \mathbb{R}^2$

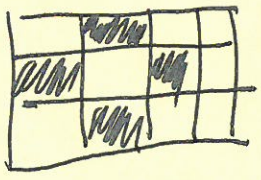
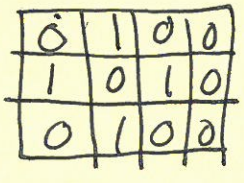
V is set of all pixel values

$$I(x,y) : R \to V$$

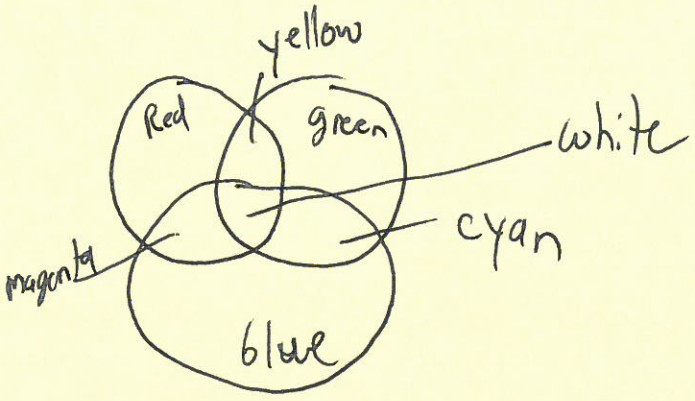


What could we store in each pixel?

- RGB values
- grey scale

- 1-bit image  →  → 010010100100

Representing Color



red + green = yellow

100 010 110

A representation

- each RGB is a float color = (r, g, b)

  w/ $r, g, b \in [0, 1]$

  (high dynamic range)

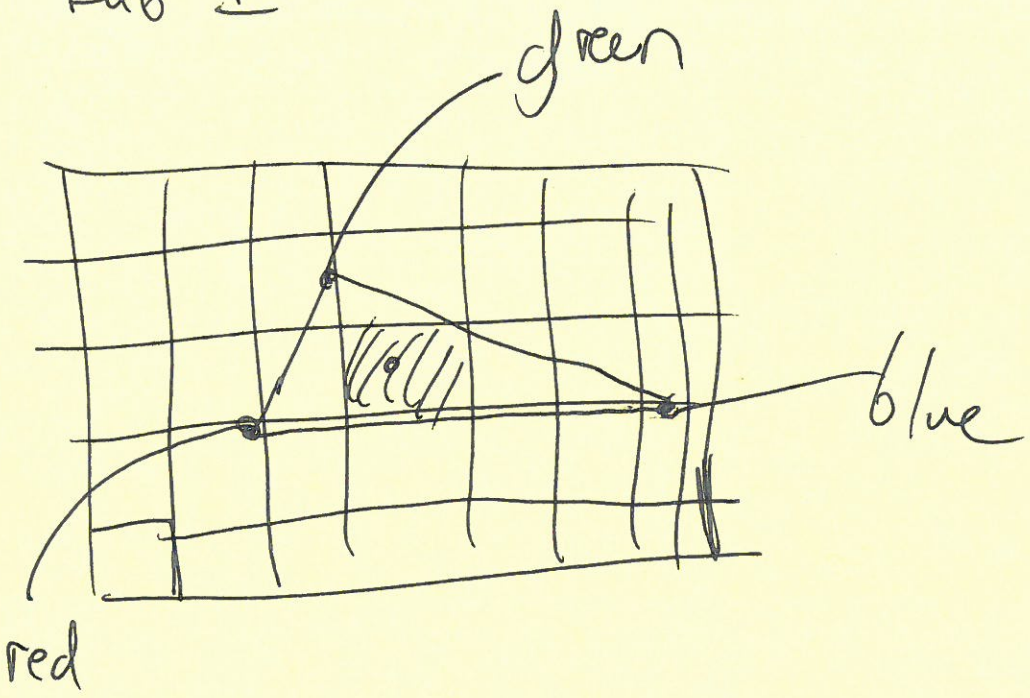
- pixel has vales for each component

  $\{0, 1, \cdots, 255\}$

  ↳ to RGB in $[0, 1]$

  divide by 255

Lab 1



Q1: is a point inside of the Δ

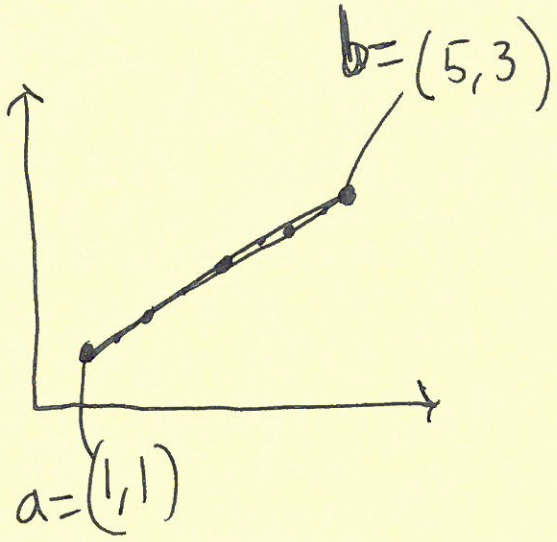
Q2: if it is in Δ what color

Linear interpolation

$a, b \in \mathbb{R}^2$

$t \in [0, 1]$

def $p = (1-t)a + tb$



$t = 0$

$$(1-0)\begin{bmatrix}1\\1\end{bmatrix} + 0\begin{bmatrix}5\\3\end{bmatrix} = \begin{bmatrix}1\\1\end{bmatrix}$$

$t = 1$

$$(1-1)\begin{bmatrix}1\\1\end{bmatrix} + 1\begin{bmatrix}5\\3\end{bmatrix} = \begin{bmatrix}5\\3\end{bmatrix}$$

$t = .5$

$$(1-.5)\begin{bmatrix}1\\1\end{bmatrix} + .5\begin{bmatrix}5\\3\end{bmatrix} =$$

$$\begin{bmatrix}.5\\.5\end{bmatrix} + \begin{bmatrix}2.5\\1.5\end{bmatrix} = \begin{matrix}3\\2\end{matrix}$$

Lines

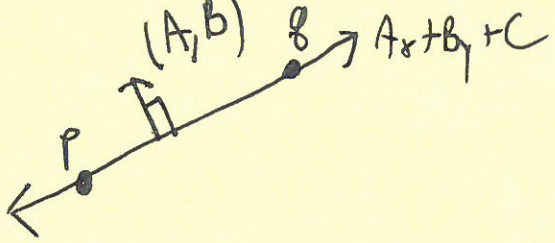
General form for lines: $Ax + By + C = 0$

Given 2 points $p, q \in \mathbb{R}^2$ what is general form line through p, q

$$Ap_x + Bp_y + C = 0$$
$$Aq_x + Bq_y + C = 0$$

$$f(x, y) = Ax + By + C$$

$$\nabla f(x, y) = \begin{bmatrix} A \\ B \end{bmatrix}$$



$\Rightarrow$ ~~vector~~ $\perp$ vector $= t\begin{bmatrix} q_y - p_y \\ q_x - p_x \end{bmatrix} = \begin{bmatrix} p_y - q_y \\ q_x - p_x \end{bmatrix}$

$\Rightarrow$ vector represting slope of line $\begin{bmatrix} q_x - p_x \\ q_y - p_y \end{bmatrix}$

$$\Rightarrow A = p_y - q_y$$
$$B = q_x - p_x$$

$$Ax + By + C = 0$$

$$(p_y - q_y)x + (q_x - p_x)y + C = 0$$

$$C = p_x q_y - q_x p_y$$

$$(p_y - q_y)x + (q_x - p_x)y + p_x q_y - q_x p_y = 0$$

$$\Leftrightarrow \begin{vmatrix} p_x & p_y & 1 \\ q_x & q_y & 1 \\ x & y & 1 \end{vmatrix} = 0$$