Concatenation of Matrices

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 0 \end{bmatrix}, \qquad B = \begin{bmatrix} 4 & 5 \\ 9 & \pi \end{bmatrix}$$

2×3 $\qquad$ 2×2

$$C = \begin{bmatrix} 0 & 0 & 0 \end{bmatrix}$$

1×3

Horizontal Concatenation: $\begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 0 \end{bmatrix}$ with $\begin{bmatrix} 4 & 5 \\ 9 & \pi \end{bmatrix}$

A concatenated with B is $\begin{bmatrix} 1 & 2 & 3 & 4 & 5 \\ 0 & 1 & 1 & 9 & \pi \end{bmatrix}$ 2×5

MATLAB code: `[A,B]`

B concatenated with A is $\begin{bmatrix} 4 & 5 & 1 & 2 & 3 \\ 9 & \pi & 0 & 1 & 0 \end{bmatrix}$

MATLAB code: `[B,A]`

A concatenated with C

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 0 \end{bmatrix}, \quad C = [0\ 0\ 0]$$

`[A,C]` = ERROR!

CAUTION: in order to horizontally concatenate, we need the matrices to have the same # rows!

Vertical Concatenation:

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 0 \end{bmatrix}, \quad C = [0\ 0\ 0]$$

A (vertically) concatenated with C is $\begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

MATLAB code: `[A;C]`

ASIDE/PRO TIP: tell MATLAB to stop what its doing by using CTRL+C.

C concatenated with A is $\begin{bmatrix} 0 & 0 & 0 \\ 1 & 2 & 3 \\ 0 & 1 & 0 \end{bmatrix}$

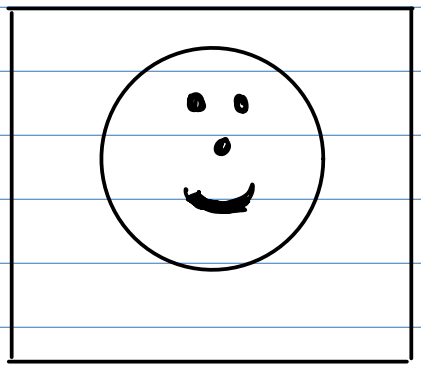
MATLAB code: `[C;A]`

CAUTION: to do vertical concatenation, both matrices must have the same # columns!

`[A;B]` ⇝ ERROR!

$A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 4 & 5 \\ 9 & \pi \end{bmatrix}$

Pixels and RGB values



- Matrix of pixels
- each pixel is a tiny square of color
- color of each pixel is specified by a triple of integers (r, g, b) between 0, 255

(255, 0, 0) ≈ bright red
(50, 0, 0) = dark red
(0, 0, 0) = black
(255, 255, 255) = white
(100, 100, 100) = gray

Image ⇒ array $n_x \times n_y \times 3$

A black and white image is specified by a matrix of black and white pixels whose values are grayscale, specified by an integer between 0 and 255.

0 ↑ black

255 ↑ white.