



# The Matrix Pt. 1

John Hohman

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# Dimensions



Column Vector:  $\begin{pmatrix} 2 \\ 4 \\ 1 \end{pmatrix}$

Row Vector:  $(2 \quad 4 \quad 1)$

# A Matrix

$$I_3 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Note - This is an identity Matrix

# Matrix Addition

Only like size matrices can be added

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} + \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix} = \begin{bmatrix} a_{11} + b_{11} & a_{12} + b_{12} \\ a_{21} + b_{21} & a_{22} + b_{22} \end{bmatrix}$$

# Scalar Matrix Multiplication

$$k \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} = \begin{bmatrix} ka_{11} & ka_{12} \\ ka_{21} & ka_{22} \end{bmatrix}$$

# Matrix Multiplication

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix} = \begin{bmatrix} a_{11}b_{11} + a_{12}b_{21} & a_{11}b_{12} + a_{12}b_{22} \\ a_{21}b_{11} + a_{22}b_{21} & a_{21}b_{12} + a_{22}b_{22} \end{bmatrix}$$

$$\begin{bmatrix} a \\ b \\ c \end{bmatrix} \begin{bmatrix} x & y & z & w \end{bmatrix} = \begin{bmatrix} ax & ay & az & aw \\ bx & by & bz & bw \\ cx & cy & cz & cw \end{bmatrix}$$

$$\begin{bmatrix} x & y & z \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix} = [ax + by + cz]$$

- Notice the input dimensions and output dimensions
- Not communicative



**Questions?**

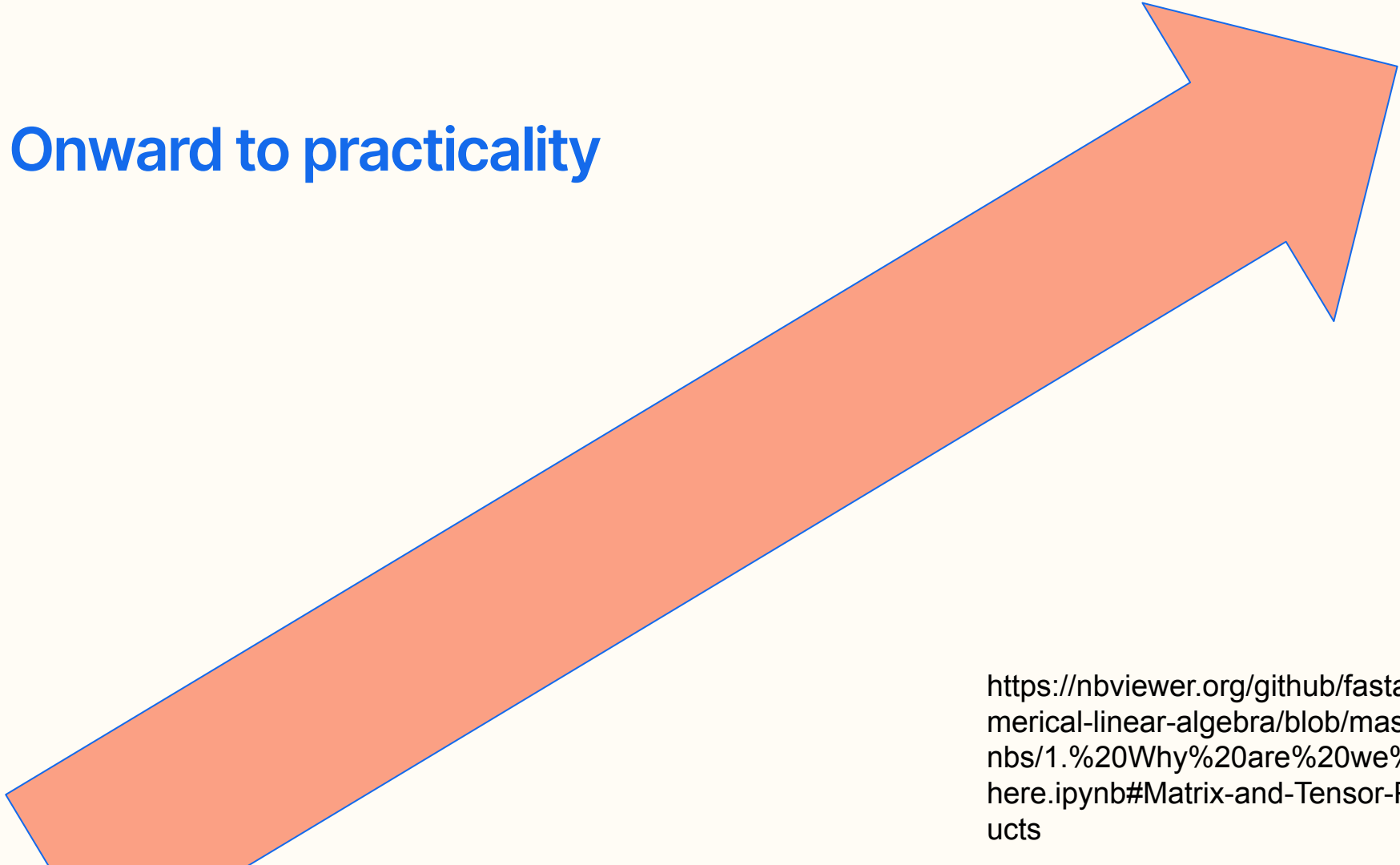


Let's do some practice!



<https://images.pexels.com/photos/796603/pexels-photo-796603.jpeg?cs=srgb&dl=hand-desk-notebook-796603.jpg&fm=jpg>

# Onward to practicality



<https://nbviewer.org/github/fastai/numerical-linear-algebra/blob/master/nbs/1.%20Why%20are%20we%20here.ipynb#Matrix-and-Tensor-Products>

## Next Week -



## Reinforcement Learning

Goal: Write a script to perform Gaussian Elimination automatically when provided a system of linear equations and notebook exercises.