1 Python, Numpy, and Matplotlib

Watch out for:

Examlet 0

HW0

Quiz 3 due before class

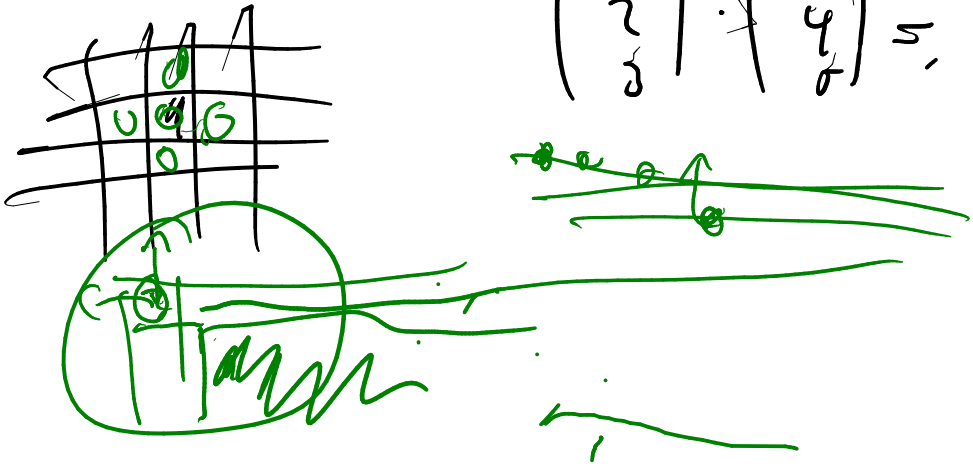
Programming Language: Python/numpy

- Reasonably readable
- Reasonably beginner-friendly
- Mainstream (top 5 in 'TIOBE Index')
- Free, open-source
- Great tools and libraries (not just) for scientific computing
- Python 2/3? 3!
- `numpy`: Provides an array datatype
  Will use this and `matplotlib` all the time.
- See class web page for learning materials

- **Demo:** Python
- **Demo:** numpy

In-class exercise: Pixel Averaging

$$\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} \cdot \begin{pmatrix} 2 \\ 4 \\ 6 \end{pmatrix} = 2+8+18 = 28$$



2 Making Models with Polynomials

Why polynomials?

$$a_3x^3 + a_2x^2 + a_1x + a_0$$

- How do we write the general case?
- *Why* polynomials and not something else?

$$\sum_{i=0}^{n} a_i x^i$$

- Simple
- Use +, · to evaluate
  → easy to build hw for

Reconstructing a Function From Derivatives

- If we know $f(x_0), f'(x_0), f''(x_0)$, can we reconstruct the function as a polynomial?

$$f(x) = ??? + ???x + ??? x^2 + \cdots$$

$x_0 = 0$

$f(0)$
$f'(0)$
$f''(0)$
$f'''(0)$

$f(x) = a + bx + cx^2 + dx^3 \rightarrow f(0) = a$

$f'(x) = b + 2cx + 3dx^2 \rightarrow f'(0) = b$

$f''(x) = 2c + 3 \cdot 2 \cdot dx \rightarrow \frac{f''(0)}{2} = c$

$a_i = \frac{f^{(i)}(0)}{i!} \rightarrow \frac{f'''(0)}{3 \cdot 2} = d$

$$f(x) \approx f(0) + f'(0) \cdot x + \frac{f''(0)}{2} x^2$$

$$f(x) \approx \sum_{i=0}^{n} \frac{f^{(i)}(0)}{i!} \cdot x^i$$

Demo: Polynomial Approximation with Polynomials (Part I)