Matrix Programming

Introduction

Studying patients with Babbage's Syndrome

How effective are available treatments?

	A	B	C
John	2.5	3.5	3.0
Mary	3.0	1.5	3.0
Zura	2.5	2.0	5.5

How similar are patients' responses?

Can we use similarity to recommend treatments?

Answer these questions with matrix operations

How to implement them in software?

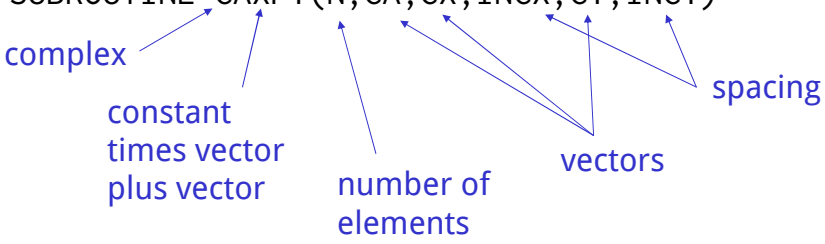
Option 1: write loops

- Makes programs many times longer than the corresponding mathematics
- And it's hard code to debug...
- ...and tune

Option 2: use libraries written in low-level, high-performance languages like Fortran and C

- Someone else has written, debugged, and tuned all the loops
- But the interface is...awkward

```
SUBROUTINE CAXPY(N,CA,CX,INCX,CY,INCY)
```



Option 3: use a high-level language like MATLAB

Or a library like Python's NumPy

Present a *data-parallel* programming model

- Operate on entire arrays at once
- No loops!

Hide details of optimizations

- Particularly differences between machines

All provide basically the same features

- Often wrappers around the same underlying libraries

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