LA

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Linear Algebra Notes

Week 1: Syllabus Week and Vector Stuff!

Notation

- Vector: Ordered list of numbers
- n-vector: vector with n entries
- ith element: a_i
  - indexes run from 1 to n
- $a = b$ if they are the same length and $a_i = b_i$ for all i

Block Vectors

A block vector (or stacked vector) is a concatenation of vectors

Special Vectors

- n-vectors
  - All Entries 0: Denoted as 0_n or just 0
  - All entries 1: Denoted as 1_n or just $\mathbf{1}$
  - A unit vector has all entries 0 except for one
- A unit vector has all entries 0 except for one
  - denoted e_i where the ith intry is 1

Sparsity

- Vector with many entries 0
- Stored very effeciently on a computer
- $\mathrm{nnz}(x)$ is the number of nonzero

Vectors as representation

- Location/displacement
- Physics
- Colors
- Images
- Word counts

Vectors can represent all sorts of things, which is why LA is so important!

Vector Addition

n-vectors a and b are added via elementwise addition, denoted $a + b$

- commutative
- associative
- identity
- zero

All just the same as normal addition. Vector addition can be viewed as the total displacement of the system, viewing from a visual standpoint

Scalar multiplication

Elementwise multiplication by a scalar

- Denoted $a\beta$ or βa
- Associative and left/right distributive