Review

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Outline

Course topics

What’s next
Vectors

- definitions, notation, stacking, slicing
- addition/subtraction, scalar multiplication
- inner product, norm, distance, RMS value
- mean and standard deviation
- Cauchy-Schwarz inequality, angle
- correlation coefficient
Linear independence

- linear combination of vectors
- linear dependence and independence
- independence-dimension inequality
- basis
- orthonormal set of vectors, Gram-Schmidt algorithm
Matrices

- definitions, notation, block matrices, submatrices
- addition/subtraction, scalar multiplication
- matrix-vector multiplication, linear equations
- matrix multiplication
- QR factorization
- left and right inverses, pseudo-inverse
- inverse, solving linear equations
Theory (linear algebra)

- columns of $A$ are independent $\iff$ Gram matrix $A^T A$ is invertible
- $A$ has a left inverse $\iff$ columns of $A$ are linearly independent
- $A$ has a right inverse $\iff$ rows of $A$ are linearly independent
- (square) $A$ is invertible $\iff$
  - columns are independent, or
  - rows are independent
Least-squares

- basic least squares problem
- solution via pseudo-inverse, QR factorization
- multi-objective least squares via weighted sum
- equality-constrained least squares
- solution via KKT system
Fitting models to data

- least squares data fitting
- regression model
- validation on a test set
- regularization
- least squares classification
Computational complexity

- floating-point operation (flop)
- vector-vector operations (inner product, norm, ...)
- matrix-vector multiplication, matrix-matrix multiplication
- QR factorization
- inverse, solving linear equations
- least squares
- linearly constrained least squares
Outline

Course topics

What’s next
Some related courses

- Math 113 (linear algebra)
- EE 263 (more applied linear algebra)
- CME 200 (computational linear algebra)
- CS 229 (machine learning)
- CS 221 (artificial intelligence)
- EE 364A (convex optimization)
- CS 109 (probability)
- EE 178 (probability)
- ... and many other applications courses