Linear Algebra

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Liner Algebra wikipedia

- **Linear algebra** is the branch of mathematics concerning vector spaces and linear mappings between such spaces. Such an investigation is initially motivated by a system of linear equations containing several unknowns. Such equations are naturally represented using the formalism of matrices and vectors.
- Linear algebra is central to both pure and applied mathematics. Techniques from linear algebra are also used in analytic geometry, engineering, physics, natural sciences, computer science, computer animation, and the social sciences (particularly in economics). Because linear algebra is such a well-developed theory, nonlinear mathematical models are sometimes approximated by linear ones.

Liner Algebra wikipedia

- The study of linear algebra first emerged from the study of determinants, which were used to solve systems of linear equations.
- Determinants were used by Leibniz in 1693, and subsequently, Gabriel Cramer devised Cramer's Rule for solving linear systems in 1750.
- Later, Gauss further developed the theory of solving linear systems by using Gaussian elimination, which was initially listed as an advancement in geodesy.

Goals

- The goals for this class are using matrices and also understanding them. Here are key computations and some of the ideas behind them:

1. Solving $A\boldsymbol{x} = \boldsymbol{b}$ for square systems by elimination (pivots, multipliers, back substitution, invertibility of A, factorization into $A = LU$)
2. Complete solution to $A\boldsymbol{x} = \boldsymbol{b}$ (column space containing $\boldsymbol{b}$, rank of A, nullspace of A and special solutions to $A\boldsymbol{x} = \boldsymbol{0}$ from row reduced R)
3. Basis and dimension (bases for the four fundamental subspaces)
4. Least squares solutions (closest line by understanding projections)
5. Orthogonalization by Gram-Schmidt (factorization into $A = QR$)
6. Properties of determinants (leading to the cofactor formula and the sum over all $n!$ permutations, applications to inv(A) and volume)
7. Basic to Eigenvalues and eigenvectors

Question?