

Linear Algebra and Elements of Statistical Inference

Upon completion of this course, the students will be able to:

Unit 1: Vectors, Matrices, and Spaces

1. Define what a vector is and calculate the length of a vector.
2. Determine the angle between two vectors and identify orthogonal and orthonormal vectors.
3. Analyze linear dependence and independence of vectors in a given set.
4. Discuss the concepts of vector spaces, spanning sets, basis, and dimension of a vector space.
5. Compute the projection of a vector on a vector space and utilize orthogonal basis and orthocomplement in vector space analysis.
6. Implement the Gram-Schmidt orthogonalization procedure to obtain an orthogonal basis.
7. Investigate the row space and column space of a matrix and perform operations such as addition, subtraction, and multiplication by scalar and matrix.
8. Identify null matrices, identity matrices, symmetric and skew symmetric matrices, orthogonal matrices, and analyze the rank of a matrix.
9. Evaluate singular and non-singular matrices, inverse of a matrix, idempotent matrices, and elementary transformations on a matrix.
10. Transform a matrix to echelon and diagonal forms using elementary transformations.
11. Calculate the trace of a matrix, understand partitioning of matrices, and apply simple properties of matrices.

Unit 2: Linear System Solution Methods

1. Utilize Gaussian elimination, LU factorization, QR factorization, and Cholesky method to solve a linear system of equations.
2. Apply Jacobi's method and Gauss-Seidel method for iterative solutions to linear systems.

Unit 3: Characteristic Roots and Quadratic Forms

1. Compute characteristic roots and characteristic vectors of a matrix and analyze their properties.
2. Implement spectral decomposition and singular value decomposition for matrices.
3. Classify quadratic forms and perform canonical reduction on them.

By the end of the course, students will have demonstrated a mastery of the concepts and techniques related to linear algebra and statistical inference, enabling them to apply these principles in mathematical and statistical analyses effectively.

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