

1. Vectors and Scalars:

- A scalar is a single numerical value.
- A vector is an ordered collection of scalars. It has both magnitude and direction.

2. Vector Operations:

- Vector Addition: Adding corresponding elements of two vectors.
- Scalar Multiplication: Multiplying a vector by a scalar.
- Dot Product (Inner Product): A binary operation that takes two equal-length sequences of numbers (usually vectors) and returns a single number. It's defined as the sum of the products of their corresponding components.

3. Matrices:

- A matrix is a 2-dimensional array of numbers, symbols, or expressions arranged in rows and columns.

4. Matrix Operations:

- Matrix Addition and Subtraction: Element-wise addition or subtraction of corresponding elements of two matrices of the same size.
- Scalar Multiplication of a Matrix: Multiplying every element of a matrix by a scalar.
- Matrix Multiplication: A more complex operation that involves the dot product of rows and columns.

5. Transpose of a Matrix:

- The transpose of a matrix flips it over its diagonal.

6. Matrix Inversion:

- The inverse of a square matrix A (denoted as A^{-1}) is another matrix such that when it's multiplied by A , the result is the identity matrix.

7. Eigenvalues and Eigenvectors:

- For a square matrix A , an eigenvector is a non-zero vector v such that Av is a scalar multiple of v . The corresponding scalar is called the eigenvalue.

8. Determinant:

- The determinant of a square matrix is a scalar value that can be computed from the elements of the matrix.

9. Solving Linear Systems:

- Linear algebra is used to solve systems of linear equations. This is particularly important in regression problems in machine learning.

10. Matrix Decompositions:

- Techniques like LU decomposition, QR decomposition, and Singular Value Decomposition (SVD) are used to factorize a matrix into simpler, more interpretable components.

11. Norms:

- A norm is a way of measuring the size of a vector. Common norms include the L1-norm (sum of absolute values), L2-norm (Euclidean norm), and infinity-norm (maximum absolute value).

12. Orthogonality:

- Vectors are orthogonal if their dot product is zero. A set of vectors is orthonormal if they are orthogonal and all have a unit norm.

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