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Report

An eigenvector, corresponding to a real nonzero eigen value, points in a direction in which it is stretched by the transformation & the eigen value is the factor by which it is stretched, if the eigen value is negative the direction is reversed. Loosely speaking, in a multi dimensional vector space, the eigenvectors is not rotated. However, in a one dimensional vector space, the concept of rotation is meaningless.

If T is a linear transformation from a vector space V over a field F into itself & v is a nonzero vector in V, then v is an eigenvector of T if T(v) is a scalar multiple of v, this can be written as where λ is a scalar in F, known as the eigen value, characteristic value, or characteristic not associated with v,

There is a direct correspondance b/w n by n square matrices & linear transformations from an n-dimensional vector space into itself, given any basis of the vector space, Hence in a finite dimensional vector space, it is equivalent to define eigenvalues & eigenvectors using either the language of matrices or the language of linear transformation.

If V is finite dimensional, the above eqn is equivalent to where A is the matrix representation of T & u is the coordinate vector of V.

In essence, an eigenvector v of a linear transformation T is a nonzero vector that, when T is applied to it, does not change direction. Applying T to the eigenvector only scales the eigenvector by the scalar value λ, called an eigenvalue. This condition can be written as the eqn referred to as the eigenvalue eqn or eigen eqn. in general λ may be any scalar. for ex: λ may be negative, in which case the eigen vector reverses direction as part of the scalling, or it may be zero or complex.

Linear transformations can take many different form, mapping vectors in a variety of vector spaces, so the eigenvectors can also take many forms. for ex: the linear transformation could be a differential operat like, in which case the eigenvectors are funs called eigenfuns that are scaled by that differential operator, such as.

Alternatively, the linear transformation could take the form of an n by n matrix, in which case the eigen vectors are n by 1 matrices. if the linear transformation is expressed in the form of an n by n matrix A then the eigenvalue eqn above for a linear transformation can be rewritten as the matrix multiplication.

Where the eigenvector v is an n by 1 matrix, for a matrix, eigenvalues & eigenvectors can used to decompose the matrix, for ex: by diagonizing it. eigen values & eigen vectors give rise to many closely related mathematical concepts, & the prefix eigen- is applied liberally when naming them

→ The set of all eigenvectors of a linear transformation, each paired with its corresponding eigenvalue, is called the eigensystem of that transformation

→ The set of all eigenvectors T corresponding to the same eigenvalue, together with the zero vector, is called an eigenspace or characteristic space of T associated with that eigenvalue.

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