

Special cases of eigendecomposition

Every diagonalizable matrix has $A = PDP^{-1}$. Narrower classes get a better P : unitary for normal matrices, orthogonal for real symmetric ones.

$$A^T = A \subset AA^* = A^*A \subset PDP^{-1} \subset n \times n$$

$n \times n$ **Square**

an eigendecomposition may not exist

PDP^{-1} **Diagonalizable**

P invertible

$AA^* = A^*A$ **Normal**

adds **the complex case** · U unitary

$A^T = A$ **Real symmetric**

$A = QDQ^T$, Q orthogonal

What symmetry buys

With $A = QDQ^T$, inversion is free, norms are preserved and the pieces are orthogonal projections. D is real exactly when the matrix is Hermitian.

