SVD

Imagine you have a rectangular matrix A (size m x n). SVD breaks down A into three matrices:

- **U (m x m):** Left singular vectors. These represent the directions of maximum variance in the data represented by A. Each column of U is a unit vector (length 1) pointing in a direction of significant variation.
- **Σ (Sigma) (m x n):** Diagonal matrix. This contains the singular values, which are non-negative real numbers on the diagonal. The singular values represent the magnitude of variance along each direction identified by the left singular vectors (U). Larger singular values indicate directions with more significant variations in the data.
- **V^T (n x n):** Right singular vectors (transpose). These represent a new basis for the data. Each row of V^T represents a data point from the original matrix A projected onto the new basis defined by the left singular vectors (U).