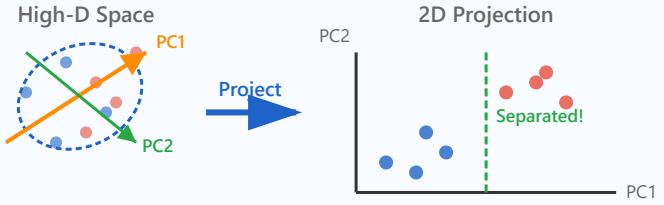
Dimensionality Reduction

PCA

Principal Component Analysis - linear transformation preserving maximum variance

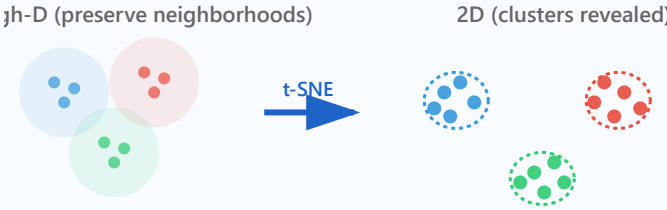


Clinical Applications:

→ Gene expression clustering
→ Quality control visualization
→ Batch effect detection

t-SNE

t-Distributed Stochastic Neighbor Embedding - nonlinear visualization method



Clinical Applications:

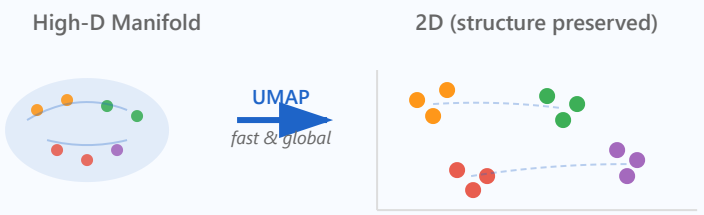
→ Single-cell RNA-seq visualization
→ Patient subtype discovery
→ Exploratory data analysis

UMAP

Uniform Manifold Approximation - faster than t-SNE, preserves global structure

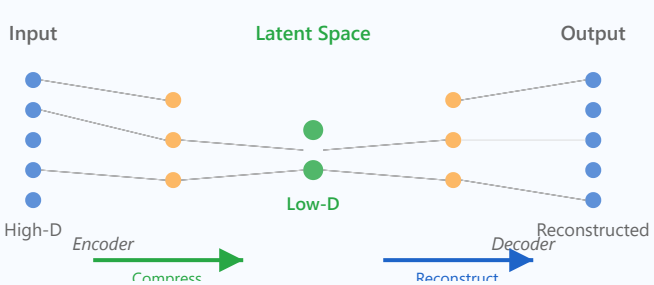
Autoencoders

Deep learning compression - learns nonlinear representations



Clinical Applications:

→ Large dataset visualization
→ Multimodal data integration
→ Trajectory inference



Clinical Applications:

→ Feature extraction for prediction
→ Denoising medical images
→ Anomaly detection