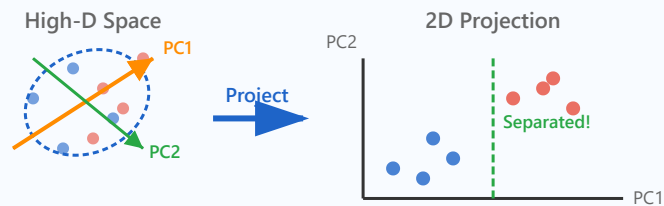


Dimensionality Reduction

PCA

Principal Component Analysis - linear transformation preserving maximum variance

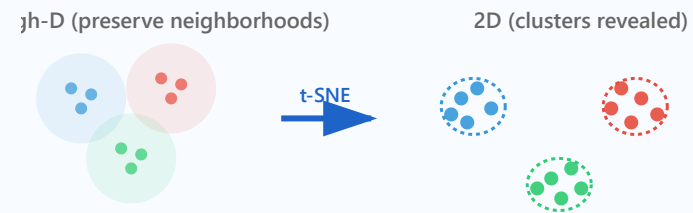


Clinical Applications:

- 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

High-D Manifold



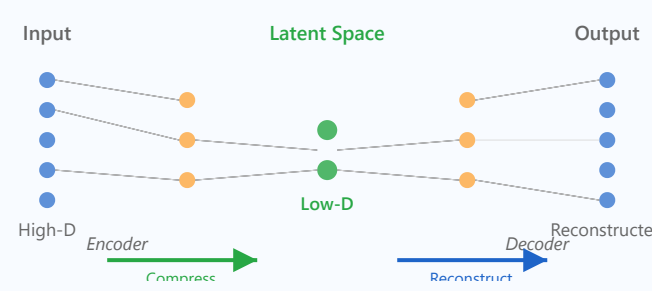
UMAP
fast & global

2D (structure preserved)



Clinical Applications:

- Large dataset visualization
- Multimodal data integration
- Trajectory inference



Clinical Applications:

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