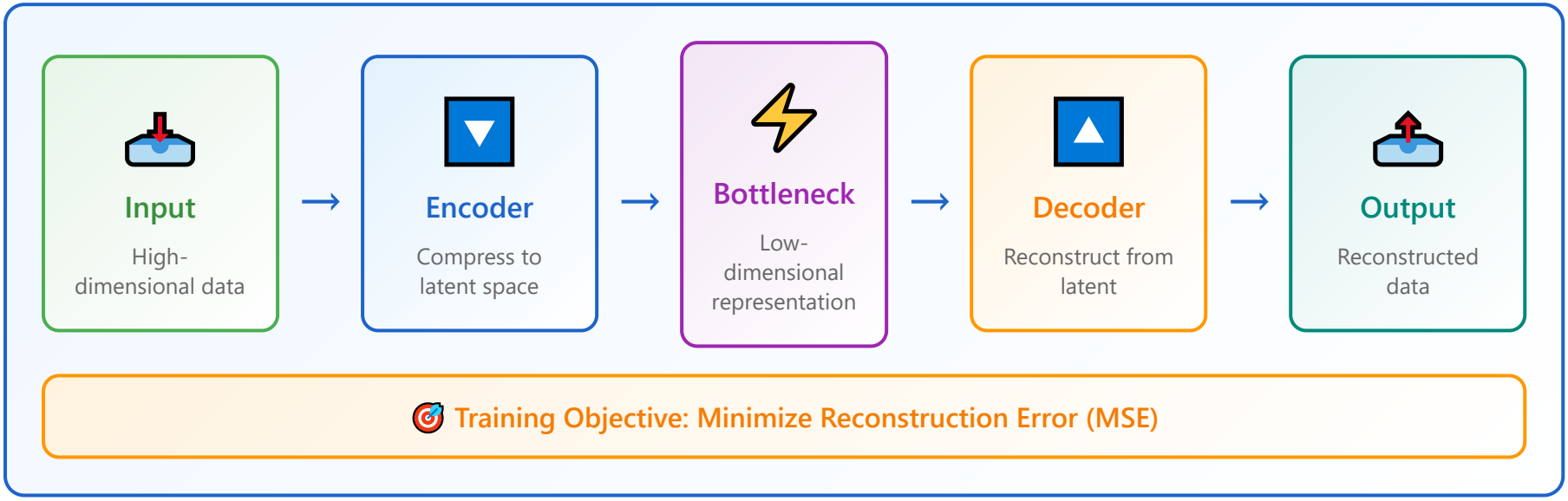
Autoencoder for Dimensionality Reduction

Neural network approach with encoder-bottleneck-decoder architecture



Variants

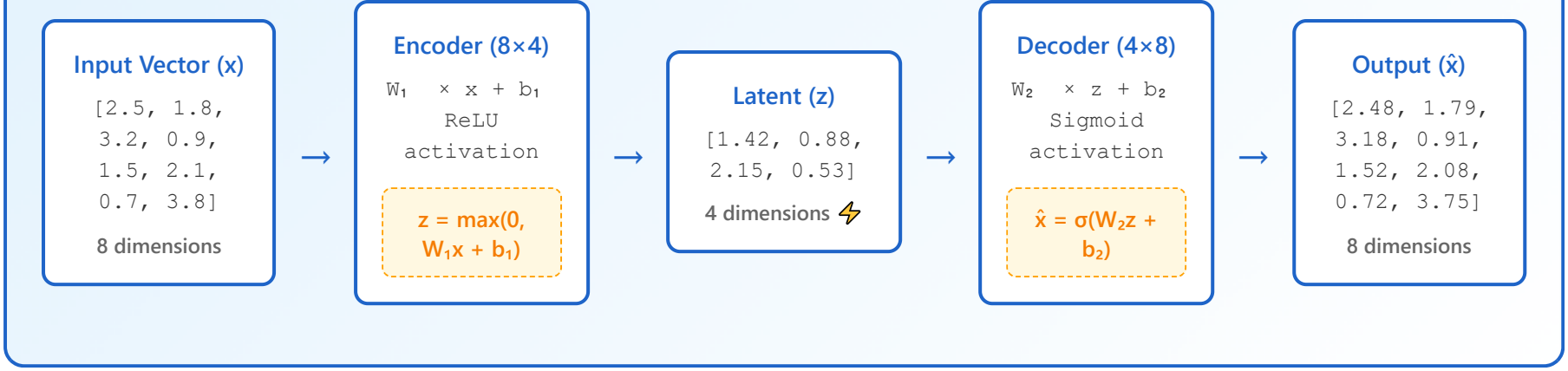
- Denoising
- Sparse
- Contractive

Non-linear transformation can learn complex manifolds

Applications

- Image compression
- Feature learning
- Anomaly detection

Calculation Example: 8D → 4D Compression


Input Vector (x)
[2.5, 1.8, 3.2, 0.9, 1.5, 2.1, 0.7, 3.8]
8 dimensions
Encoder (8×4)
W₁ × x + b₁
ReLU activation
z = max(0, W₁x + b₁)
Latent (z)
[1.42, 0.88, 2.15, 0.53]
4 dimensions
Decoder (4×8)
W₂ × z + b₂
Sigmoid activation
x̂ = σ(W₂z + b₂)
Output (x̂)
[2.48, 1.79, 3.18, 0.91, 1.52, 2.08, 0.72, 3.75]
8 dimensions