

Linear Autoencoder

ICP

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ECE 5258

Pattern Recognition

Fall 2021

Purpose

- Create a linear autoencoder
- Sample Covariance Matrix PCA
- Denoiseing

Theory

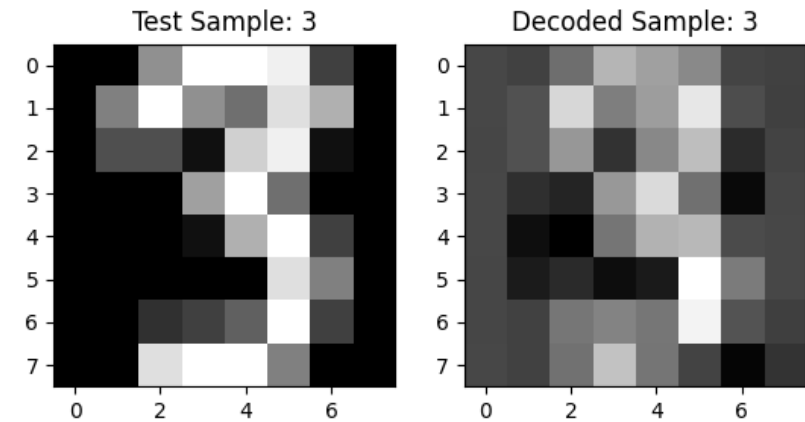
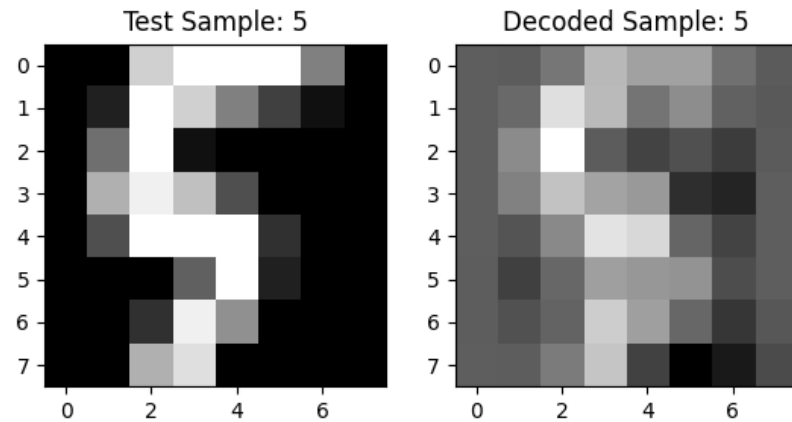
- Encoder
 - Sample Covariance Matrix PCA
 - Maps D to H dimensions
- Decoder
 - Maps H to D dimensions

Data

- Three Data Sets
 - MNIST 8x8 Digits
 - MNIST 28x28 Digits
 - Yale Faces
- Sample
 - D-length vector
 - Dimensions value = Pixel strength

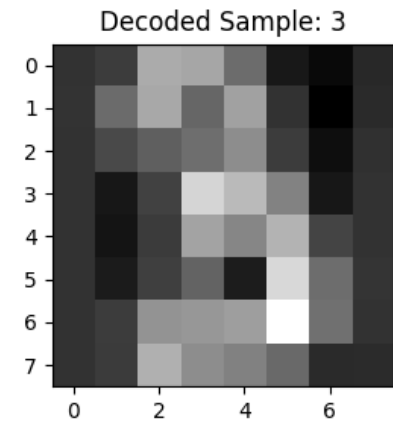
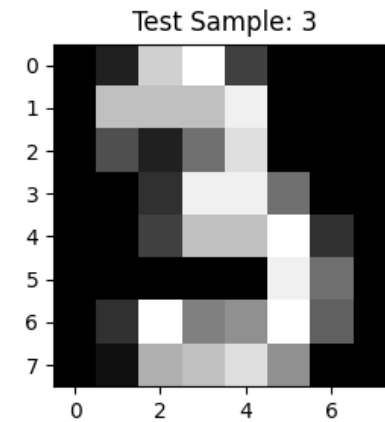
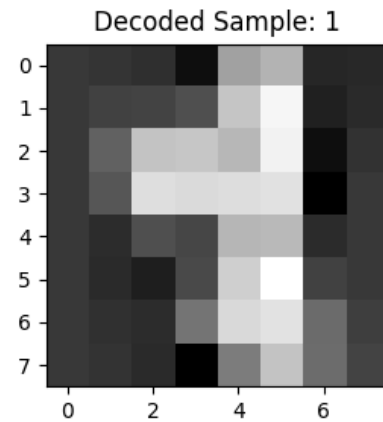
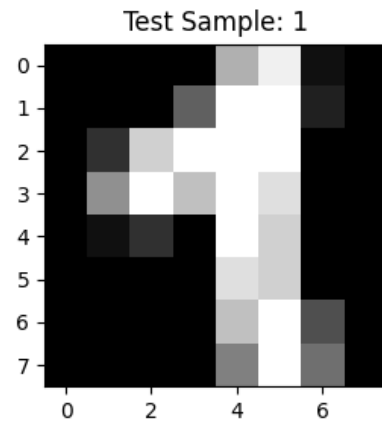
8x8 Digits

- $P = 0.8$
- $H = 13$



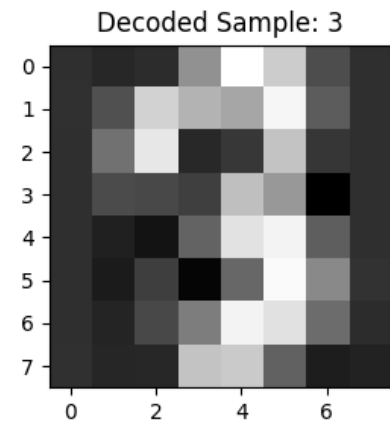
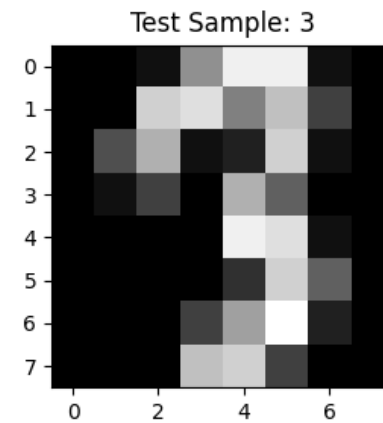
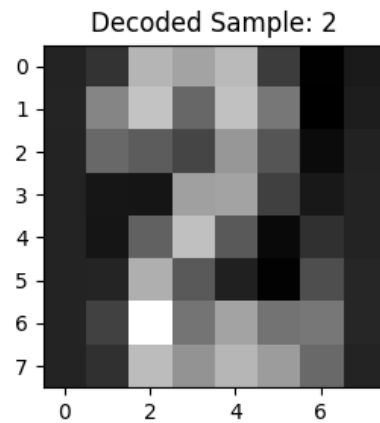
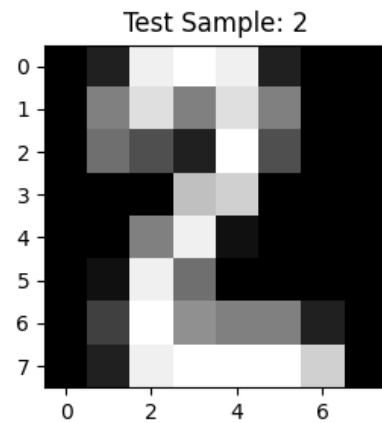
8x8 Digits

- $P = 0.85$
- $H = 17$



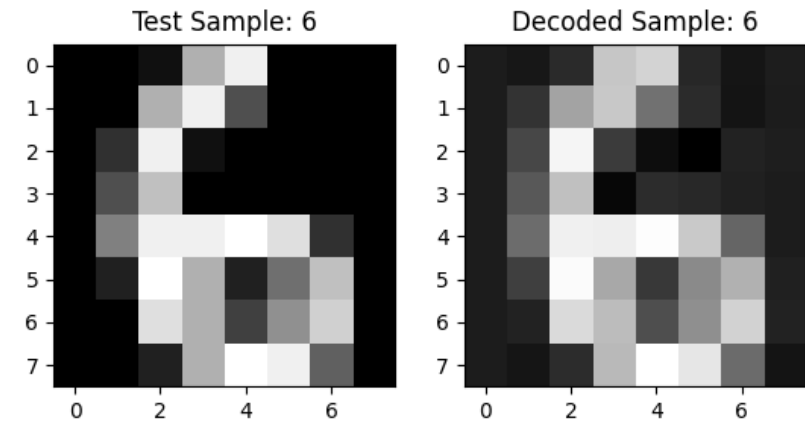
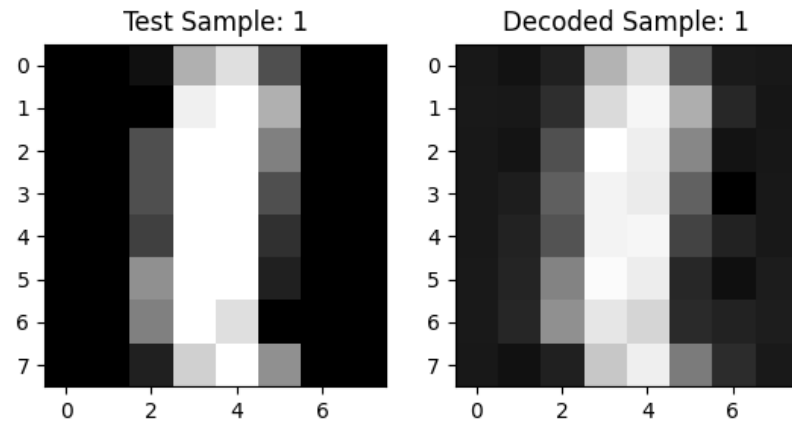
8x8 Digits

- $P = 0.9$
- $H = 21$



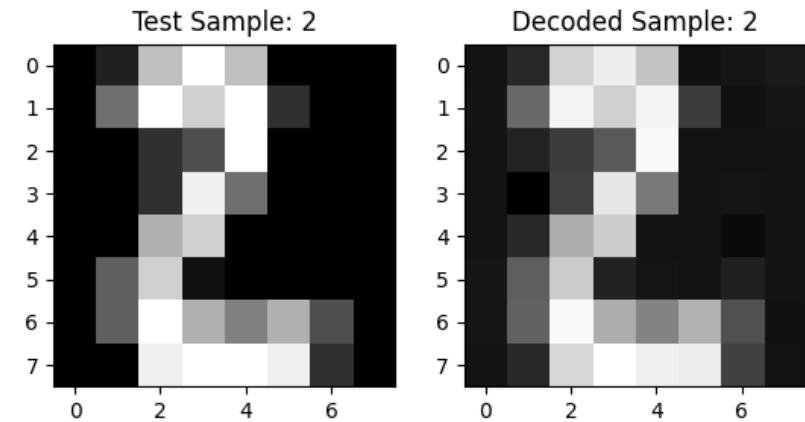
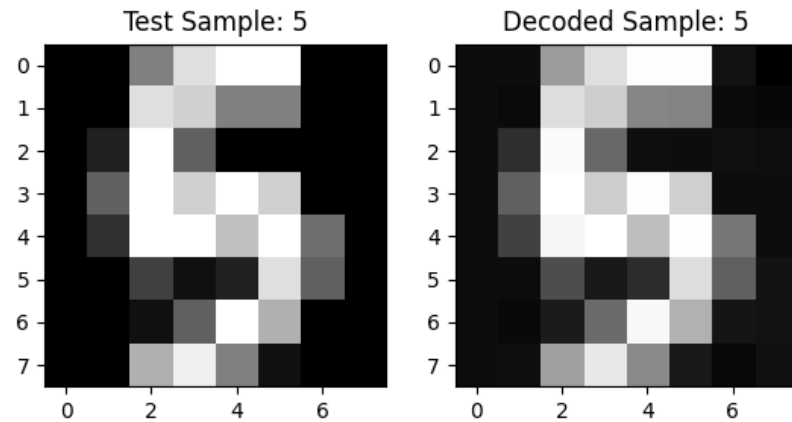
8x8 Digits

- $P = 0.95$
- $H = 29$



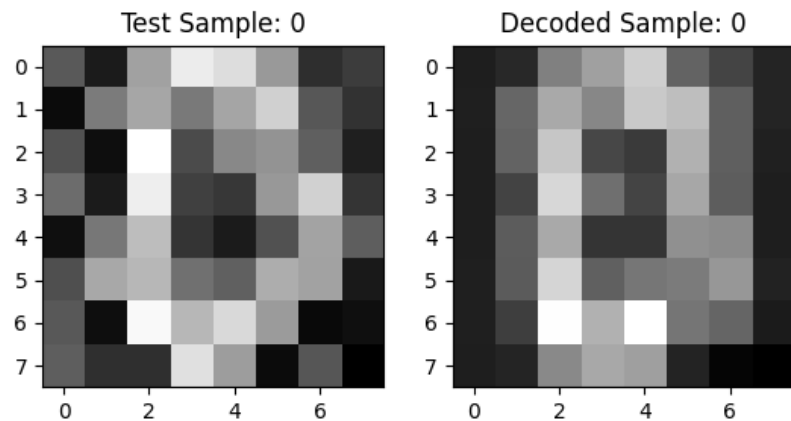
8x8 Digits

- $P = 0.99$
- $H = 41$

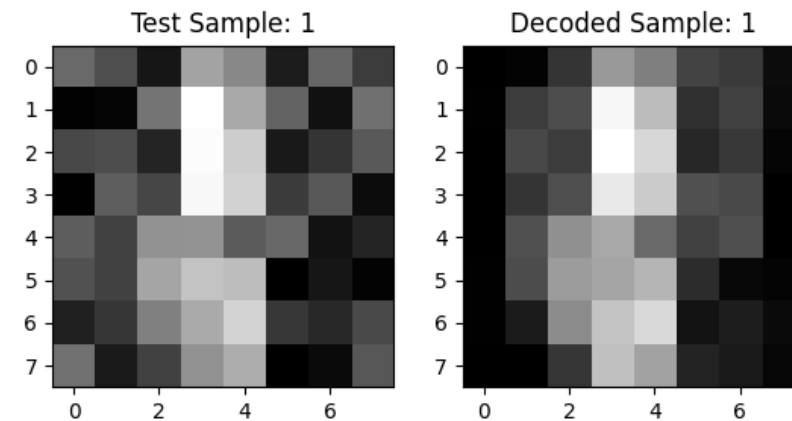


8x8 Digits with Noise

$P = 0.9$

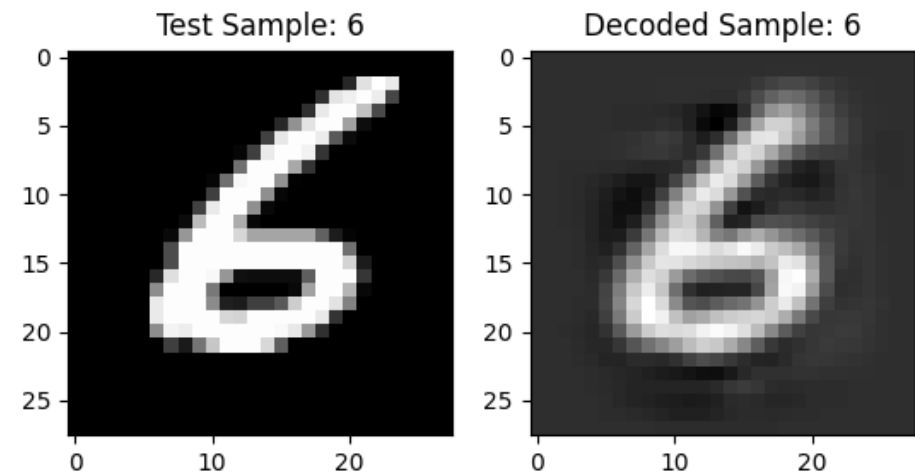


$P = 0.95$



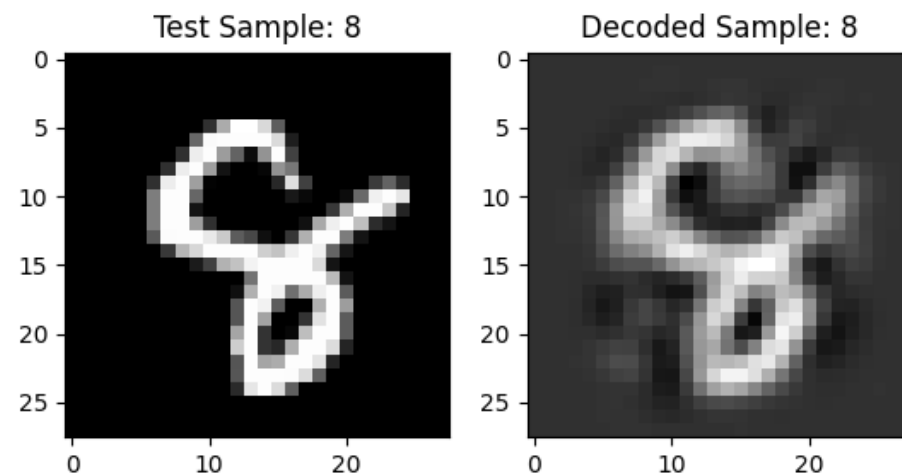
28x28 Digits

- $P = 0.8$
- $H = 44$



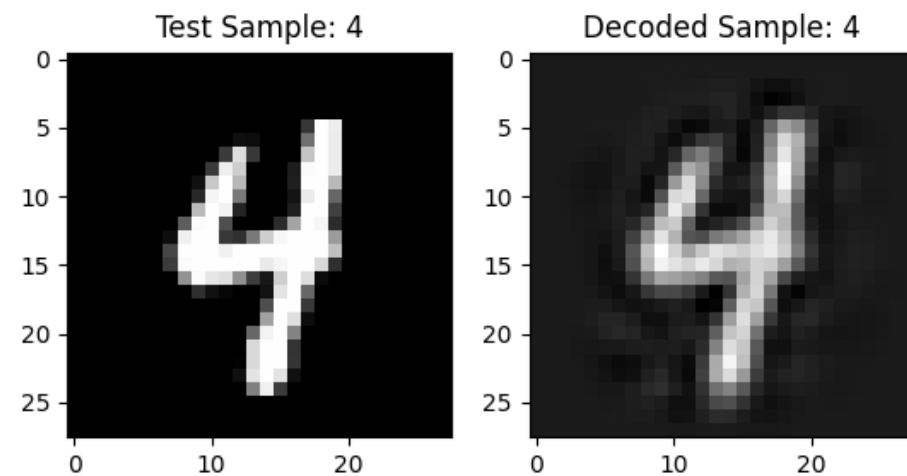
28x28 Digits

- $P = 0.85$
- $H = 59$



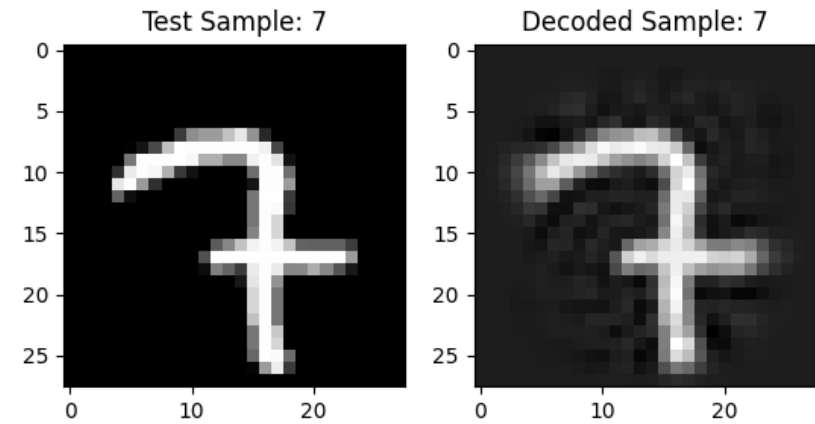
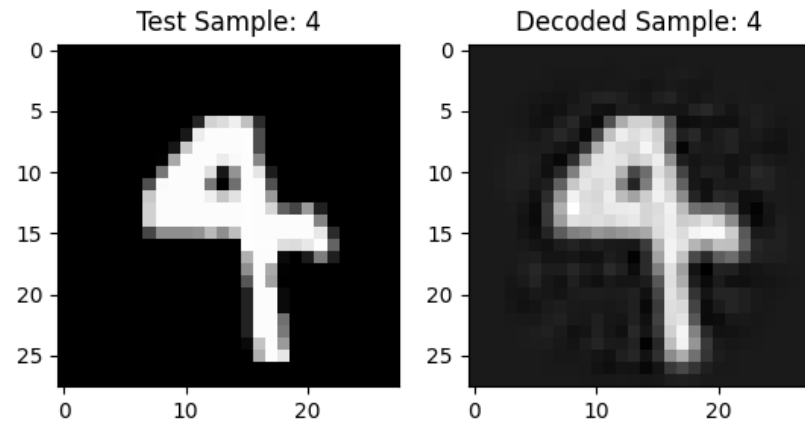
28x28 Digits

- $P = 0.9$
- $H = 87$



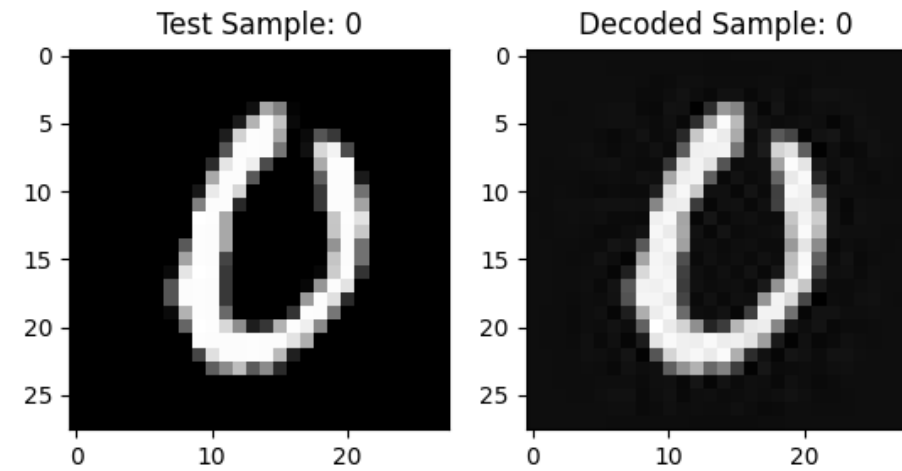
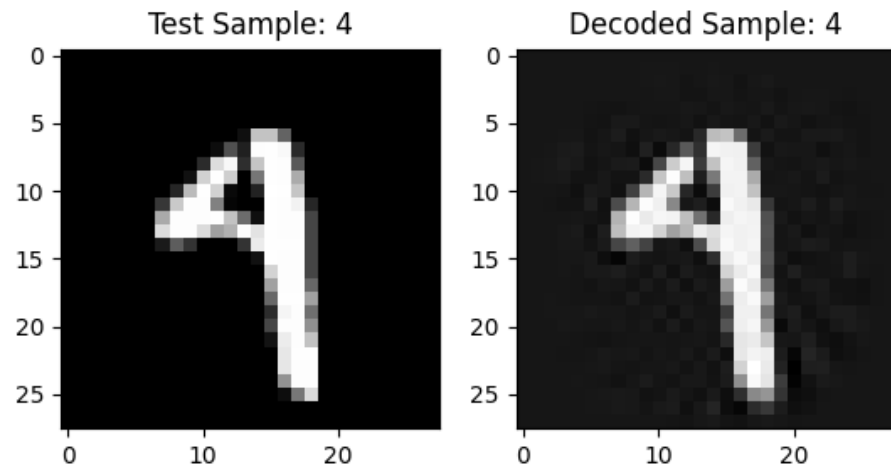
28x28 Digits

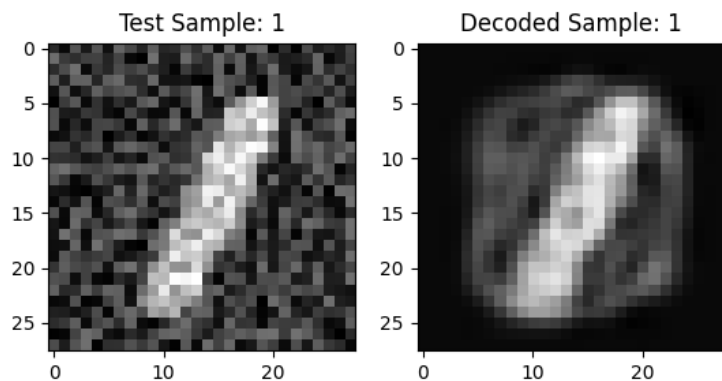
- $P = 0.95$
- $H = 154$



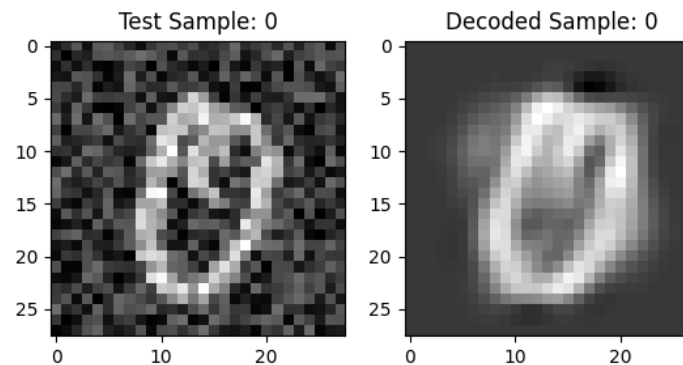
28x28 Digits

- $P = 0.99$
- $H = 331$

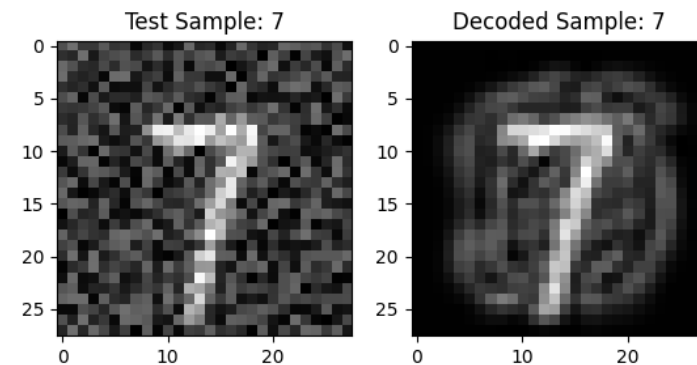




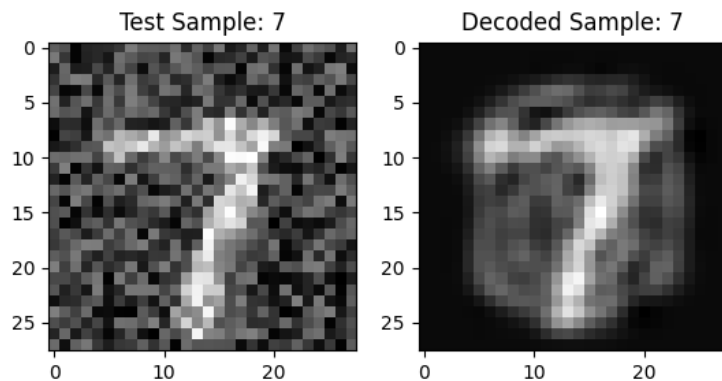
$p = 0.9$



$p = 0.8$



$p = 0.95$



$p = 0.9$

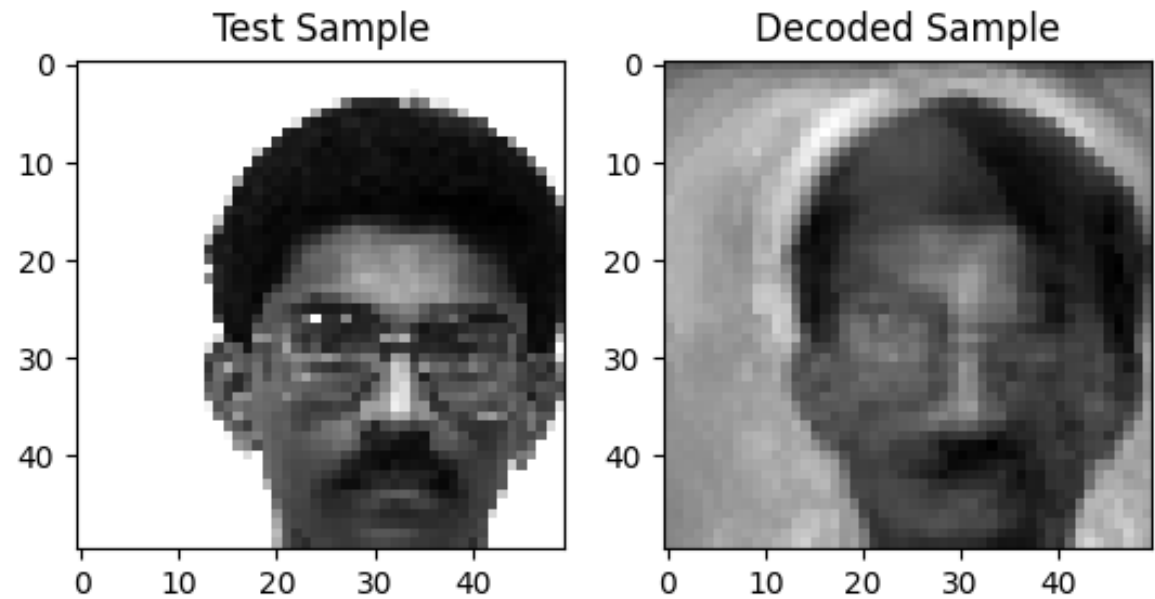
28x28 Digits with Noise

Yale Faces

- 200 x 200
- Down sampled by 4
- $D = 2500$

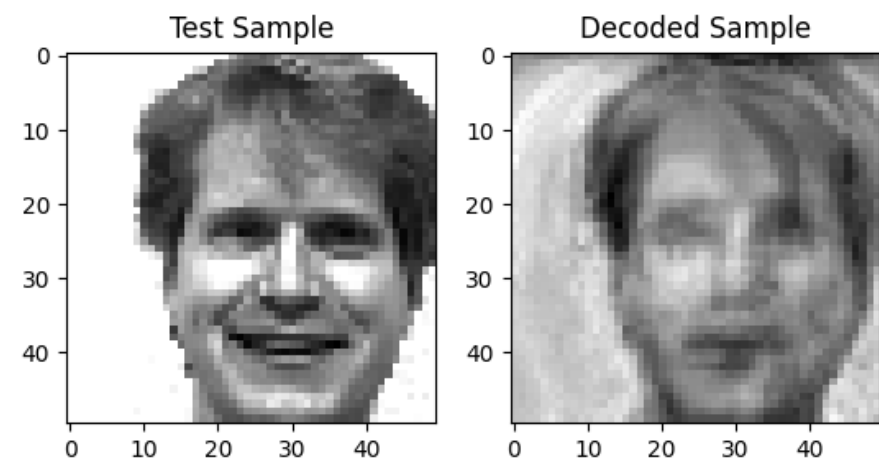
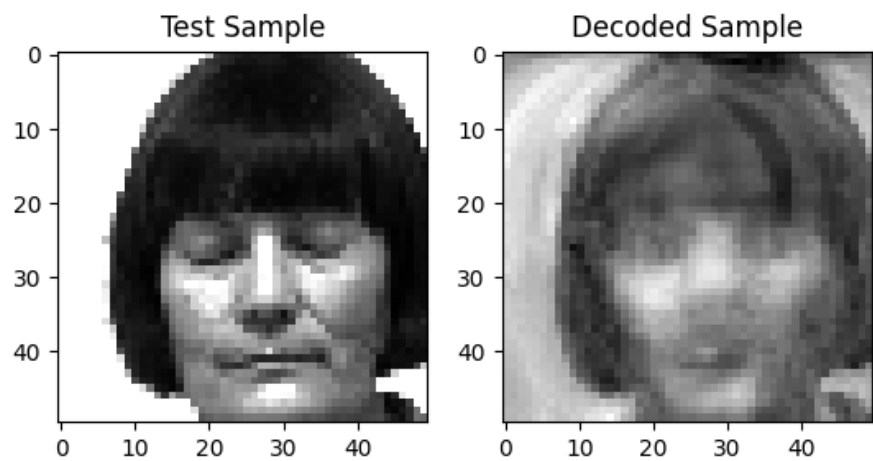
Yale Faces

- $P = 0.8$
- $H = 11$



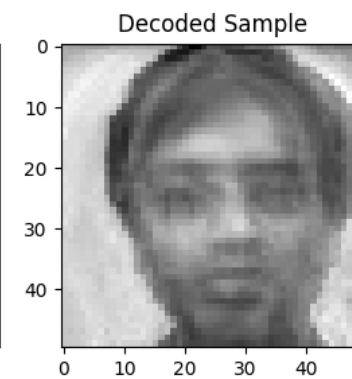
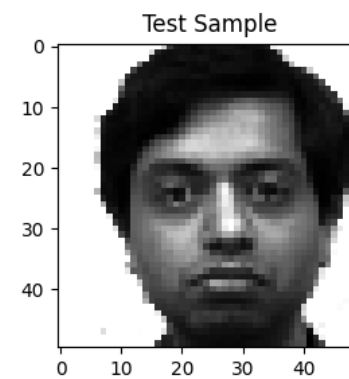
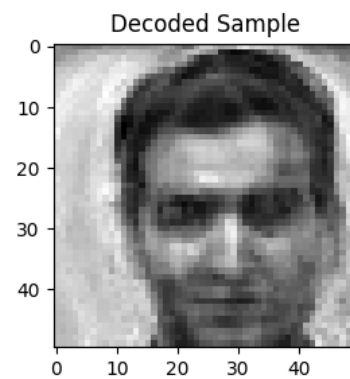
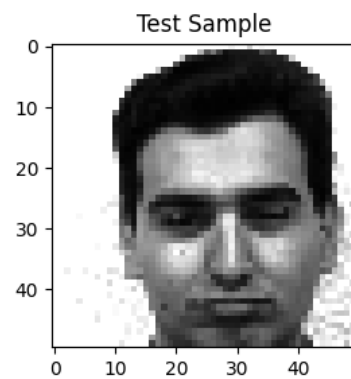
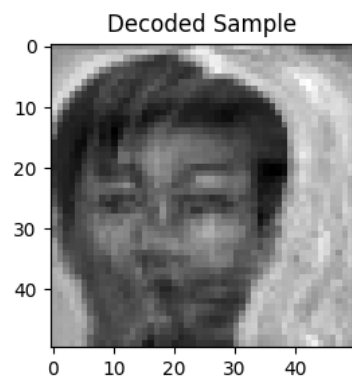
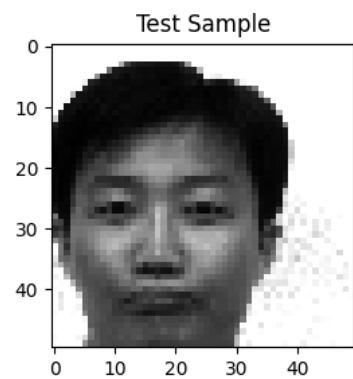
Yale Faces

- $P = 0.85$
- $H = 17$



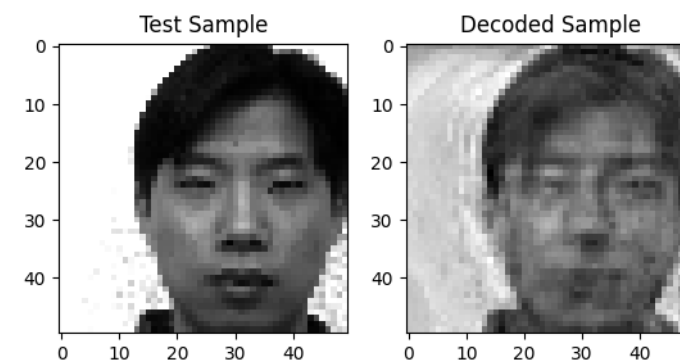
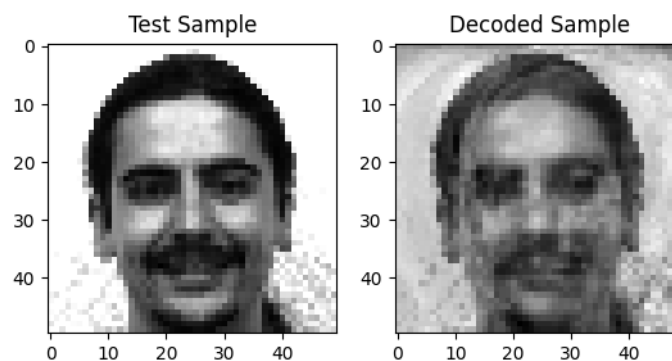
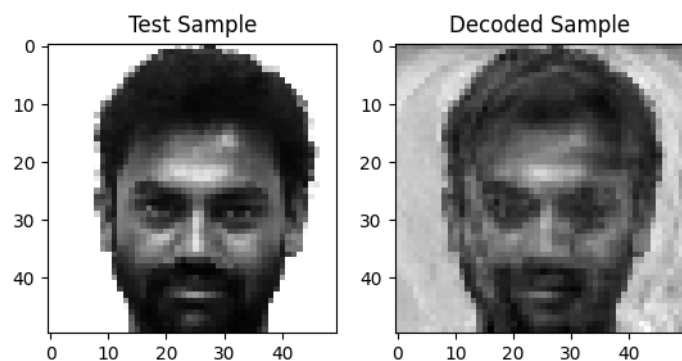
Yale Faces

- $P = 0.9$
- $H = 26$



Yale Faces

- $P = 0.95$
- $H = 50$



Yale Faces

- $P = 0.99$
- $H = 106$

