

---

# EXAM PROJECT FOR PML 2022/2023

---

## REPORT

**Christian Dybdahl Troelsen**  
Department of Computer Science  
University of Copenhagen  
Universitetsparken 1  
DK-2100 Copenhagen Ø  
tfp233@alumni.ku.dk

**Jens Sørensen**  
Department of Computer Science  
University of Copenhagen  
Universitetsparken 1  
DK-2100 Copenhagen Ø  
qrw992@alumni.ku.dk

**Mathias Rasmussen**  
Department of Computer Science  
University of Copenhagen  
Universitetsparken 1  
DK-2100 Copenhagen Ø  
tjc725@alumni.ku.dk

January 17, 2023

## 1 Density modeling

### 1.1 Implement a convolutional VAE

### 1.2 Alternative models

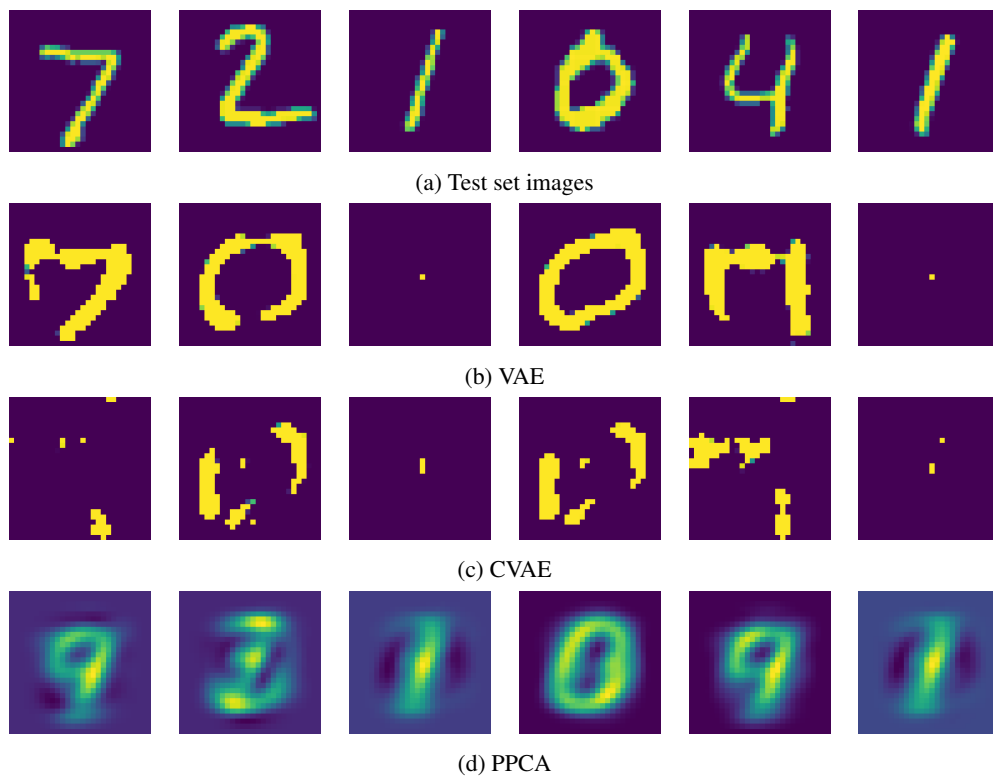


Figure 1: Comparison of MNIST test set images and corresponding mean parameters generated by density models

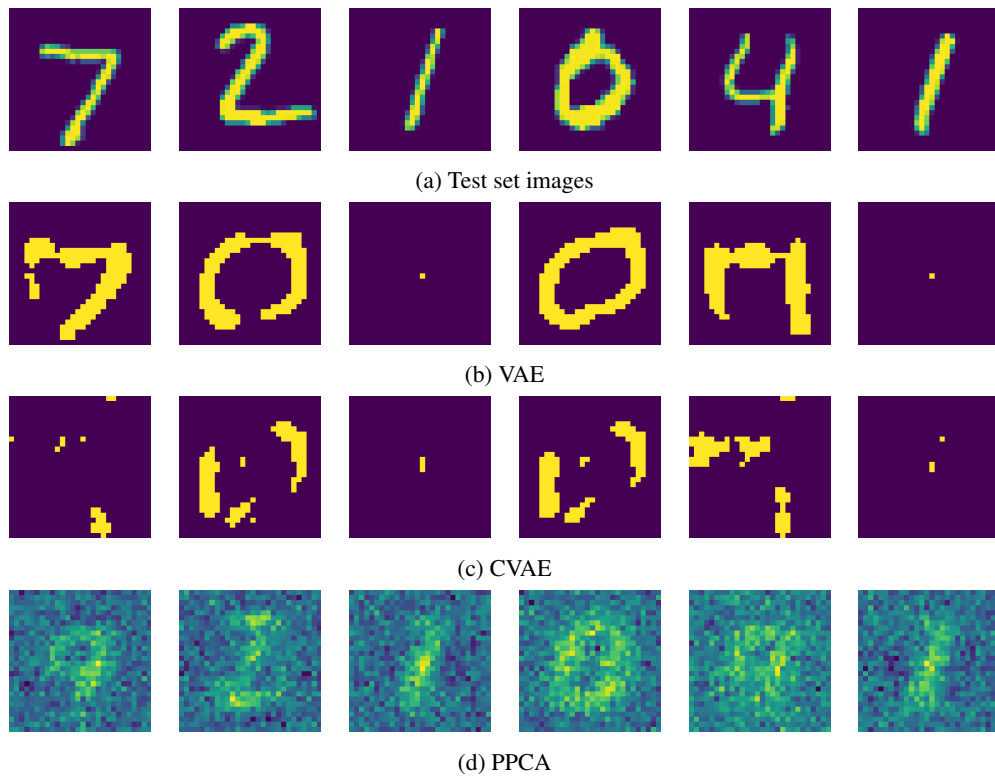
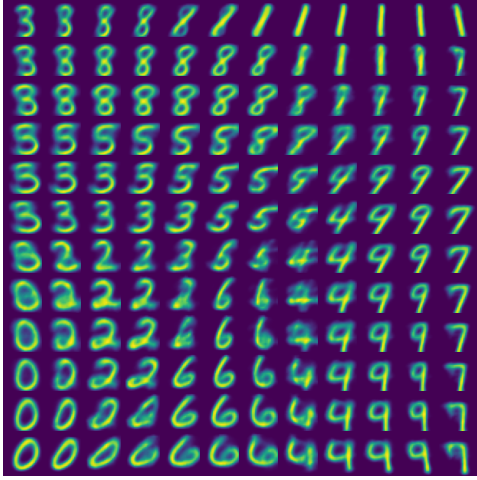
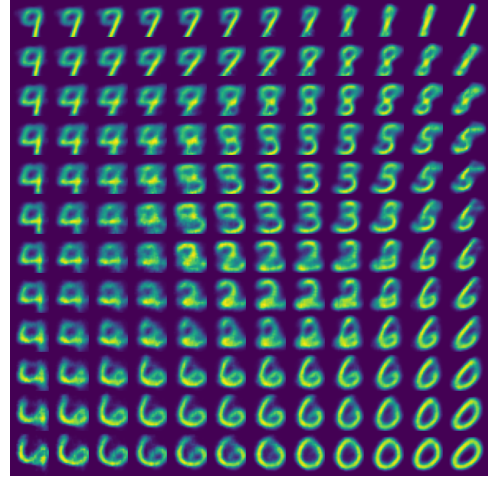


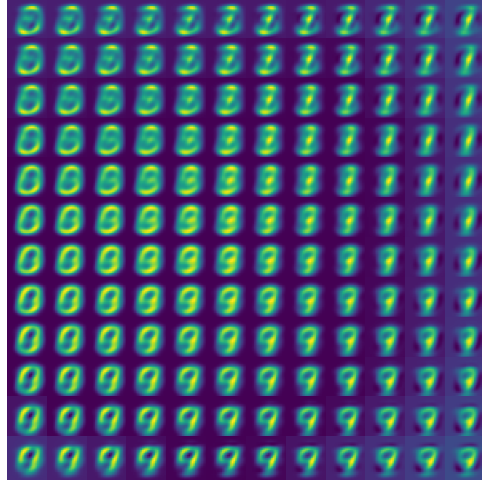
Figure 2: Comparison of MNIST test set images and corresponding reconstructions sampled from density models



(a) VAE



(b) CVAE



(c) PPCA

Figure 3: Interpolating images from latent space variables using trained density models.

	Log-Likelihood/ELBO	MSE
<b>VAE</b>	-145.122048	0.000305
<b>CVAE</b>	-157.241749	0.000352
<b>PPCA</b>	-4329.655559	3629.212532

Table 1: Model performance metrics

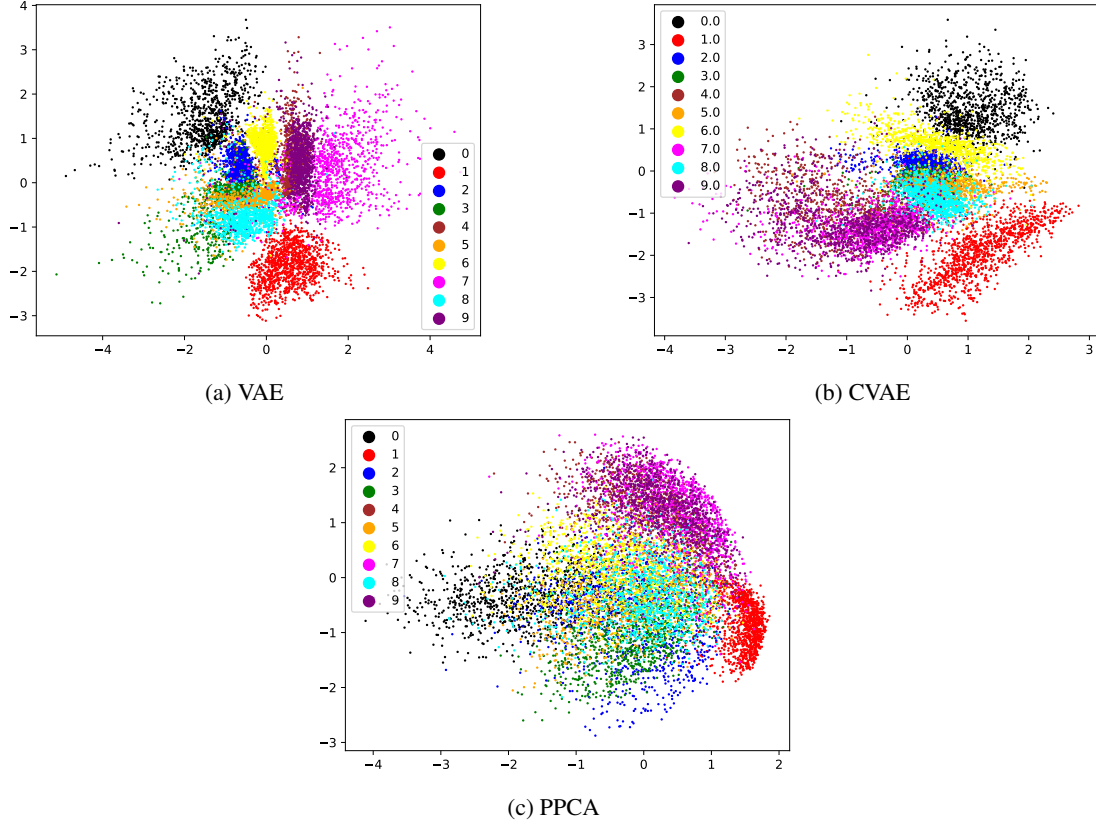


Figure 4: Clustering on MNIST test (projection to latent space) using trained density models.

## 2 Function fitting

### 2.1 Fitting a GP with Pyro

### 2.2 Bayesian Optimization

## 3 Bibliography