

# Machine Learning Workshop 2

## Variational Autoencoder

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# Outline

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# Autoencoders

Autoencoders are neural networks that are trained to learn how to map their input to their input. Internally, it has a hidden layer  $\mathbf{h}$  that contains a lossy summary of the relevant feature for the task.

An autoencoder can be seen as a two-part network

- Encoder function:  $\mathbf{h} = f(\mathbf{x})$
- Decoder function:  $\tilde{\mathbf{x}} = g(\mathbf{h})$

The simplest autoencoder is a MLP:

$$\begin{aligned}\mathbf{h} &= \sigma_1(W_{xh}\mathbf{x}) \\ \tilde{\mathbf{x}} &= \sigma_2(W_{hx}\mathbf{h})\end{aligned}\tag{1}$$

# Anomaly detection

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## Algorithm 1 Pseudocode for Batch Gradient Descent

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**Require:** Learning rate  $\epsilon_k$

**Require:** Initial parameter  $w_0$

**Require:** Number of epochs  $T$

**for**  $i = 1$  to  $T$  **do**

    Compute gradient  $g_t = \frac{1}{m} \nabla_w \sum_i L(h_{w_{t-1}}(x^{(i)}), y^{(i)})$

    Apply update:  $w_t = w_{t-1} - \epsilon g_t$

**end for**

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# Anomaly detection

```
import numpy
def forward():
    # fjdk sjfksjfkls
```