Machine Learning Workshop 2

Variational Autoencoder

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Outline

Autoencoders

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

Autoencoders

An autoencoder can be seen has a two parts network

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

Autoencoders

The simplest autoencoder is a one layer MLP:

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

Pytorch autoencoder

```
import numpy
def forward():
# fjdksjfksjfkls
```

Anomaly detection

Algorithm 1 Pseudocode for Batch Gradient Descent

Require: Learning rate ϵ_k

Require: Initial parameter $\boldsymbol{w}_0$

Require: Number of epochs T

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

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

    Apply update: $\boldsymbol{w}_t = \boldsymbol{w}_{t-1} - \epsilon \boldsymbol{g}_t$

  end for

Anomaly detection

```
import numpy
def forward():
    # fjdksjfksjfkls
```