

# Machine Learning

Jan Grosser, TroLUG, 2021/11/04

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- Was ist Machine Learning?
  - Was sind kuenstliche neuronale Netze?
- ML Frameworks/APIs
- ML “Hello world” (primitive Datentypen)
- ML mit komplexen Daten (Fashion MNIST)
- Convolution/Pooling
- ML in Embedded Systems

# Was ist Machine Learning?



ankle boots



All

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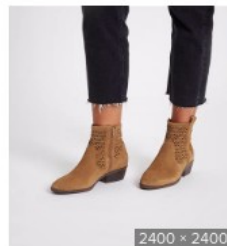
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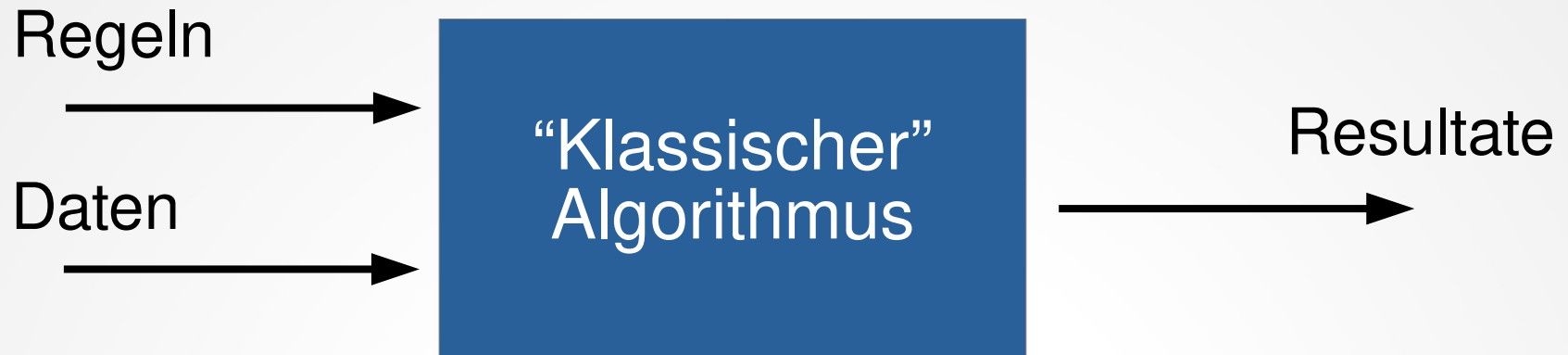
Lyst - UGG Jerene Sue...  
lyst.com

# Was ist Machine Learning?

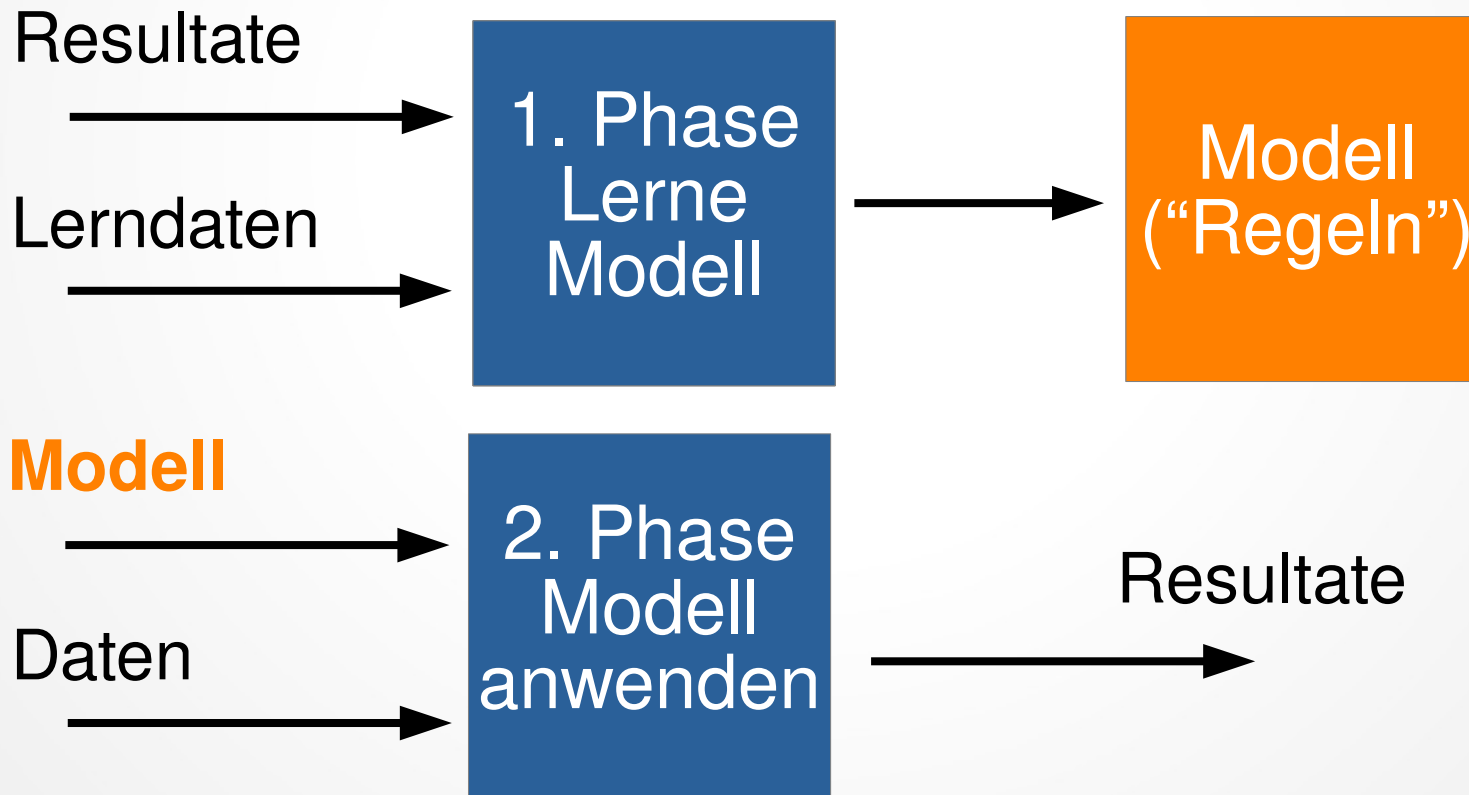
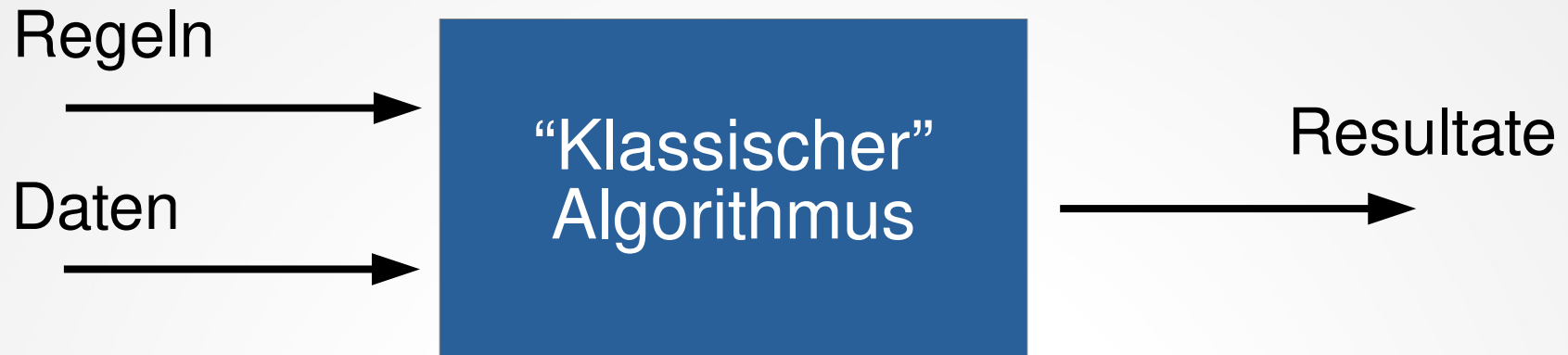
## ML Algorithmen

- lernen auf Basis von **Trainingsdaten**
- koennen Charakteristika auch in komplexen Datentypen erkennen
- treffen Vorhersagen fuer Inputs ausserhalb der Trainingsdaten
- koennen sich **kuenstlicher neuronaler Netze** bedienen

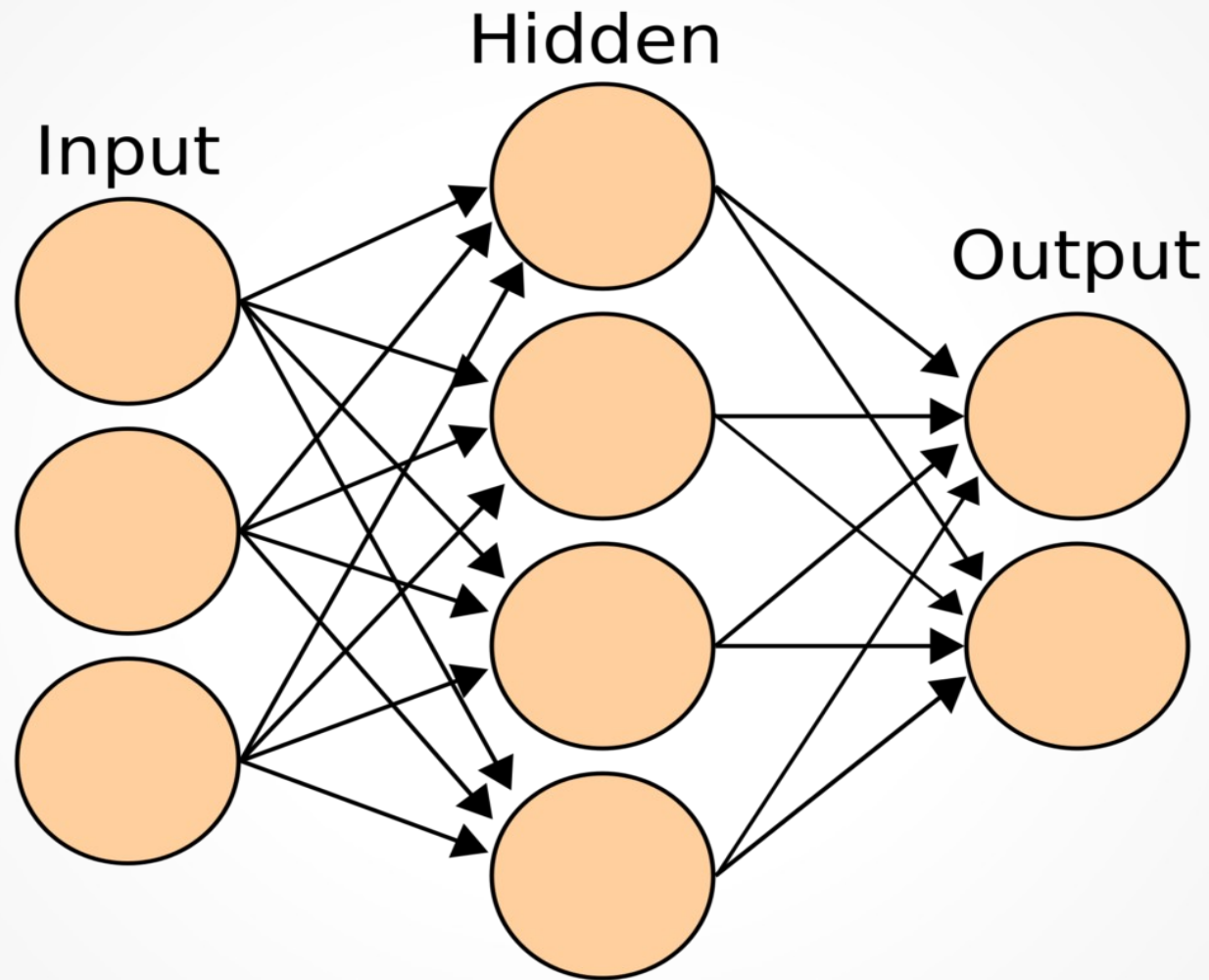
# Was ist Machine Learning?



# Was ist Machine Learning?



# Was sind kuenstliche neuronale Netze?





# Was ist Machine Learning?

## Grundlegende Konzepte

- 1) Supervised Learning
- 2) Unsupervised Learning
- 3) Reinforcement Learning



# Was ist Machine Learning?

Grundlegende Konzepte

- 1) Supervised Learning**
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# ML Frameworks/APIs

Name	Developer	License
TensorFlow	Google	Apache 2.0
PyTorch	Facebook	BSD
Keras (API)	François Chollet (currently working for Google)	MIT License
Microsoft Cognitive Toolkit (CNTK)	Microsoft	MIT License

# ML “Hello World”

$x = [-1.0, 0.0, 1.0, 2.0, 3.0, 4.0]$

$y = [-2.0, 1.0, 4.0, 7.0, 10.0, 13.0]$

# ML “Hello World”

$x = [-1.0, 0.0, 1.0, 2.0, 3.0, 4.0]$

$y = [-2.0, 1.0, 4.0, 7.0, 10.0, 13.0]$

$$y = 3 * x + 1$$

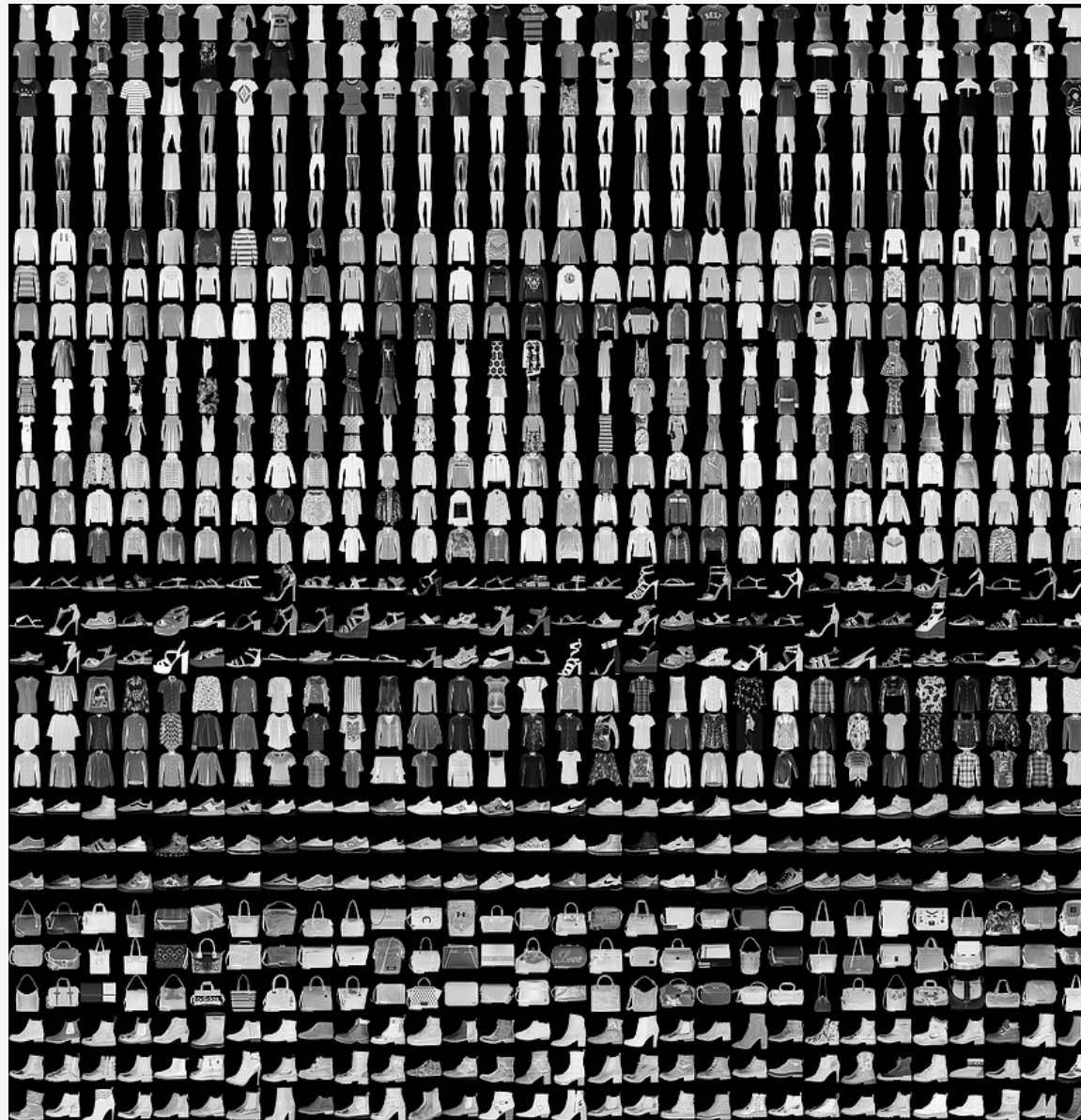
# ML “Hello World”

```
import tensorflow as tf
import numpy as np
model = tf.keras.Sequential([tf.keras.layers.Dense(units=1,
    input_shape=[1])])
model.compile(optimizer='sgd', loss='mean_squared_error')
xs = np.array([-1.0, 0.0, 1.0, 2.0, 3.0, 4.0], dtype=float)
ys = np.array([-2.0, 1.0, 4.0, 7.0, 10.0, 13.0], dtype=float)
n_epochs = 100
model.fit(xs, ys, epochs=n_epochs)
x_test = 10
print(model.predict([x_test]))
```

# ML “Hello World”

- Jupyter Notebook

# ML mit komplexen Daten (Fashion MNIST)



<https://github.com/zalandoresearch/fashion-mnist>



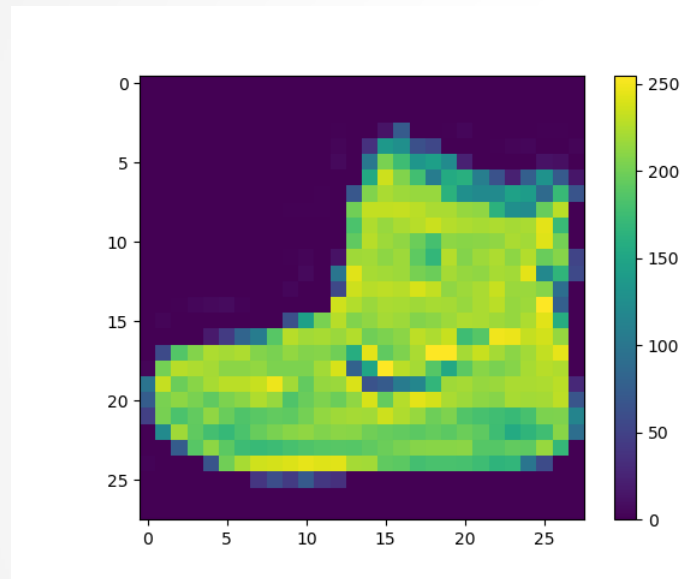
# ML mit komplexen Daten (Fashion MNIST)

- 70.000 von Modeartikeln
- Jedes Bild 28 x 28 Pixel, 255 Graustufen
- Alle Bilder sind 10 Kategorien zugeordnet  
'T-shirt/top', 'Trouser', 'Pullover', 'Dress', 'Coat', 'Sandal',  
'Shirt', 'Sneaker', 'Bag', 'Ankle boot'
- Trainingssatz: 60.000 Bilder
- Testsatz: 10.000 Bilder
- Jedes Bild zeigt nur ein Objekt
- Objekte in Bildern zentriert

# ML mit komplexen Daten (Fashion MNIST)

- Jupyter Notebook

# Convolution/Pooling



Fashion MNIST



Credit: Lyst Limited, UK via  
DuckDuckGo image search

“Real World”

# Convolution/Pooling

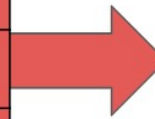
**Convolution:** Anwendung eines Filters zur Hervorhebung charakteristischer Merkmale

# Convolution/Pooling

**Convolution:** Anwendung eines Filters zur Hervorhebung charakteristischer Merkmale



-1	0	1
-2	0	2
-1	0	1



# Convolution/Pooling

**Convolution:** Anwendung eines Filters zur Hervorhebung charakteristischer Merkmale

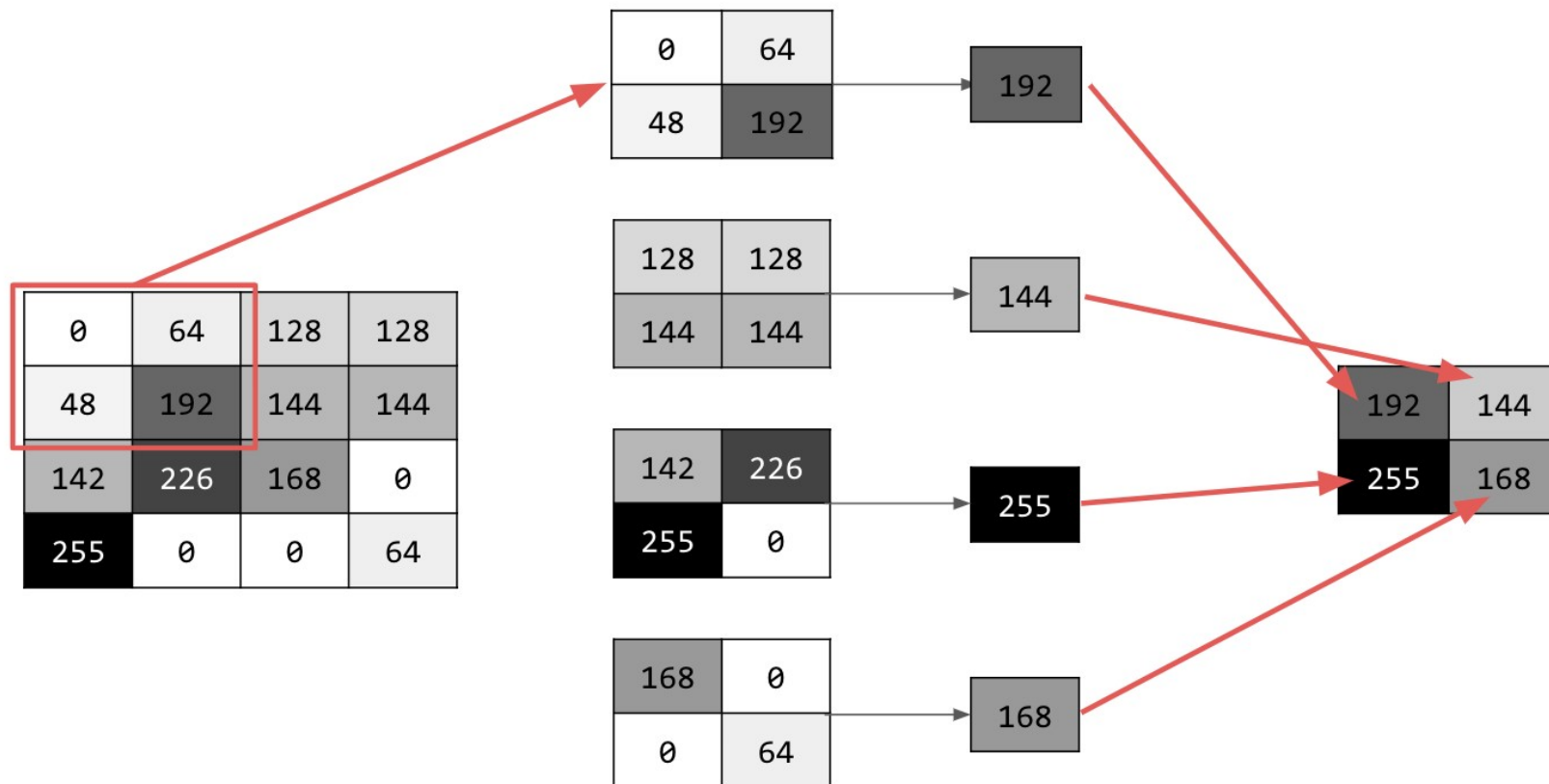


-1	0	1
-2	0	2
-1	0	1



# Convolution/Pooling

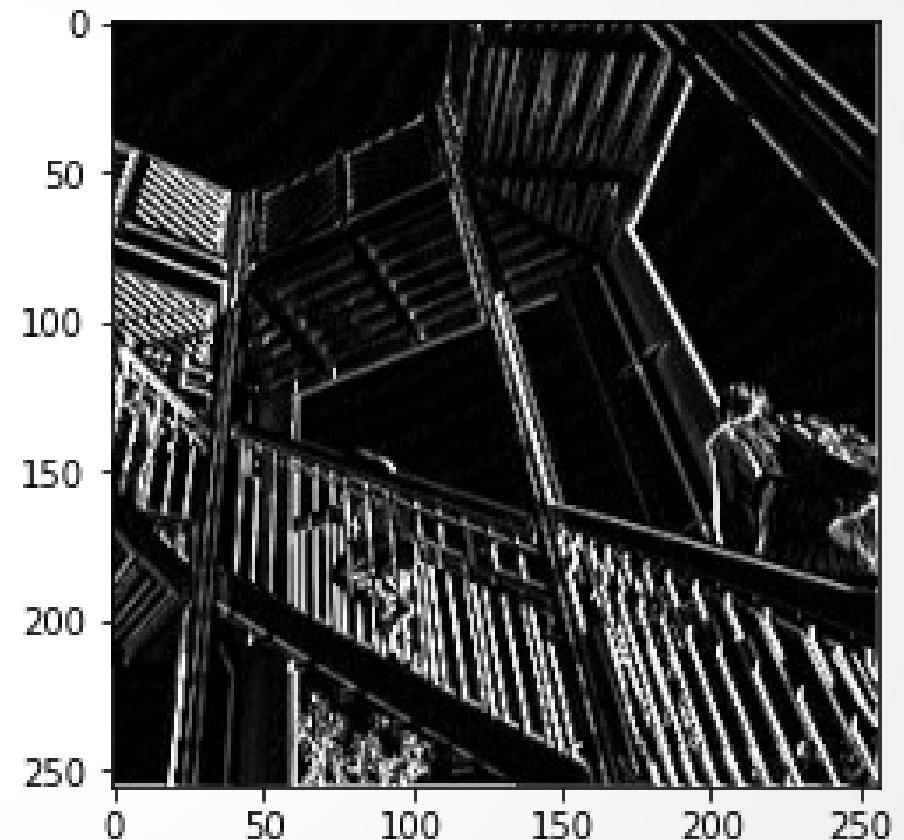
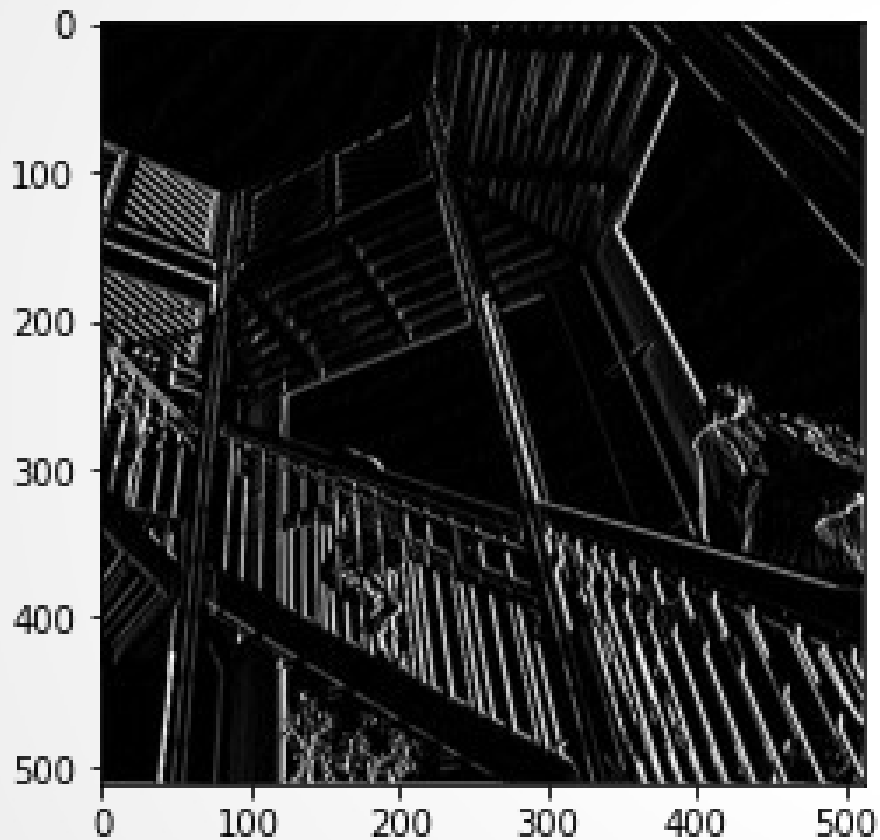
**Pooling:** Reduktion der Daten bei Beibehaltung der relevanten Information





# Convolution/Pooling

## Beispiel: MaxPooling2D(2,2)



# Convolution/Pooling

- Jupyter Notebook

# Convolution/Pooling

## Bsp ohne Convolution/Pooling:

```
model = tf.keras.Sequential([  
    tf.keras.layers.Flatten(input_shape=(28, 28)),  
    tf.keras.layers.Dense(128, activation='relu'),  
    tf.keras.layers.Dense(10)  
])
```

Korrespondiert mit  
den 10 Kategorien!



# Convolution/Pooling

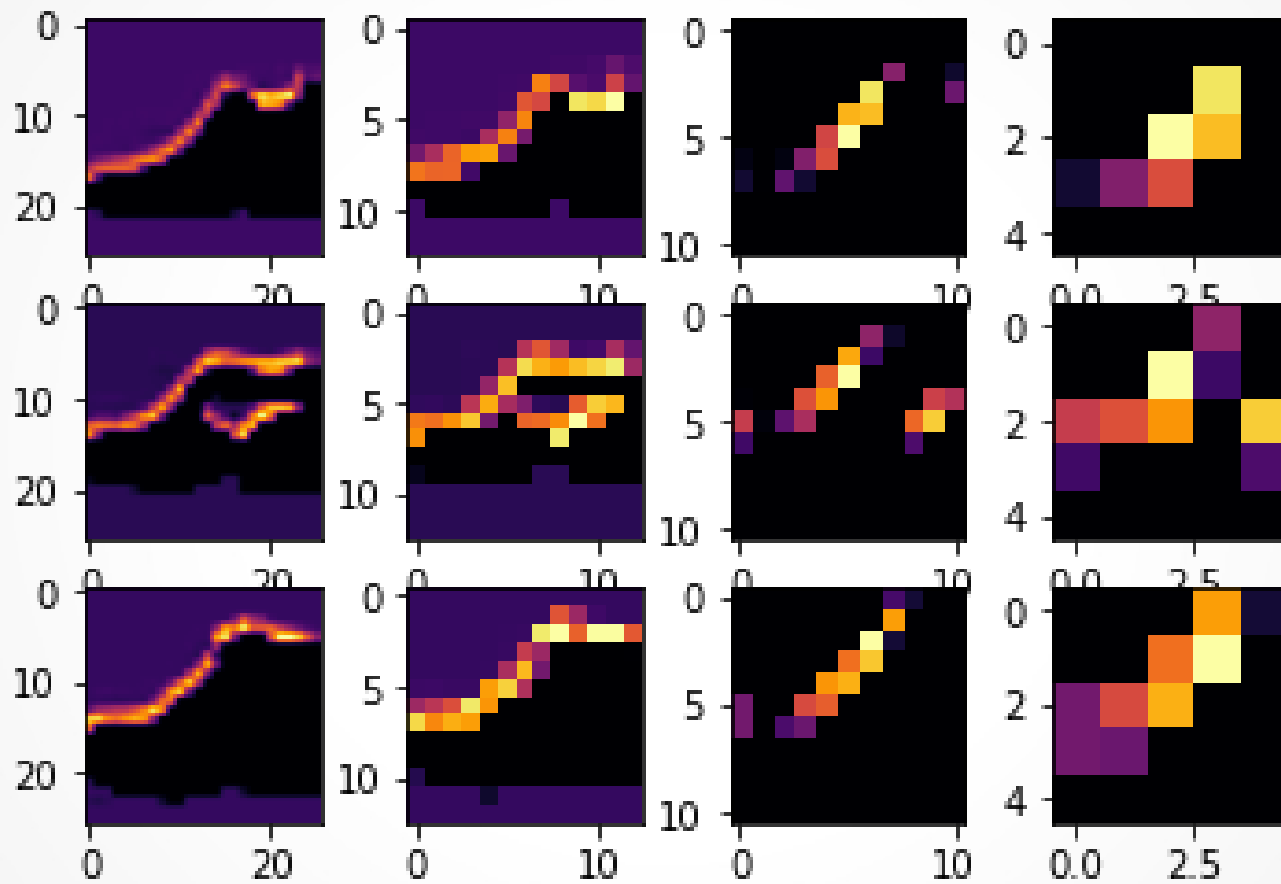
## Bsp MIT Convolution/Pooling:

```
training_images=training_images.reshape(60000, 28, 28, 1)
model2 = tf.keras.models.Sequential([
    tf.keras.layers.Conv2D(64, (3,3), activation='relu', input_shape=(28, 28, 1)),
    tf.keras.layers.MaxPooling2D(2, 2),
    tf.keras.layers.Conv2D(64, (3,3), activation='relu'),
    tf.keras.layers.MaxPooling2D(2, 2),
    tf.keras.layers.Flatten(),
    tf.keras.layers.Dense(128, activation='relu'),
    tf.keras.layers.Dense(10, activation='softmax')
])
```

# Convolution/Pooling

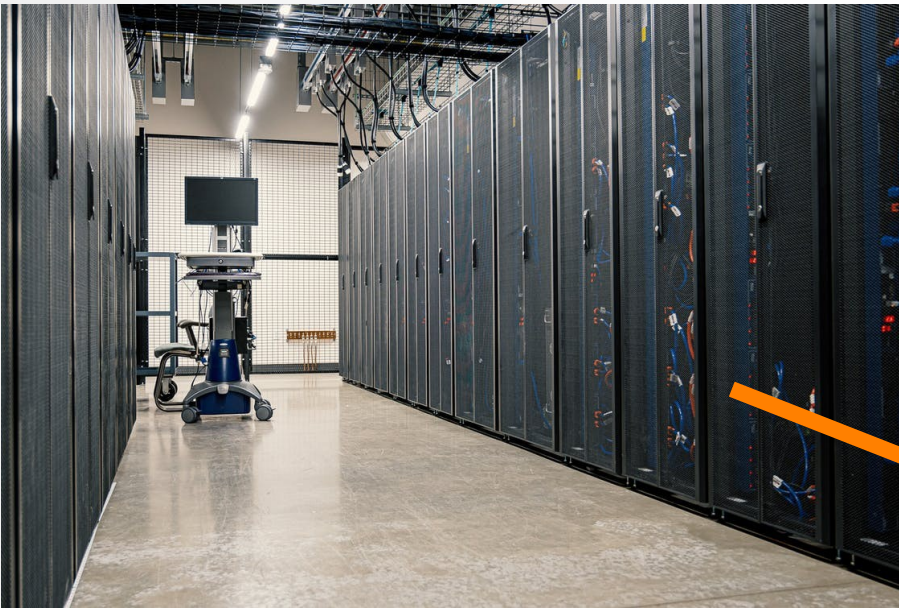
- Jupyter Notebook

# Convolution/Pooling



# ML in Embedded Systems

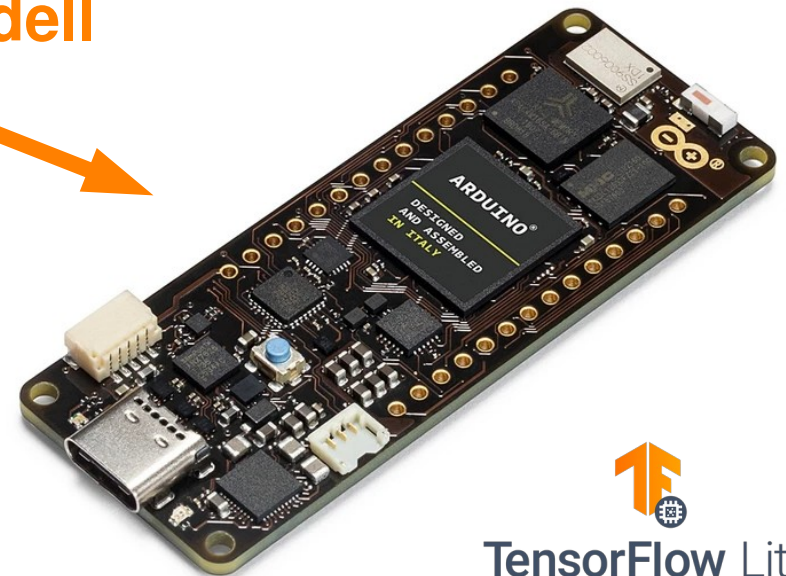
## 1) Lernen



Credit: [Brett Sayles/Pexels](#)

## 2) Anwenden

Modell



  
TensorFlow Lite



# Zum Weitermachen ...

- YouTube: Intro to Machine Learning (ML Zero to Hero)
- <https://github.com/Imoroney/mlday-tokyo>
- <https://www.tensorflow.org/tutorials/quickstart/advanced>
- <https://github.com/PINTO0309/Tensorflow-bin>
- <https://github.com/rzbrk/ml-demo>