

Machine Learning

Jan Grosser, 2021/10/22

Inhalt

- 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

Images

Videos

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Settings

Germany

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Any time

All sizes

All colors

All types

All layouts

All Licenses

1780 x 2375



2800 x 4200



1100 x 1100



1100 x 1100



1100 x 1100



1200 x 1200



1100 x 1100



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1000 x 1000



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1200 x 1200



1000 x 1000



1100 x 1100



1100 x 1100



1385 x 1847



1000 x 1000



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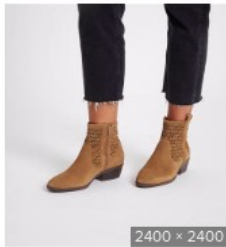
1100 x 1100



1000 x 1500



1385 x 1846



2400 x 2400



1600 x 1600



4348 x 3179



1438 x 1500



1180 x 1505



2176 x 2460

Mustang Ankle Boot W...
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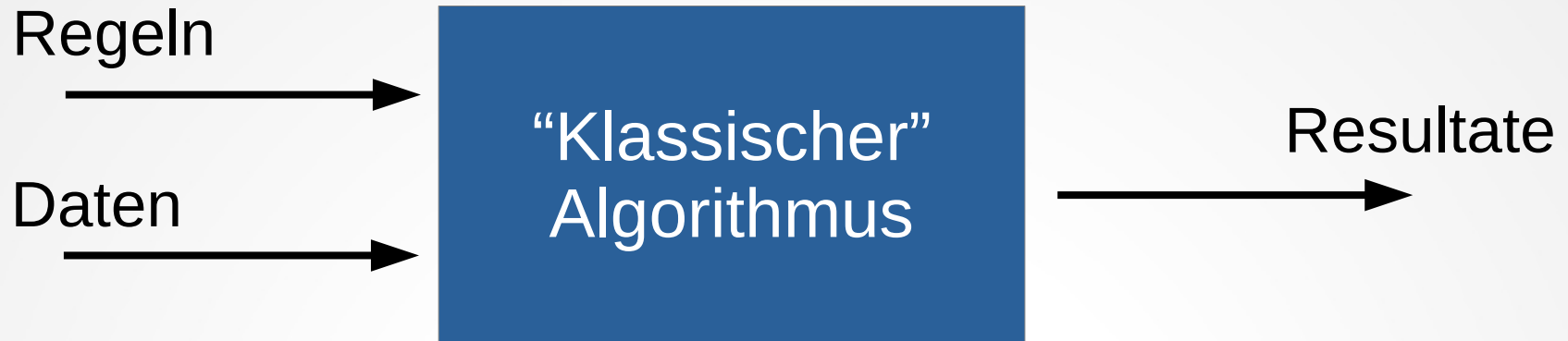
Lyst - UGG Jerene Sue...
lyst.com

Was ist Machine Learning?

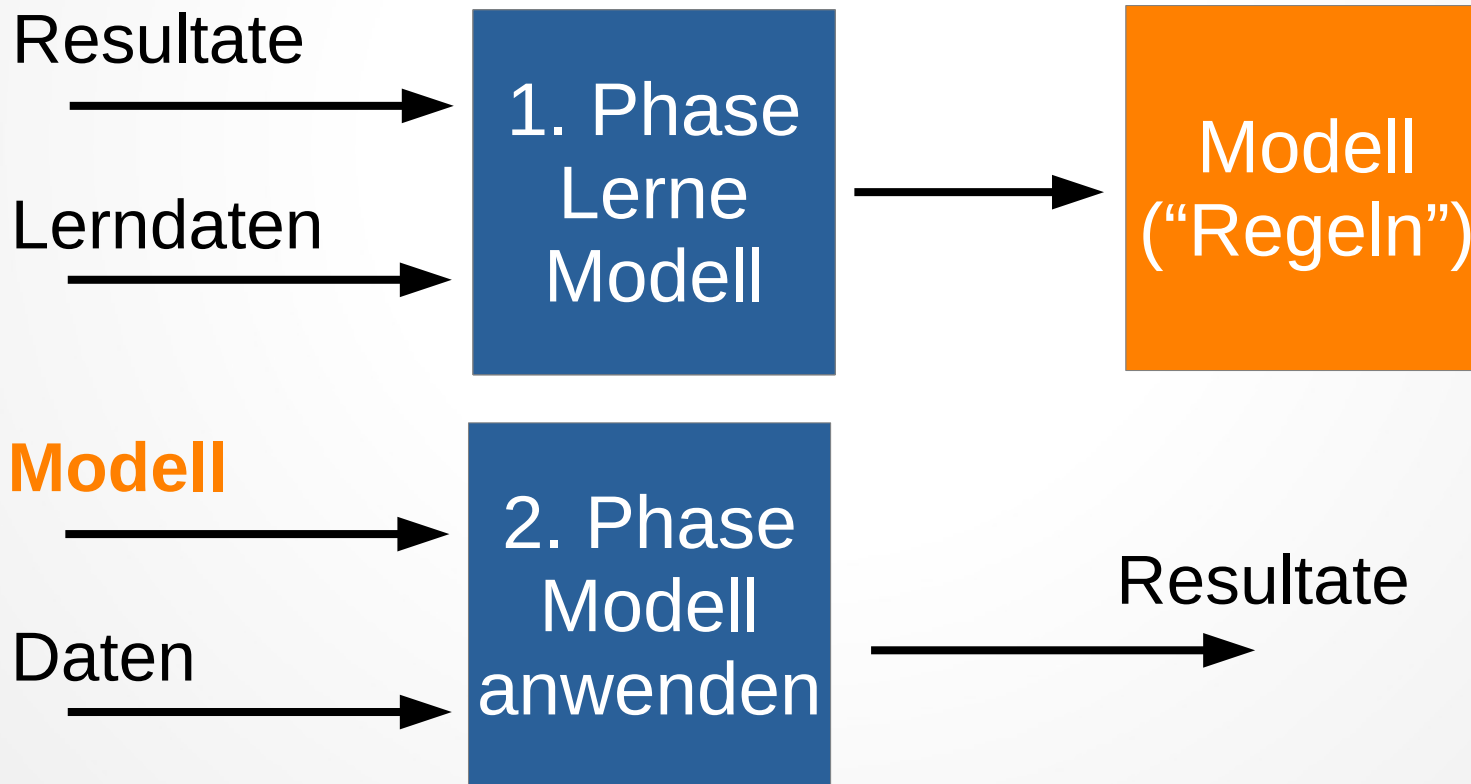
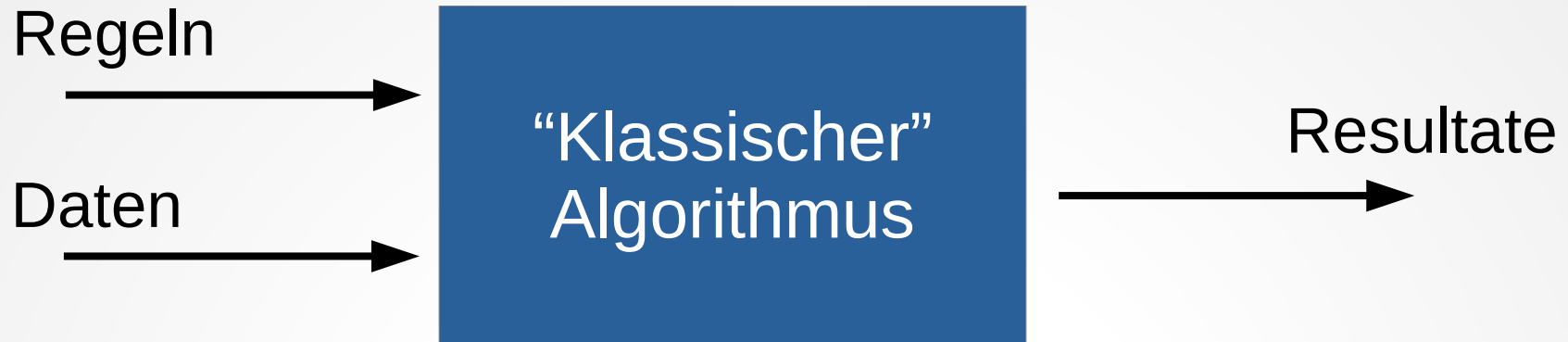
ML Algorithmen

- 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

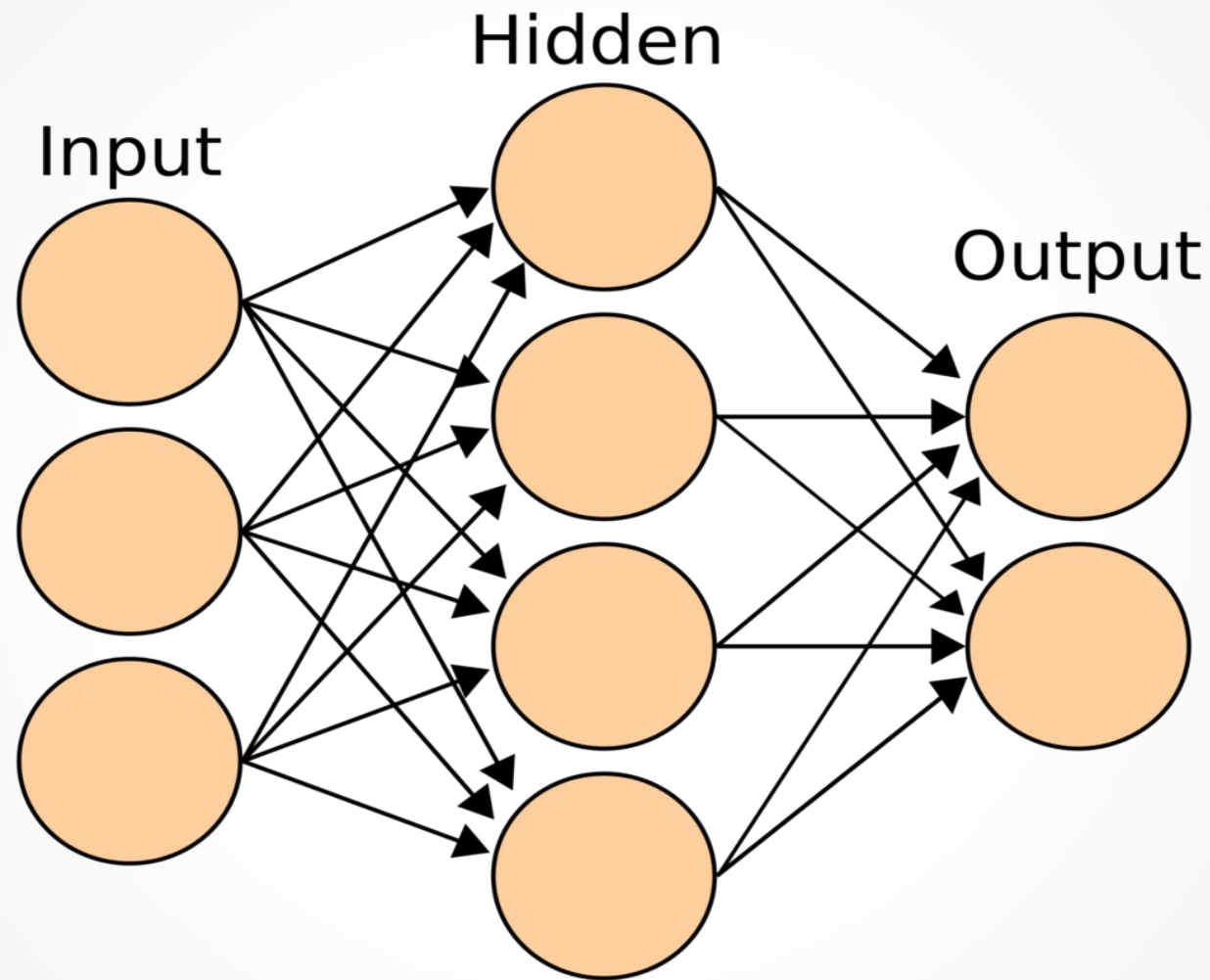
Was ist Machine Learning?



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

2)Unsupervised Learning

3)Reinforcement Learning

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”

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

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

$$y = 3 * x + 1$$

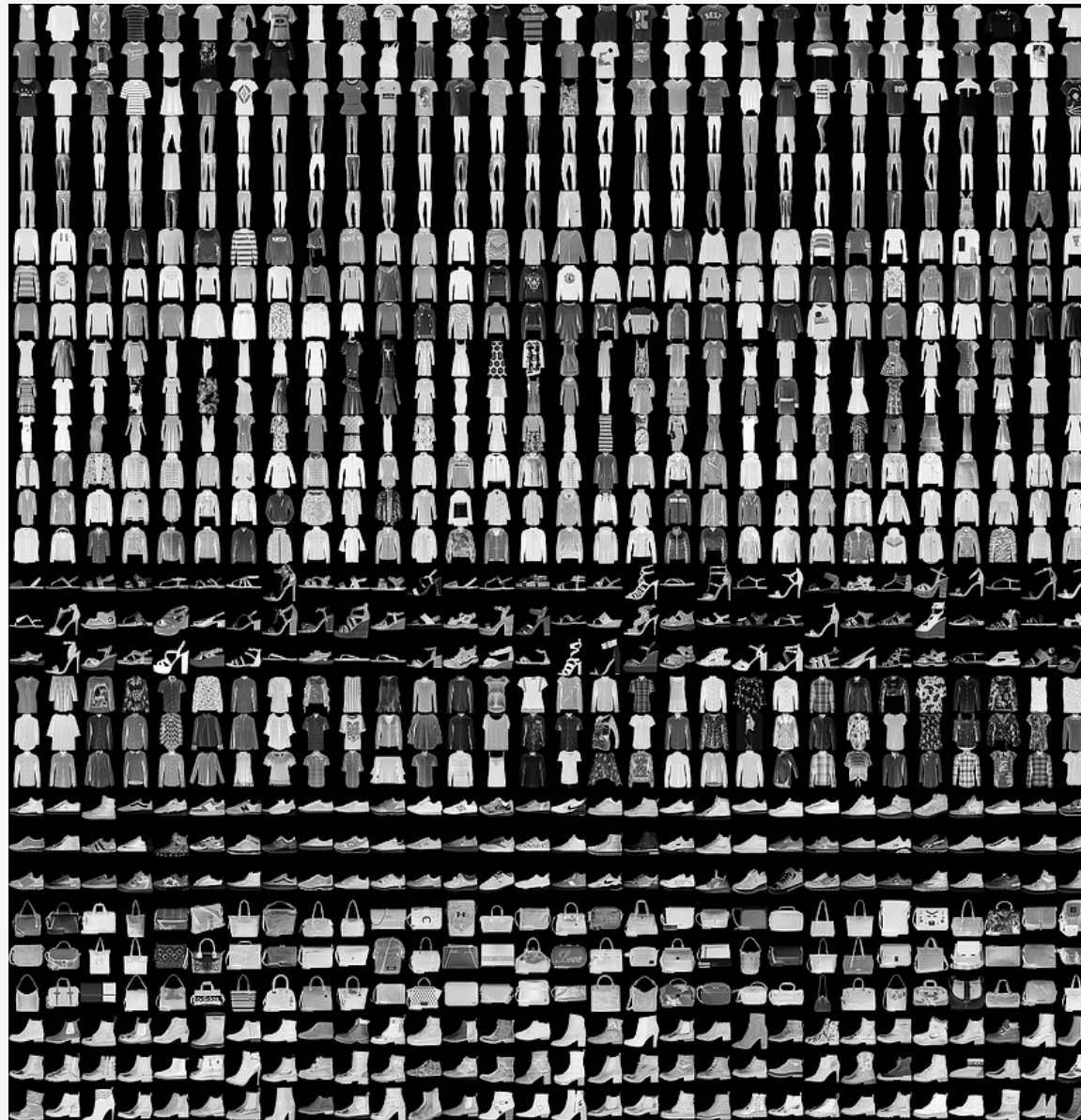
ML “Hello World”

```
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>

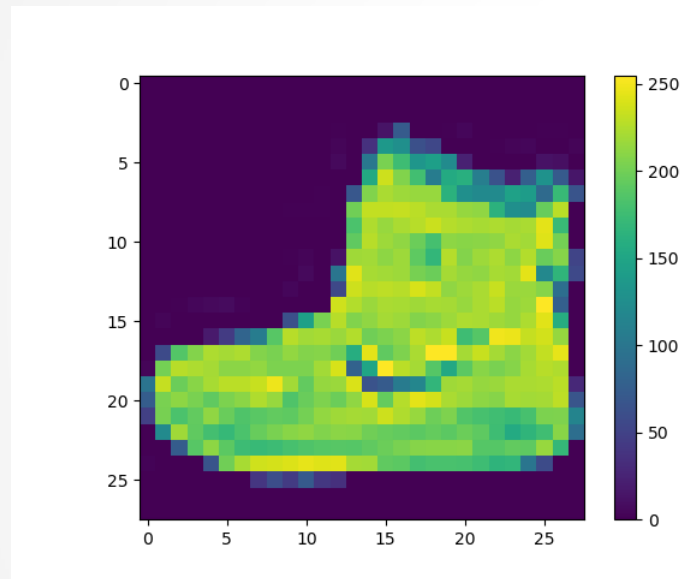
ML mit komplexen Daten (Fashion MNIST)

- 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



“Real World”

Convolution/Pooling

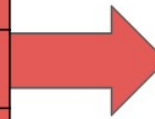
Convolution: Anwendung eines Filters zur Hervorhebung charakteristischer Merkmale

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

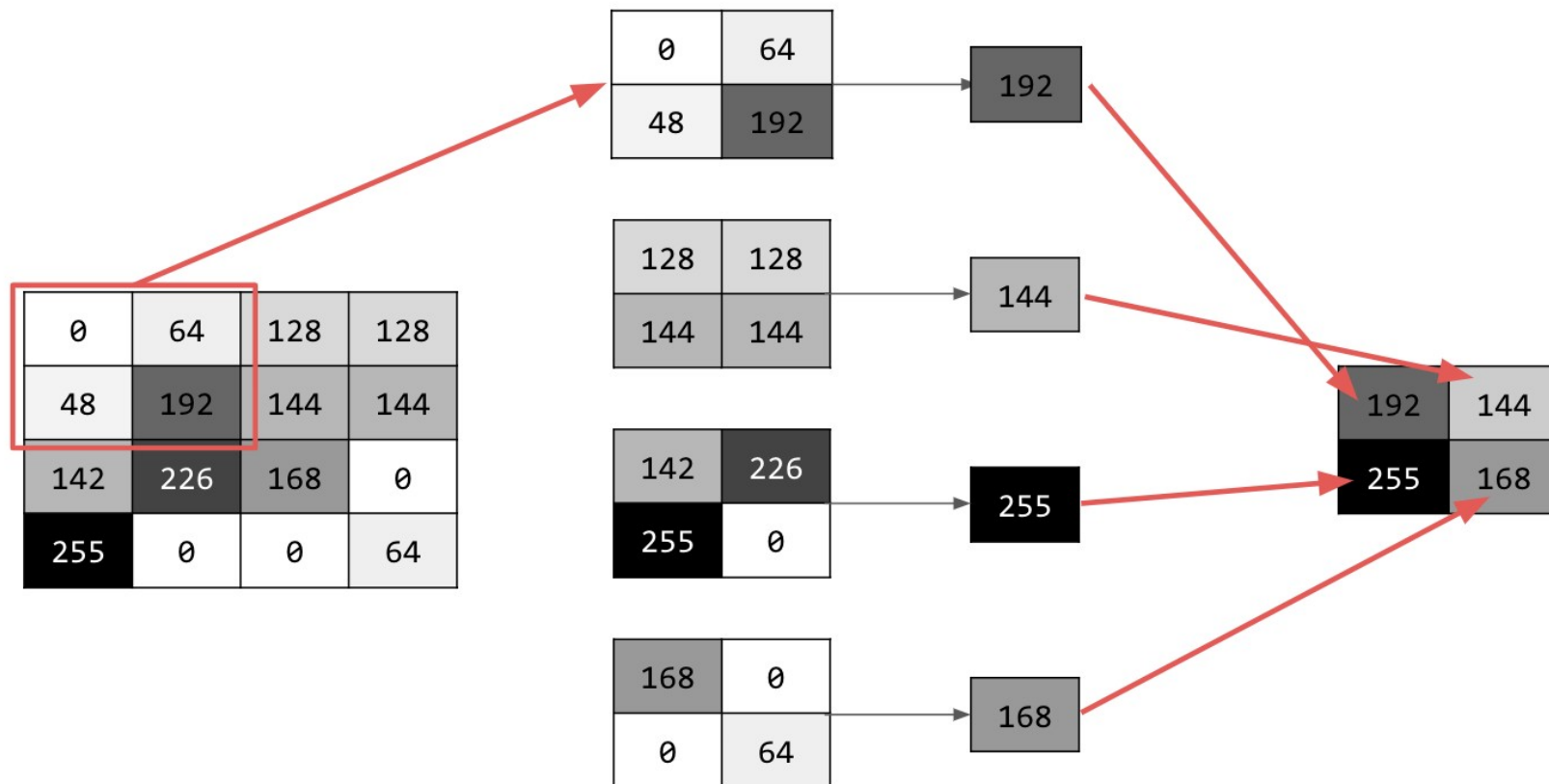


| | | |
|----|---|---|
| -1 | 0 | 1 |
| -2 | 0 | 2 |
| -1 | 0 | 1 |



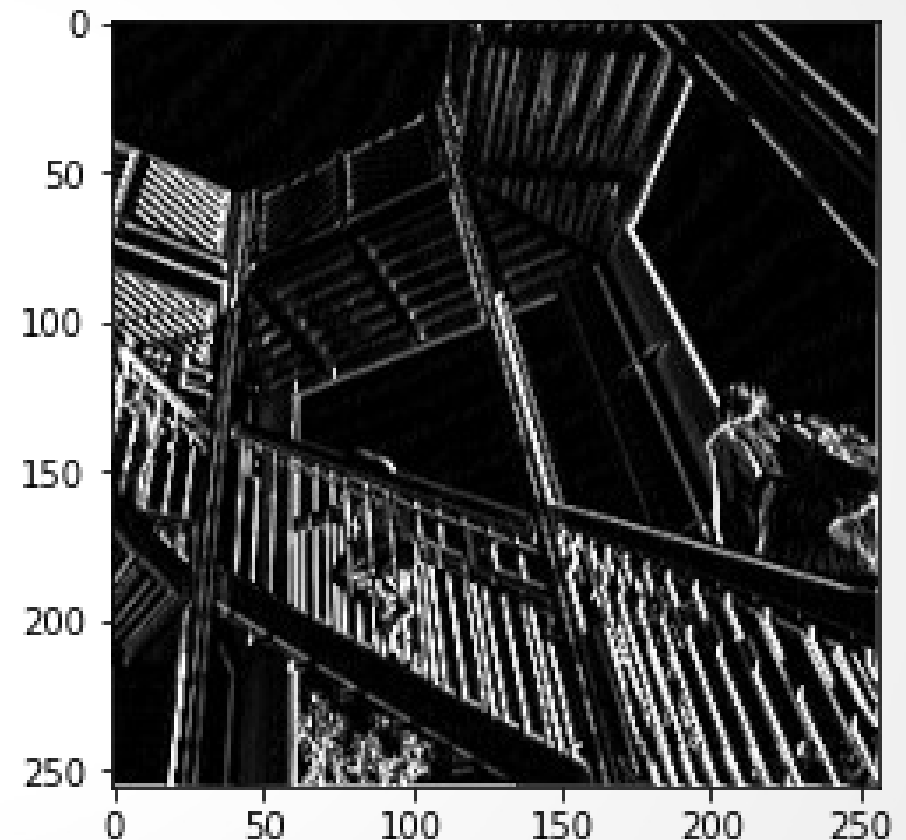
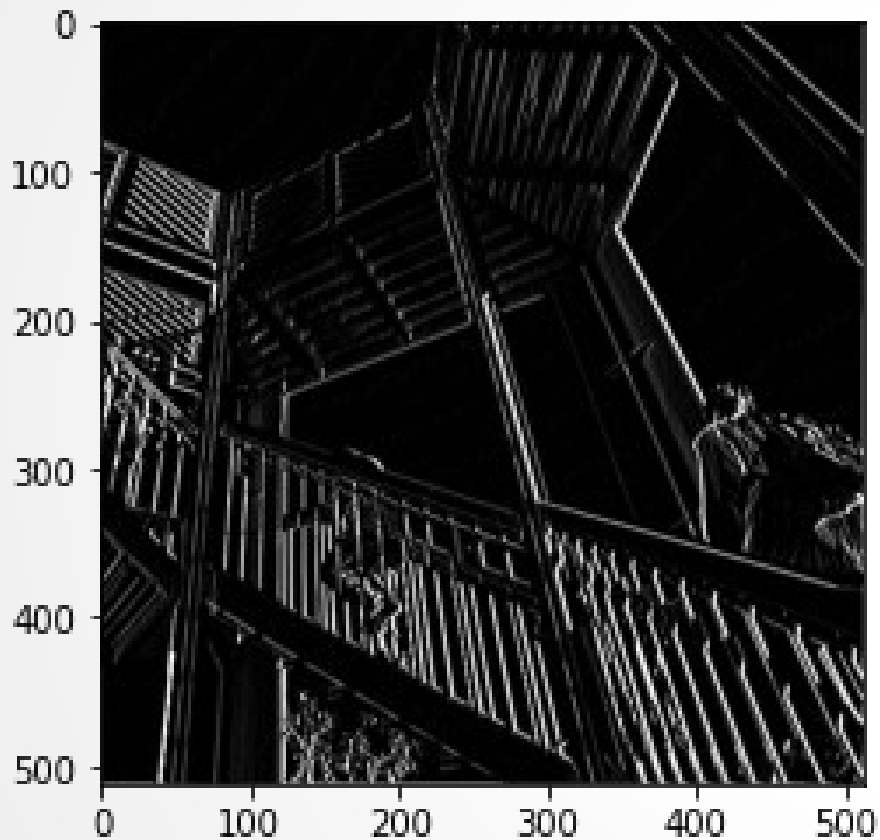
Convolution/Pooling

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

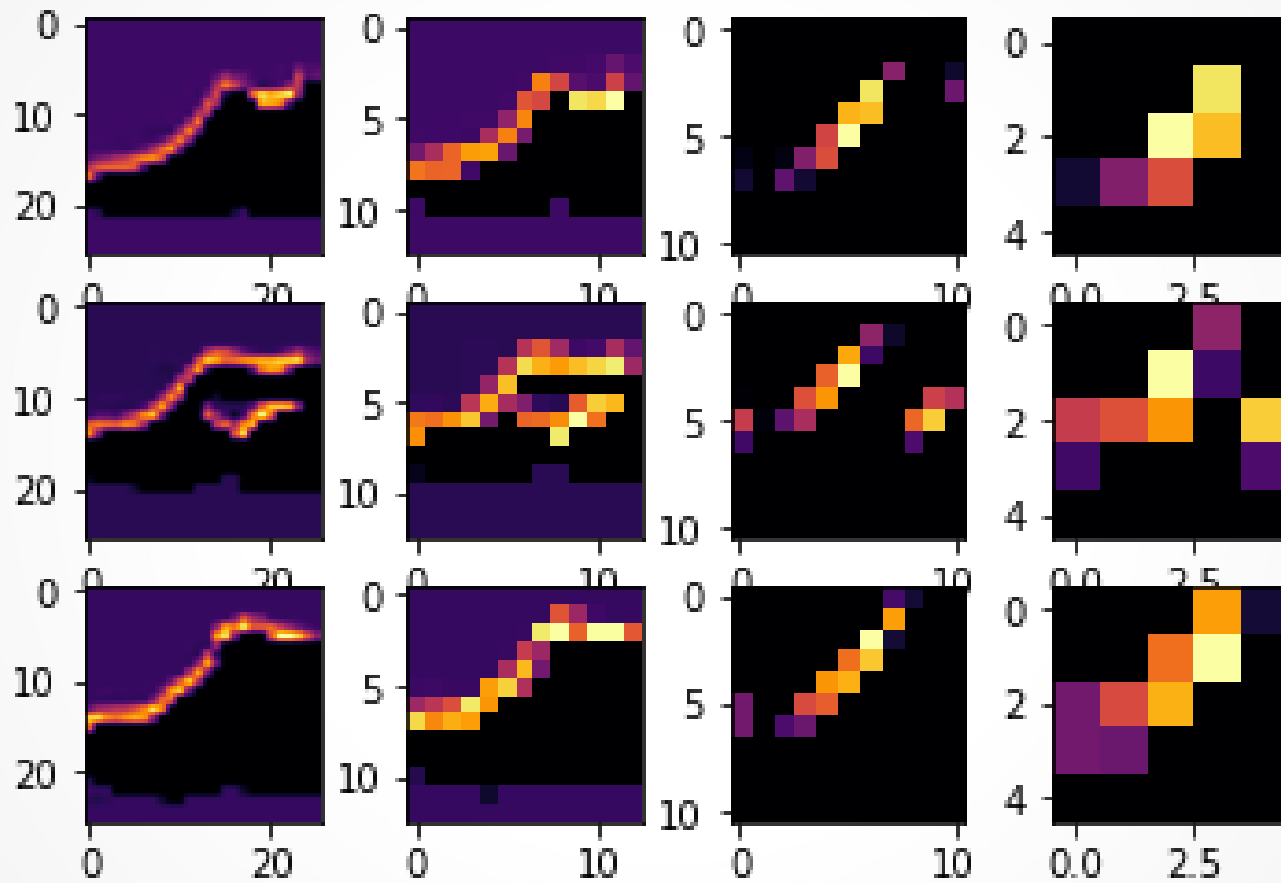
Bsp MIT Convolution/Pooling:

```
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



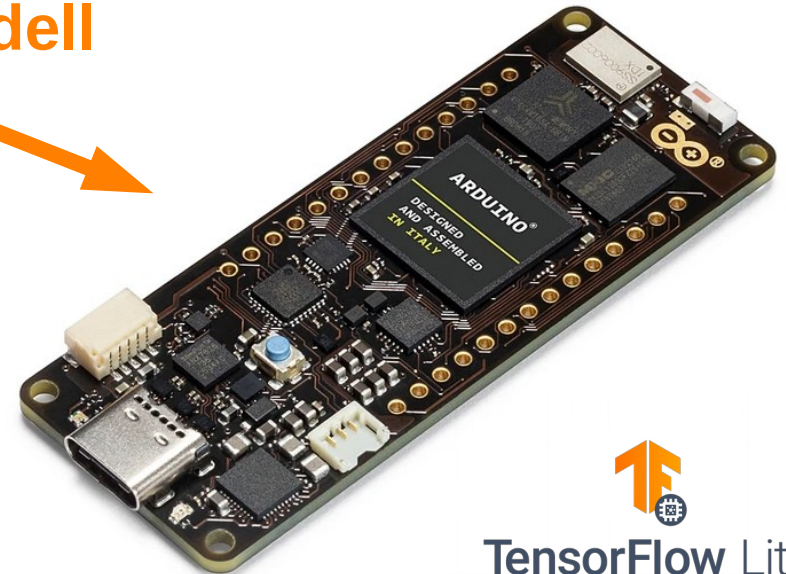
ML in Embedded Systems

1) Lernen



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>
- <https://github.com/rzbrk/ml-demo>