TECHNISCHE UNIVERSITÄT DRESDEN

Fakultät für Elektro- und Informationstechnik, Professur für Grundlagen der Elektrotechnik und Elektronik

FliK Modul 2020

Data Pipeline and Keras

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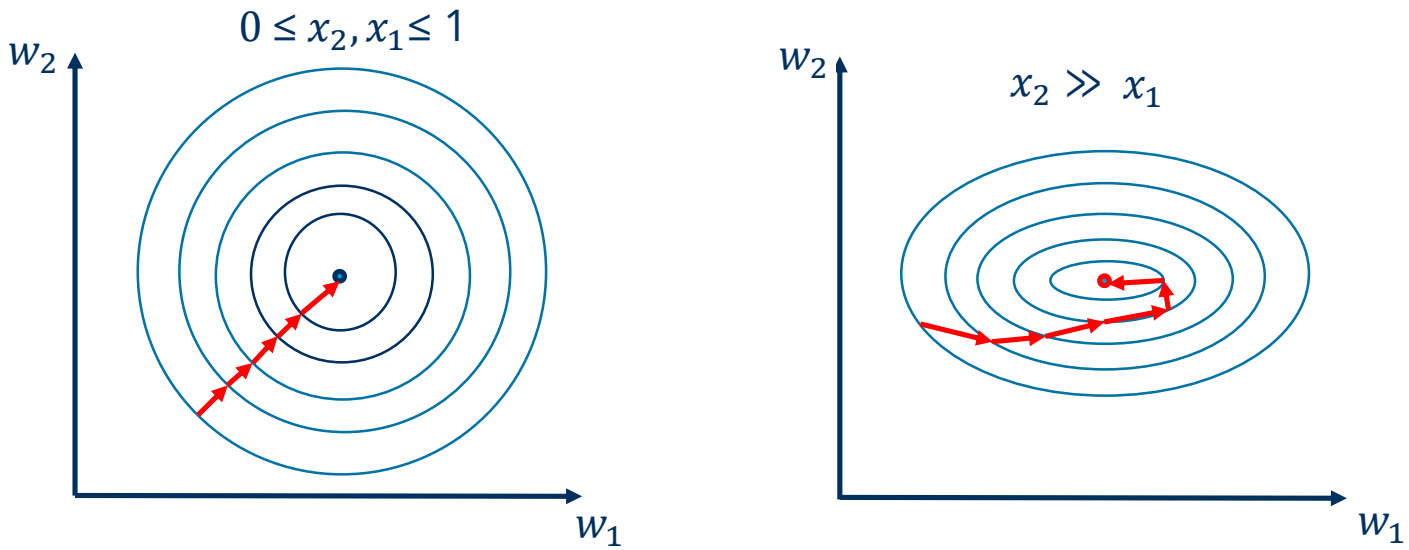
Data Pre-Adjustments
Normalization

Data is normalized, before given to the network.

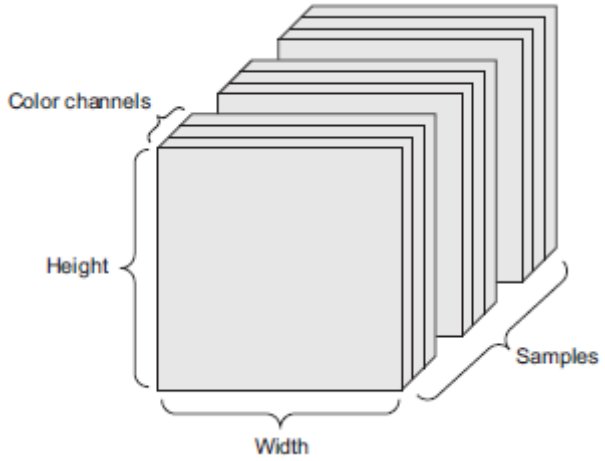


For **skewed classes**, learning will be slower!

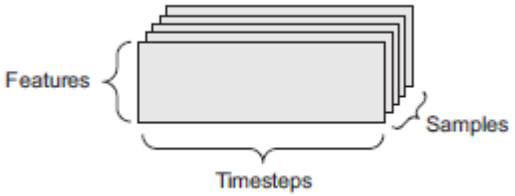
This is why you need to scale the input values to have unit variance and zero mean:

Data Pre-Adjustments
Train Test Validation splitting

Image Data



Time Series Data



Normalization to counteract skewed data/classes:

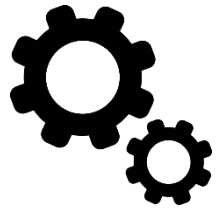
Normalization

$$\mathbf{x}_{j,std} = \frac{\mathbf{x}_j - \mu_j}{\sigma_j}$$

Data split into 3 partitions

Training | Validation | Test

Train Network Weights → Optimize Network Parameters → Verify Results on unseen data



Label Pre-Adjustments
One-Hot Encoding

index	label
0	airplane (0)
1	automobile (1)
2	bird (2)
3	cat (3)
4	deer (4)
5	dog (5)
6	frog (6)
7	horse (7)
8	ship (8)
9	truck (9)
...	...
...	...

original label data

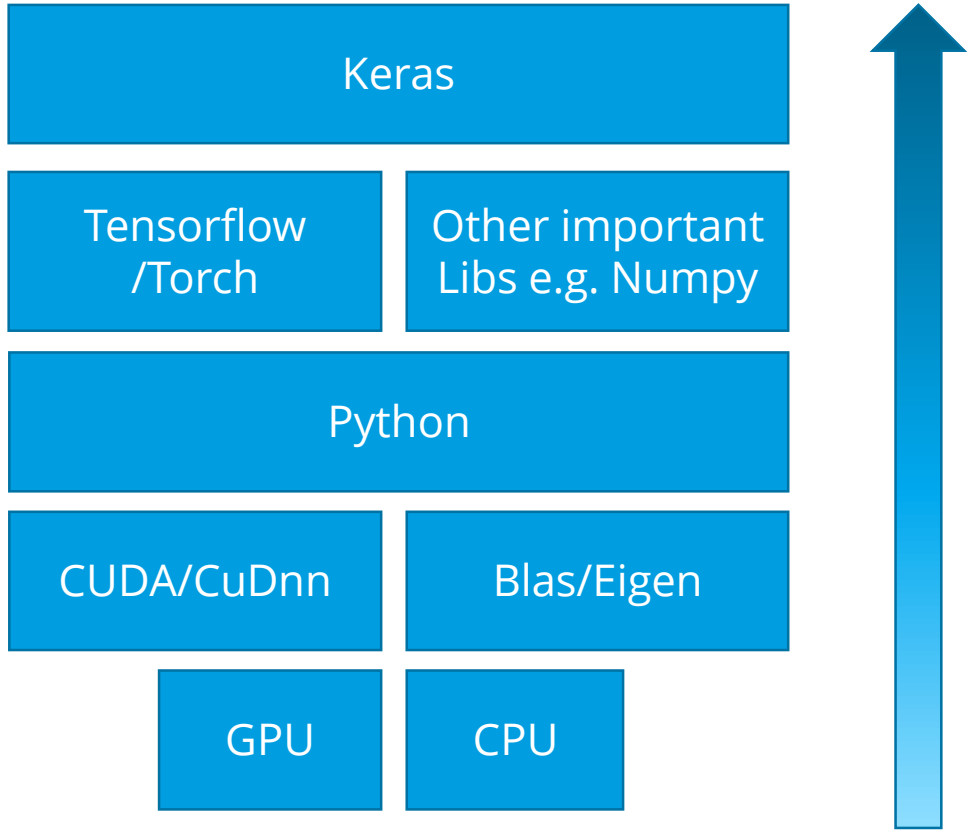
label	index											
	0	1	2	3	4	5	6	7	8	9	...	...
airplane	**1**	0	0	0	0	0	0	0	0	0	...	...
automobile	0	**1**	0	0	0	0	0	0	0	0	...	...
bird	0	0	**1**	0	0	0	0	0	0	0	...	...
cat	0	0	0	**1**	0	0	0	0	0	0	...	...
deer	0	0	0	0	**1**	0	0	0	0	0	...	...
dog	0	0	0	0	0	**1**	0	0	0	0	...	...
frog	0	0	0	0	0	0	**1**	0	0	0	...	...
horse	0	0	0	0	0	0	0	**1**	0	0	...	...
ship	0	0	0	0	0	0	0	0	**1**	0	...	...
truck	0	0	0	0	0	0	0	0	0	**1**	...	...

one-hot-encoded label data

The Keras Software & Hardware Stack

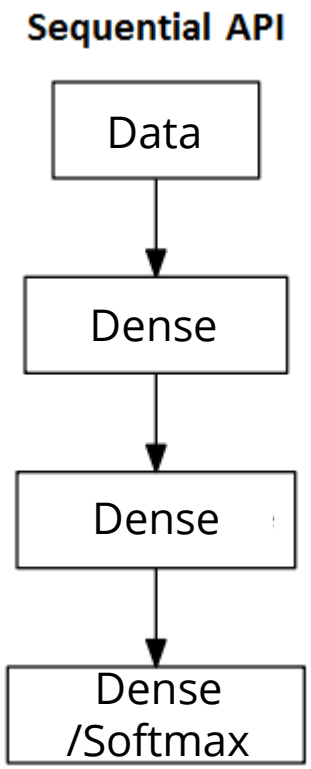
Keras is a „top level“ python class inheriting from other important liberies written in python.

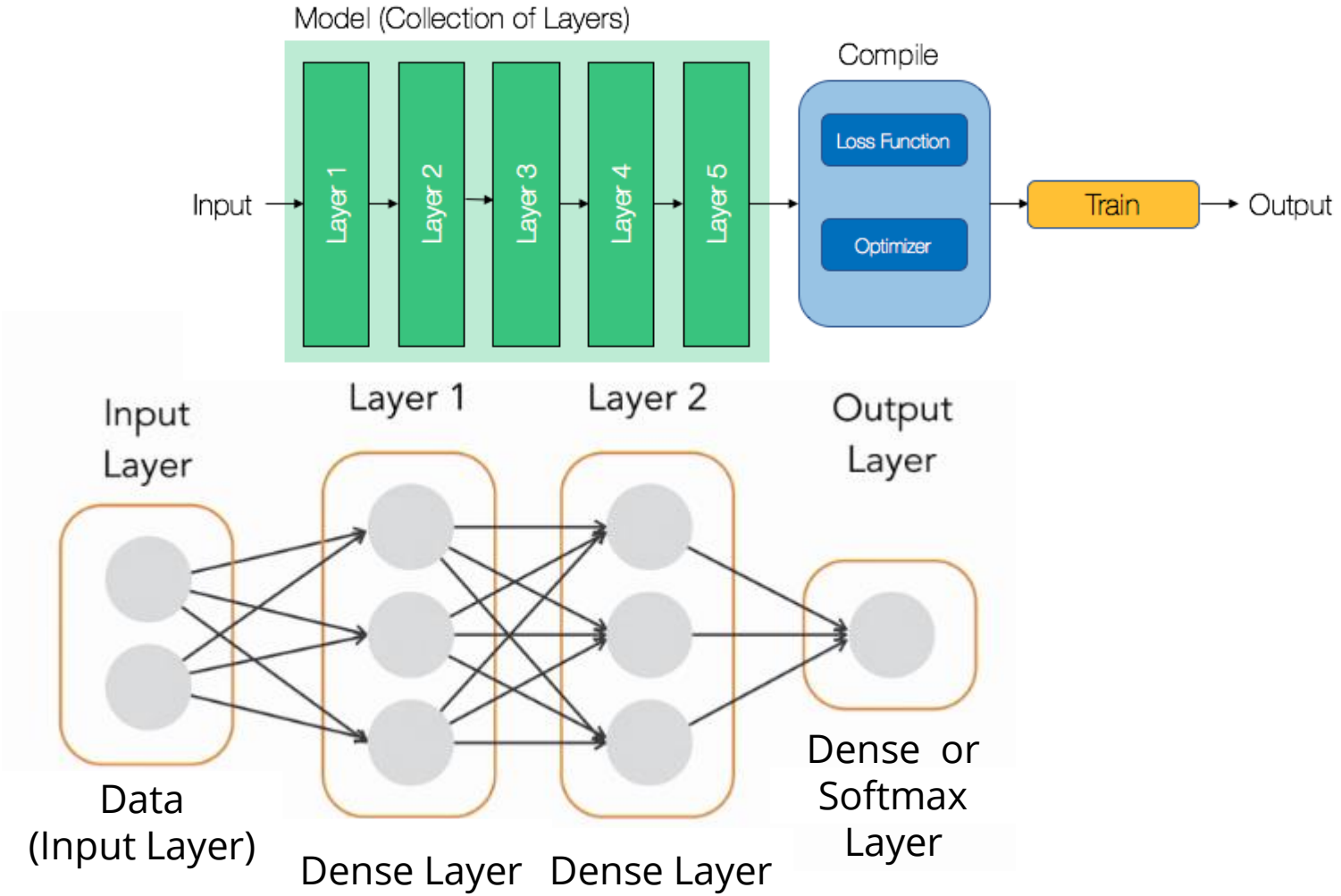
It inhertis neural networks functions from packages like tensorflow (Google) or torch (Facebook).



Keras Sequential API

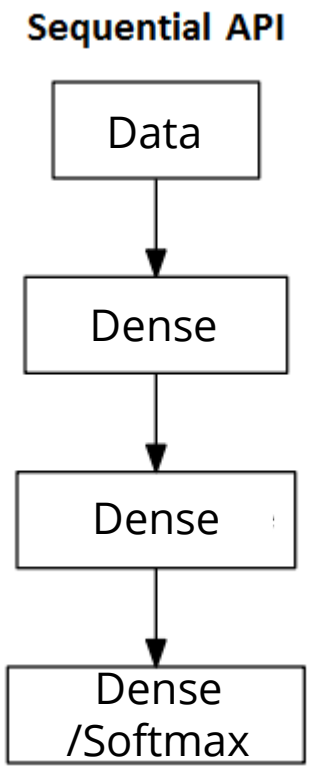
Lets classify cloths (10 classes)!





Keras Sequential API

Lets classify cloths (10 classes)!



Load Data:

```
fashion_mnist = keras.datasets.fashion_mnist

(train_images, train_labels), (test_images, test_labels) = fashion_mnist.load_data()
```

Define Model:

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

Define Optimizer:

```
model.compile(optimizer='Adam',
              loss='sparse_categorical_crossentropy',
              metrics=['accuracy'])
```

Train the Model

```
model.fit(train_images, train_labels, epochs=5)
```

Test the Model

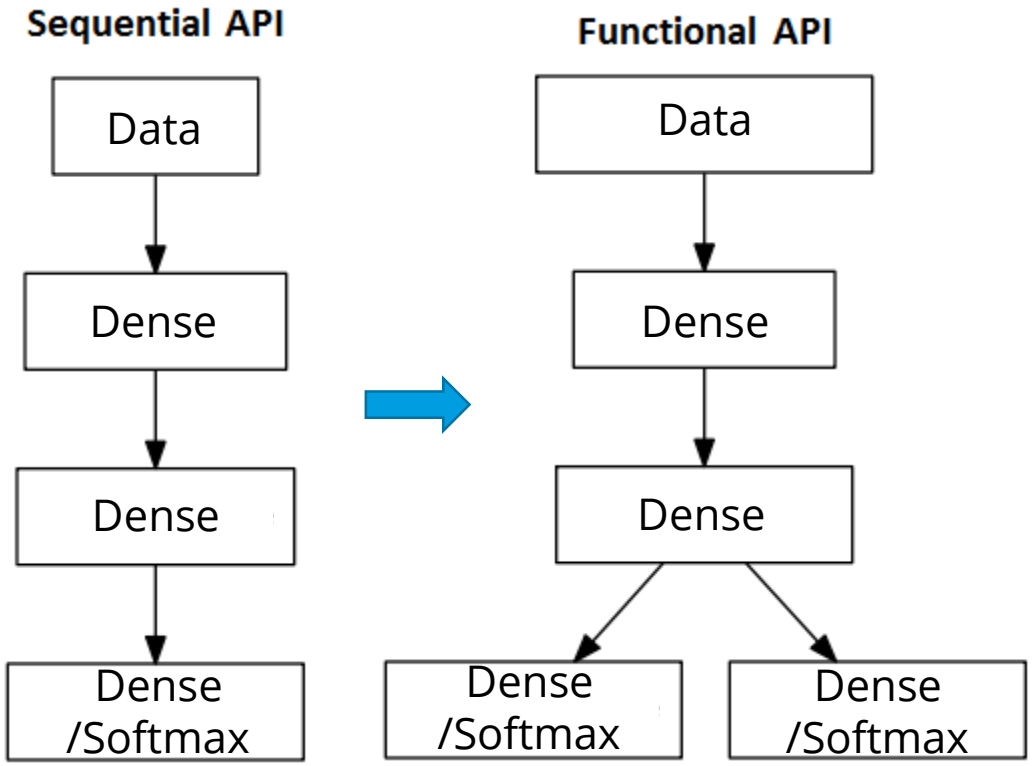
```
test_loss, test_acc = model.evaluate(test_images, test_labels)

print('Test accuracy:', test_acc)
```

Use model to make predictions:

```
predictions = model.predict(test_images)
```

Keras Functional API

Lets classify cloth and if is‘s female or male clothing with the same **neural network**! We gonna need **branching** for this which is part of the more flexibel **Functional API**.



Define Model:

```
# input layer
data = Input(shape=(28,28))
# feature extraction
hidden1 = Dense(128, activation='relu')(data)
hidden2 = Dense(128, activation='relu')(hidden1)
# classification
class1 = Dense(1, activation='softmax')(hidden2) #  male of female clothing?
class2 = Dense(10, activation='softmax')(hidden2) # classification color

# output
model = Model(inputs=data, outputs=[class1, class2])
```

Everything else stays the same!

4. Exercise

Let‘s train our first classifier with Keras!