Neuron network with Keras library

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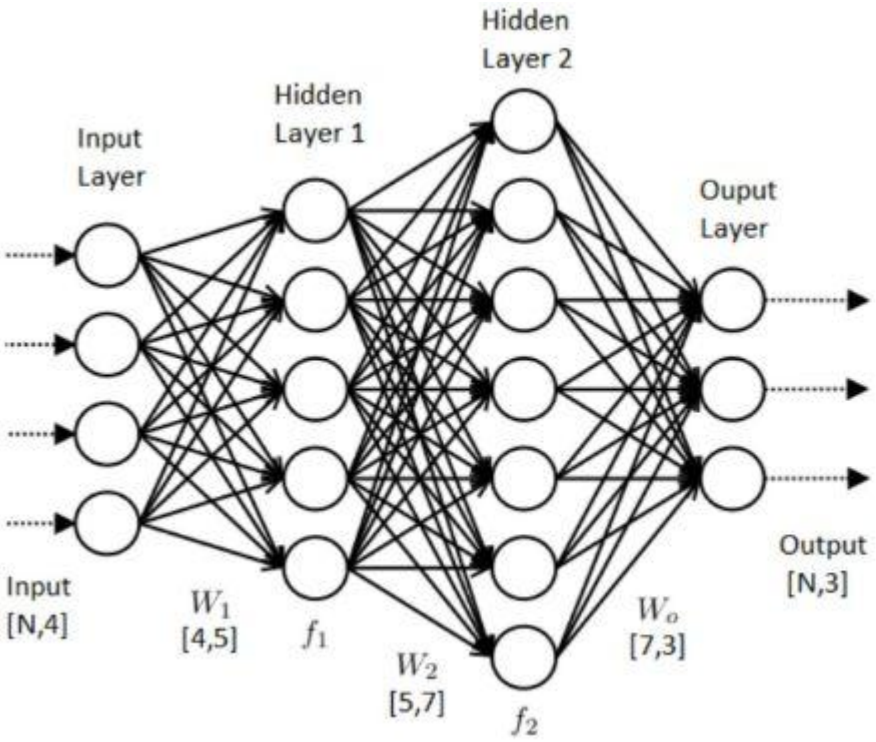

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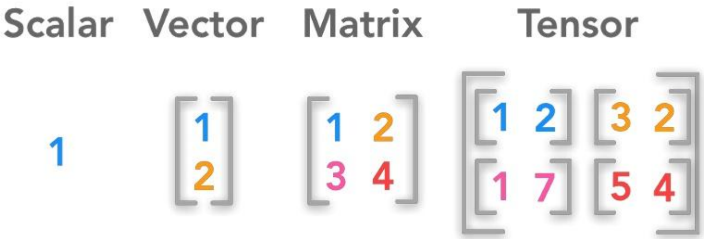
Neuron network libraries

TOP libraries

- ➢ Tensor flow
- ➢ Pytorch
- ➢ MXNet
- ➢ …

Why we need library?

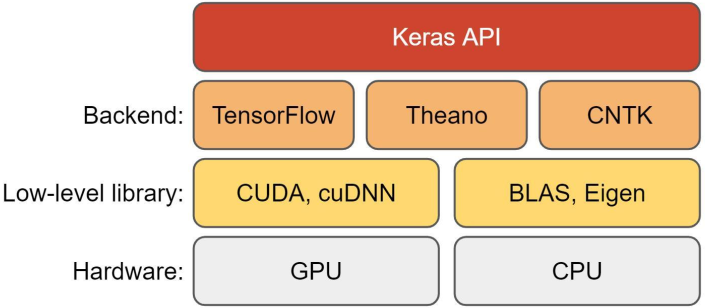
- Easy to build complex neuron network
- Auto gradient
- Utilities to control training and prediction process
- Easy to intergrate with GPU
- Processing unit is tensor



Keras

- Overview

- Simple
- Flexible
- Powerful



Keras API

Backend: TensorFlow | Theano | CNTK

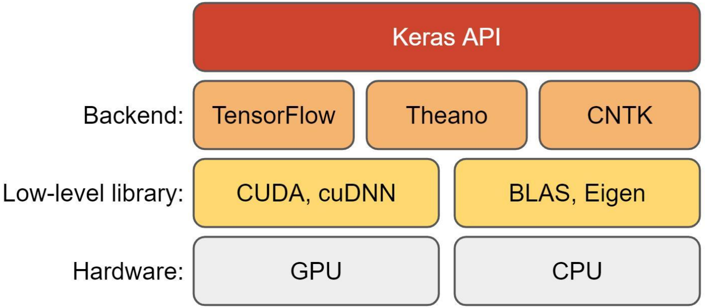
Low-level library: CUDA, cuDNN | BLAS, Eigen

Hardware: GPU | CPU

Keras

- Model

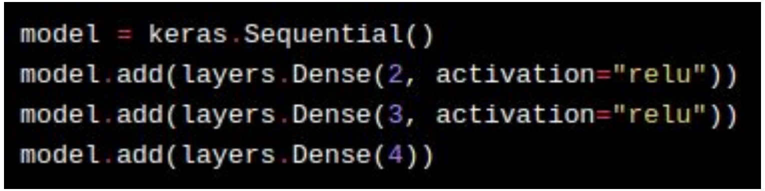
- **Sequential model**: single input, single output
- **Functional API**: support most cases
- **Model subclassing**: out of the box research use cases



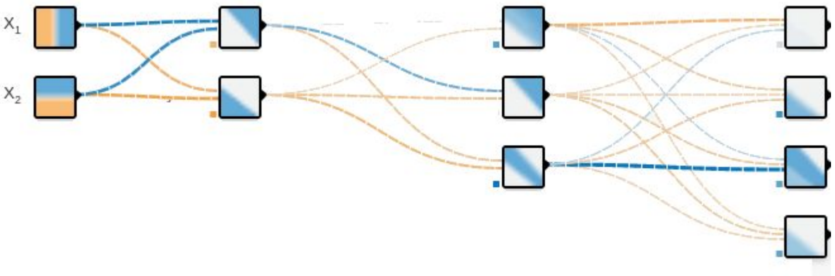
Keras

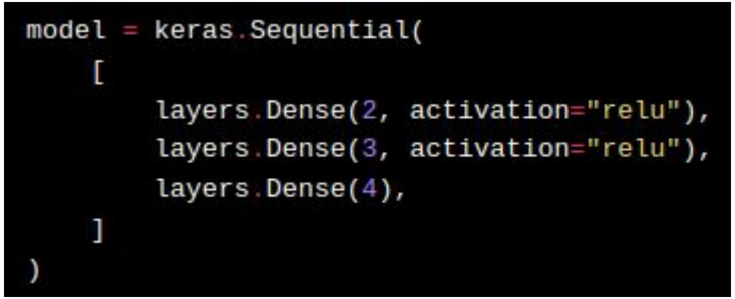
- Model

A Sequential model is appropriate for a plain stack of layers where each layer has exactly one input tensor and one output tensor.



```
model = keras.Sequential()
model.add(layers.Dense(2, activation="relu"))
model.add(layers.Dense(3, activation="relu"))
model.add(layers.Dense(4))
```



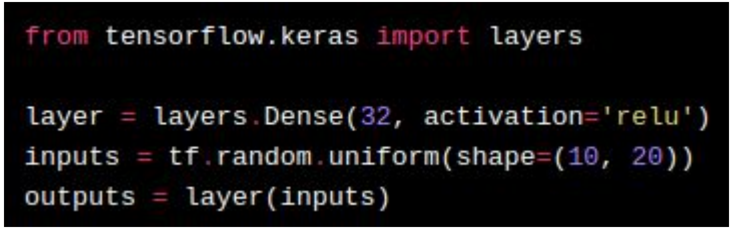


```
model = keras.Sequential(
    [
        layers.Dense(2, activation="relu"),
        layers.Dense(3, activation="relu"),
        layers.Dense(4),
    ]
)
```

Keras

- Layer

- A Layer instance is callable, much like a function
- Layers maintain a state, updated when the layer receives data during training, and stored in layer.weights
- Types of layers:
    - Core layer
    - Convolution layer
    - Pooling layer
    - Recurrent layer
    - Preprocessing layer
    - Normalization layer
    - Attention layer
    - Reshaping layer
    - Locally connected layer
    - Activation layer

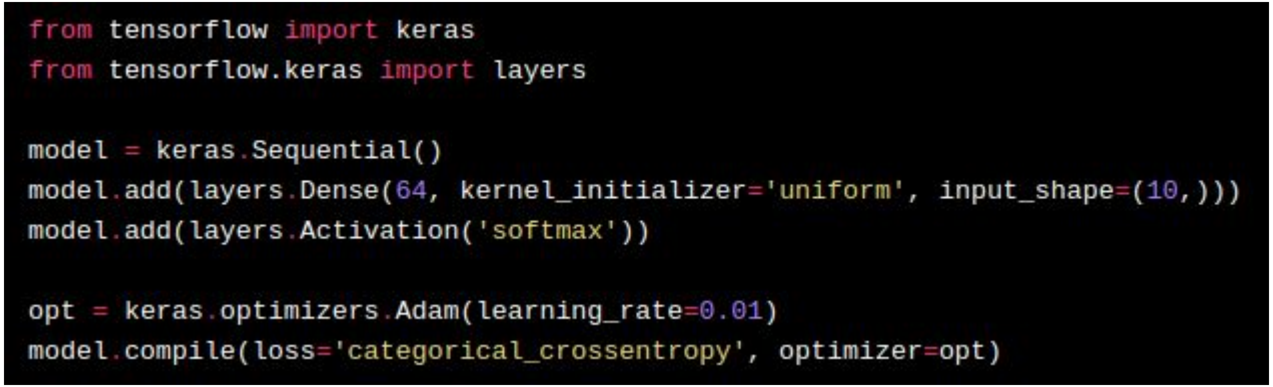


```
from tensorflow.keras import layers

layer = layers.Dense(32, activation='relu')
inputs = tf.random.uniform(shape=(10, 20))
outputs = layer(inputs)
```

Keras

- Optimizer

- SGD
- RMSprop
- Adam
- Adadelta
- Adagrad
- Adamax
- Nadam
- Ftrl

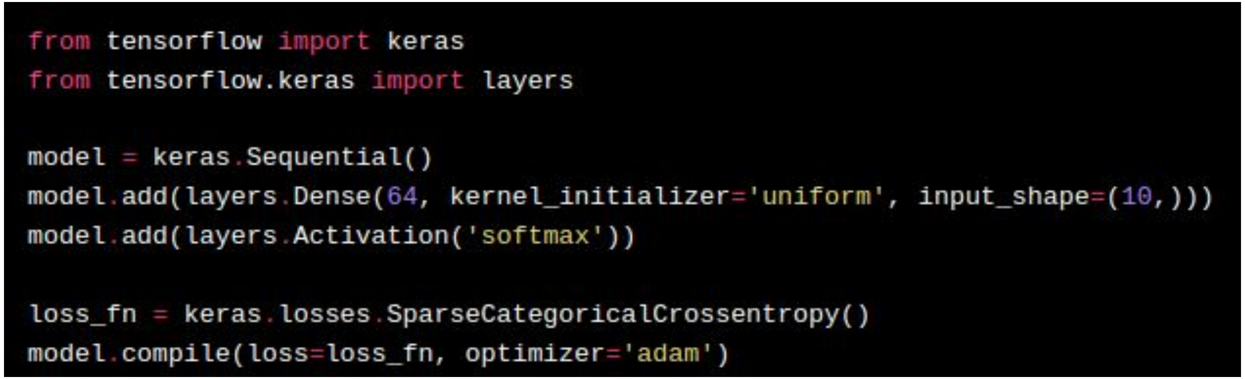


```python
from tensorflow import keras
from tensorflow.keras import layers

model = keras.Sequential()
model.add(layers.Dense(64, kernel_initializer='uniform', input_shape=(10,)))
model.add(layers.Activation('softmax'))

opt = keras.optimizers.Adam(learning_rate=0.01)
model.compile(loss='categorical_crossentropy', optimizer=opt)
```

Keras

- Losses

- The purpose of loss functions is to compute the quantity that a model should seek to minimize during training
- Reference in https://keras.io/api/losses/

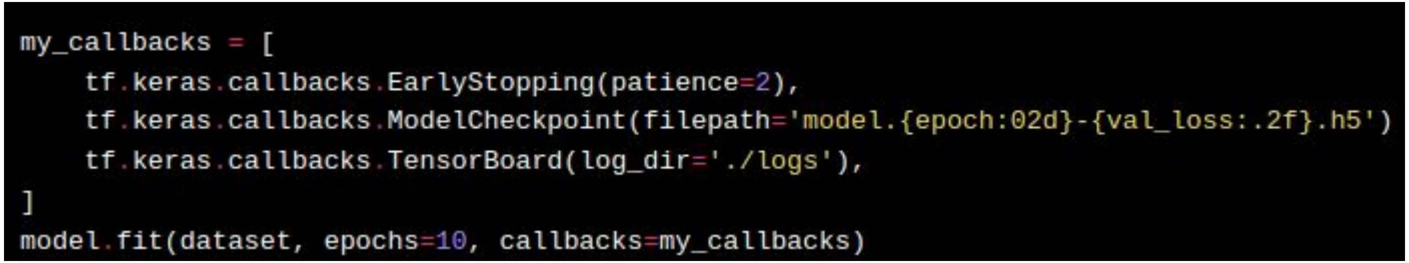


```
from tensorflow import keras
from tensorflow.keras import layers

model = keras.Sequential()
model.add(layers.Dense(64, kernel_initializer='uniform', input_shape=(10,)))
model.add(layers.Activation('softmax'))

loss_fn = keras.losses.SparseCategoricalCrossentropy()
model.compile(loss=loss_fn, optimizer='adam')
```

Keras

- Call back

- Write TensorBoard logs after every batch of training to monitor your metrics
- Periodically save your model to disk
- Do early stopping
- Get a view on internal states and statistics of a model during training
- …

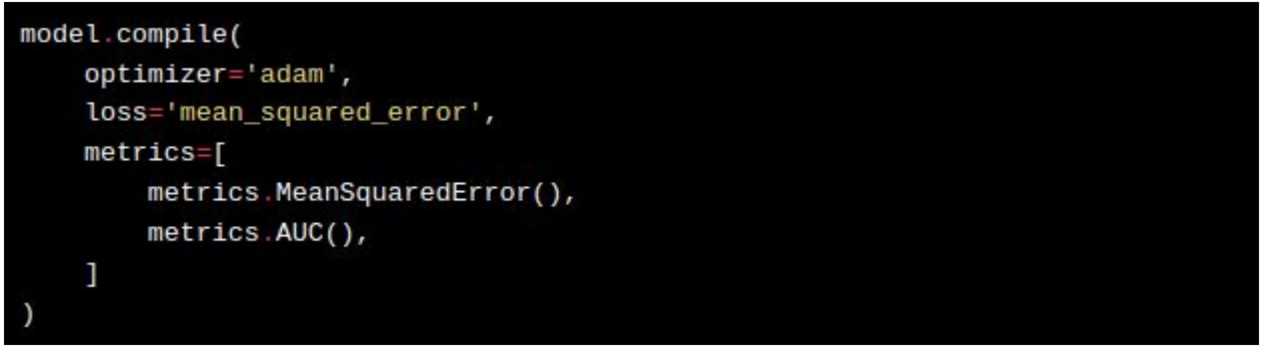


```
my_callbacks = [
    tf.keras.callbacks.EarlyStopping(patience=2),
    tf.keras.callbacks.ModelCheckpoint(filepath='model.{epoch:02d}-{val_loss:.2f}.h5')
    tf.keras.callbacks.TensorBoard(log_dir='./logs'),
]
model.fit(dataset, epochs=10, callbacks=my_callbacks)
```

Keras

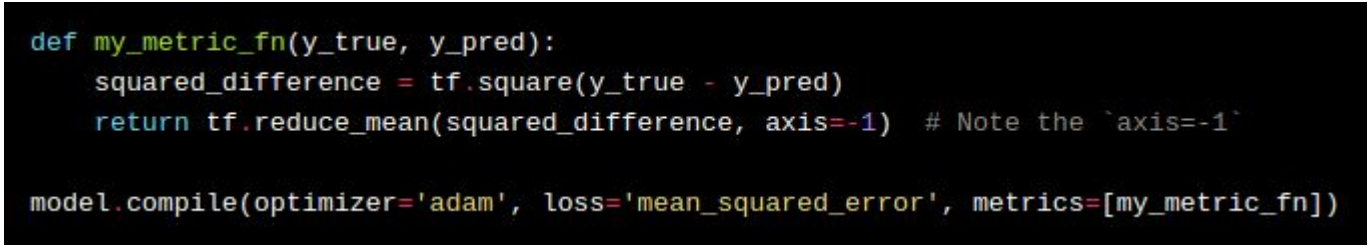
- Metric

Predefine metric



```
model.compile(
    optimizer='adam',
    loss='mean_squared_error',
    metrics=[
        metrics.MeanSquaredError(),
        metrics.AUC(),
    ]
)
```

Custom metric



```
def my_metric_fn(y_true, y_pred):
    squared_difference = tf.square(y_true - y_pred)
    return tf.reduce_mean(squared_difference, axis=-1)  # Note the `axis=-1`

model.compile(optimizer='adam', loss='mean_squared_error', metrics=[my_metric_fn])
```

References

- https://analyticsindiamag.com/top-7-python-neural-network-libraries-for-developers/
- https://keras.io/

Thank You!