Workshop 5 – Deep Learning

Advanced Analytics and Applications [AAA]

Information Systems for Sustainable Society (is3) | WiSo Faculty | Univ.-Prof. Dr. Wolfgang Ketter | 5/10/23

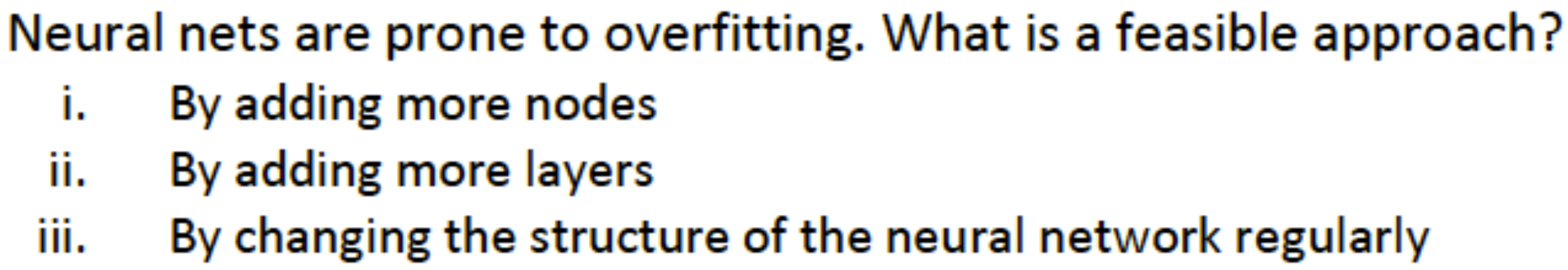
I Multiple Choice Questions

II Calculation

III Programming

AAA Workshop

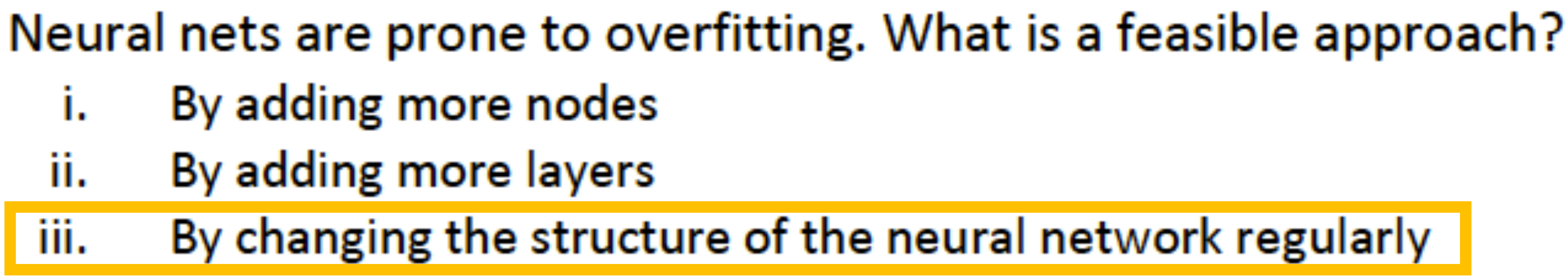
Question 1.1: Deep Learning



Neural nets are prone to overfitting. What is a feasible approach?

i. By adding more nodes
ii. By adding more layers
iii. By changing the structure of the neural network regularly

Question 1.1: Deep Learning



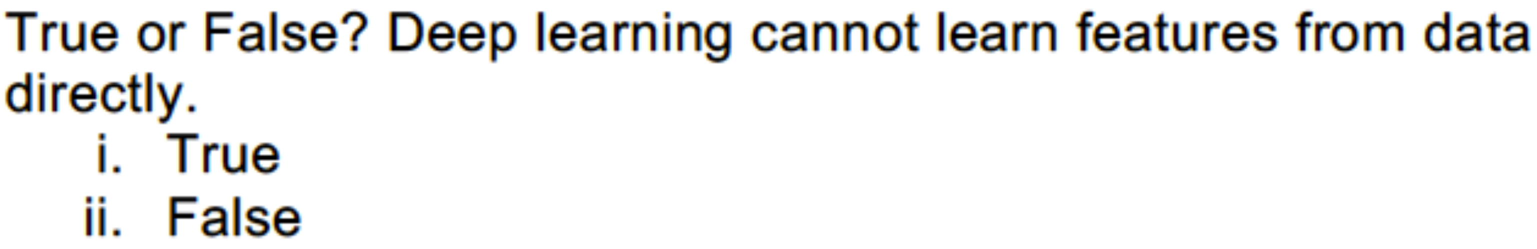
Neural nets are prone to overfitting. What is a feasible approach?

i. By adding more nodes

ii. By adding more layers

[✓ iii. By changing the structure of the neural network regularly]

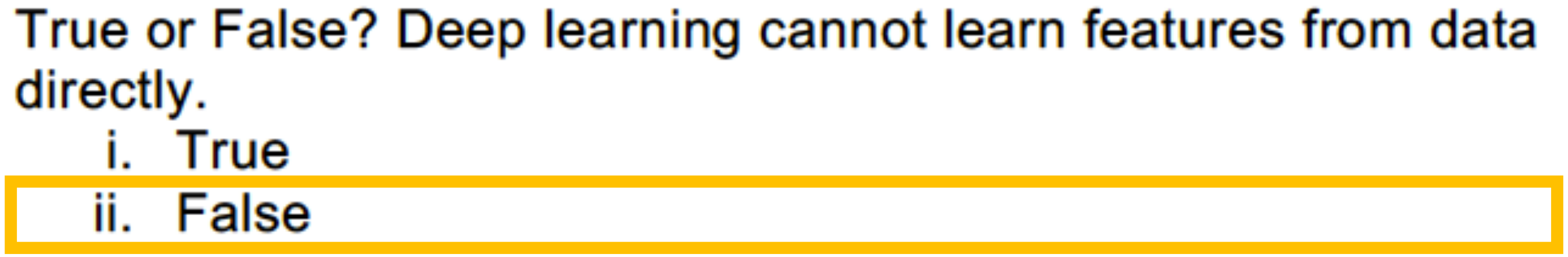
Question 1.2: Deep Learning



True or False? Deep learning cannot learn features from data directly.

i. True
ii. False

Question 1.2: Deep Learning



True or False? Deep learning cannot learn features from data directly.

i. True

ii. [✓ False]

I Multiple Choice Questions

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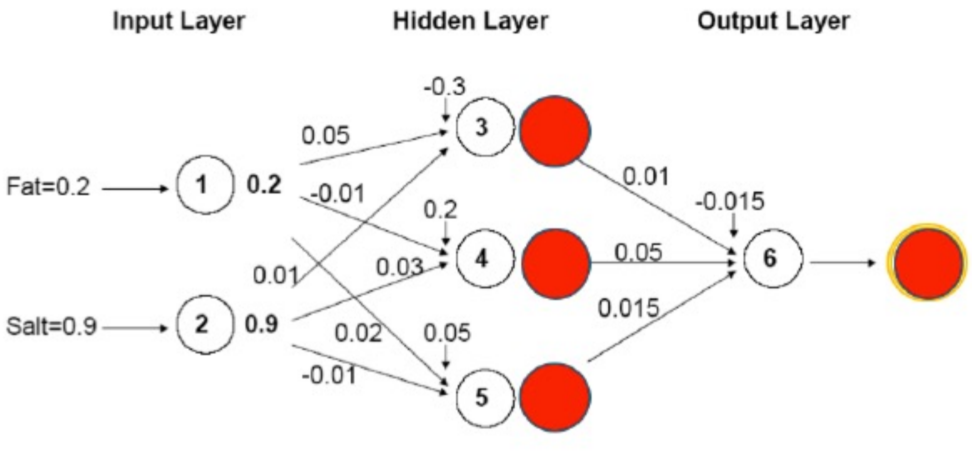
Question 2: Calculation



Activation function: g(z) = ln(1+e^z)

Calculate the missing values using a softplus activation function.

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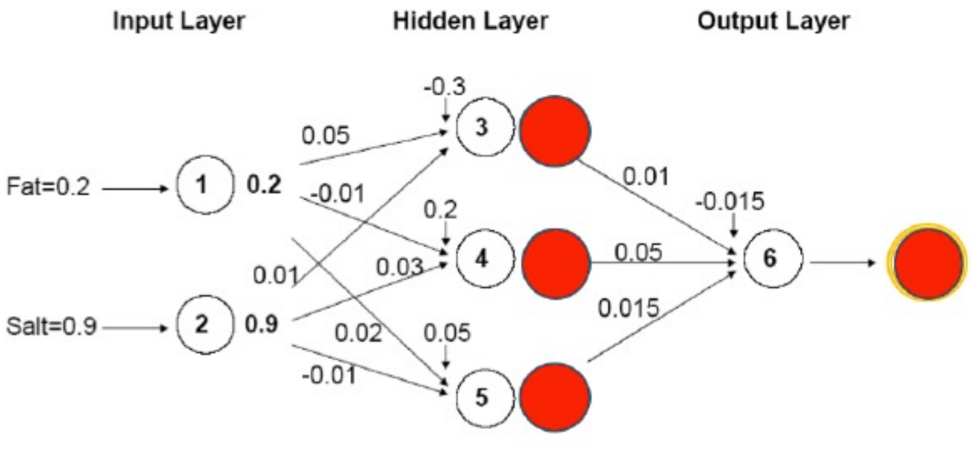
Question 2: Calculation



Activation function: g(z) = ln(1+e^z)

3) ln(1+e^(0.2*0.05+0.9*0.01-0.3)) = 0.56

4) ln(1+e^(0.2*-0.01+0.9*0.03+0.2)) = 0.81

5) ln(1+e^(0.2*0.02+0.9*-0.01+0.05)) = 0.71

6) ln(1+e^(0.56*0.01+0.81*0.05+0.71*0.15-0.015)) = 0.76

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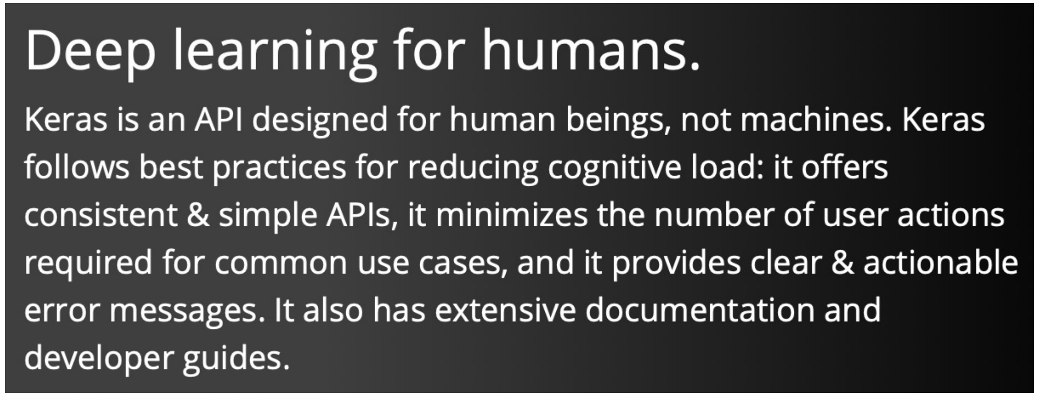
Question 3: Programming with Keras

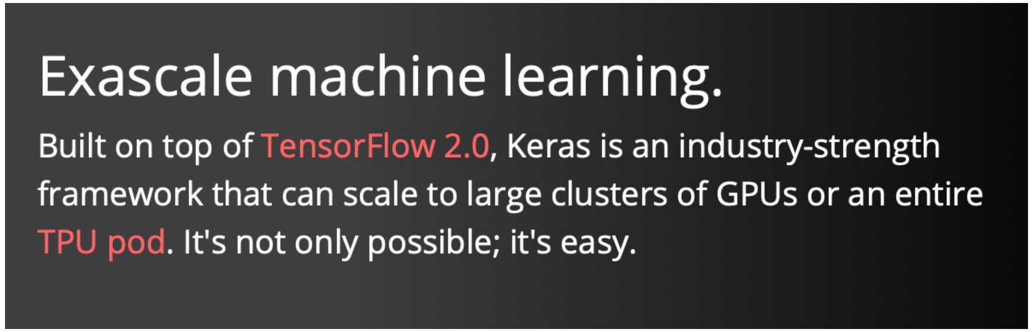
Keras

Simple. Flexible. Powerful.



Deep learning for humans.

Keras is an API designed for human beings, not machines. Keras follows best practices for reducing cognitive load: it offers consistent & simple APIs, it minimizes the number of user actions required for common use cases, and it provides clear & actionable error messages. It also has extensive documentation and developer guides.

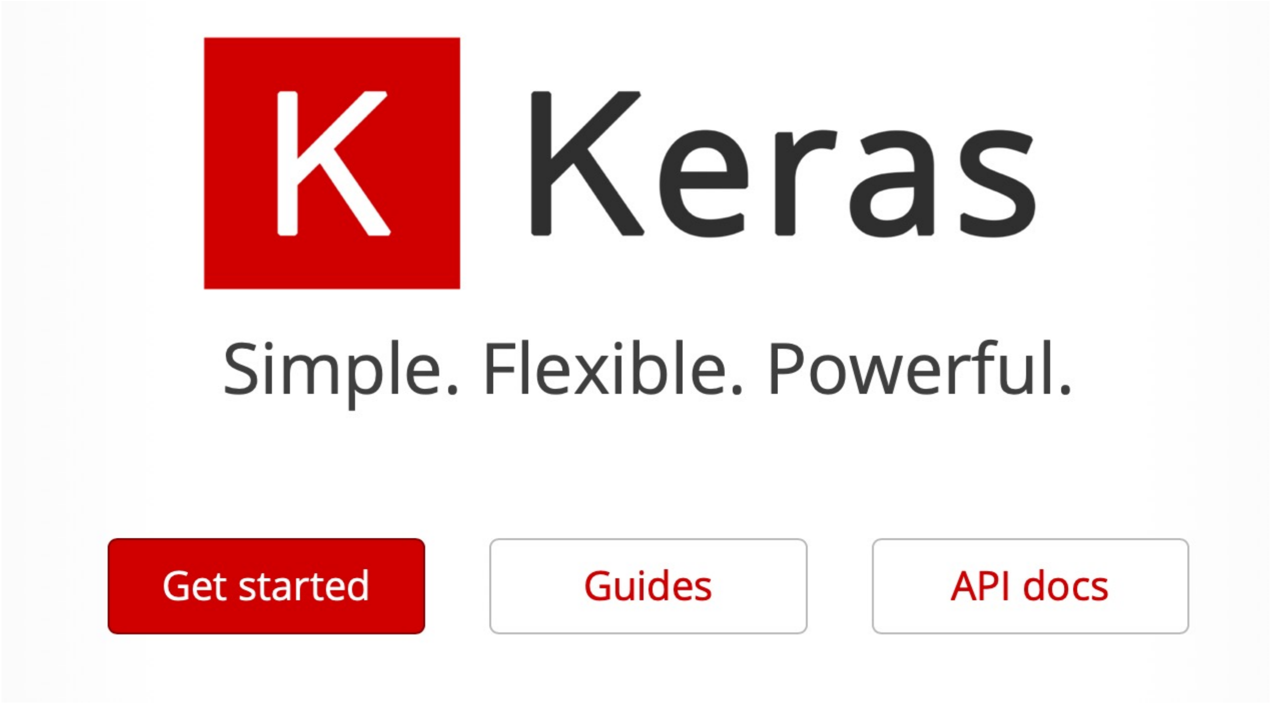


Exascale machine learning.

Built on top of TensorFlow 2.0, Keras is an industry-strength framework that can scale to large clusters of GPUs or an entire TPU pod. It's not only possible; it's easy.

Question 3: Programming with Keras

https://keras.io



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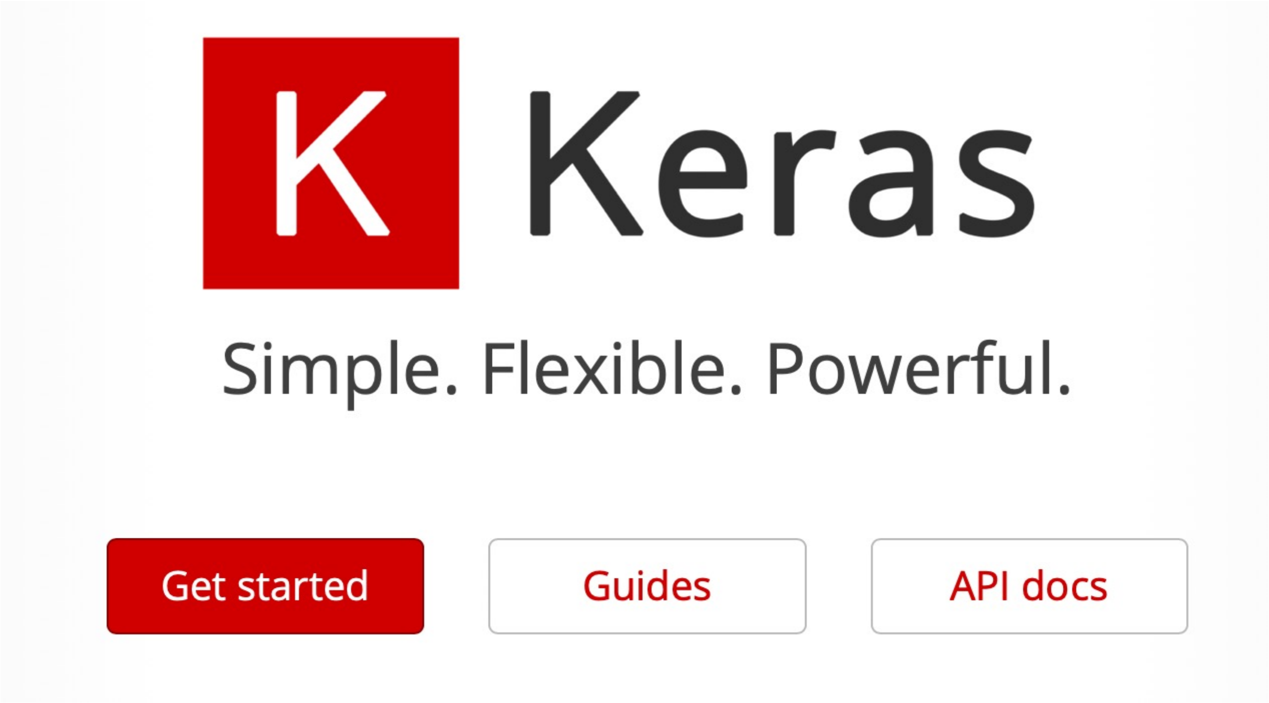

Keras

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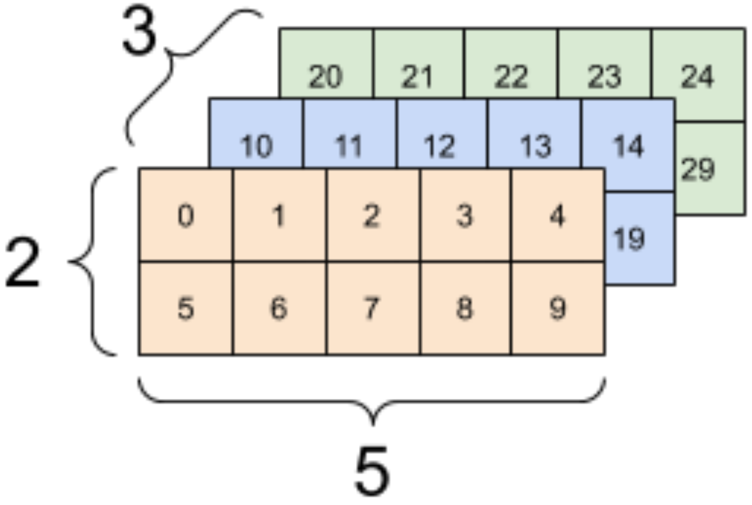
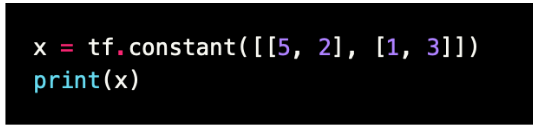
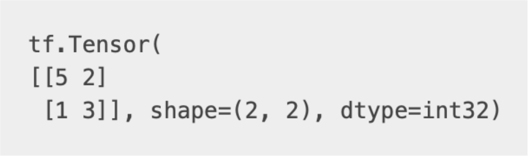
Question 3: Programming with Keras





```
x = tf.constant([[5, 2], [1, 3]])
print(x)
```

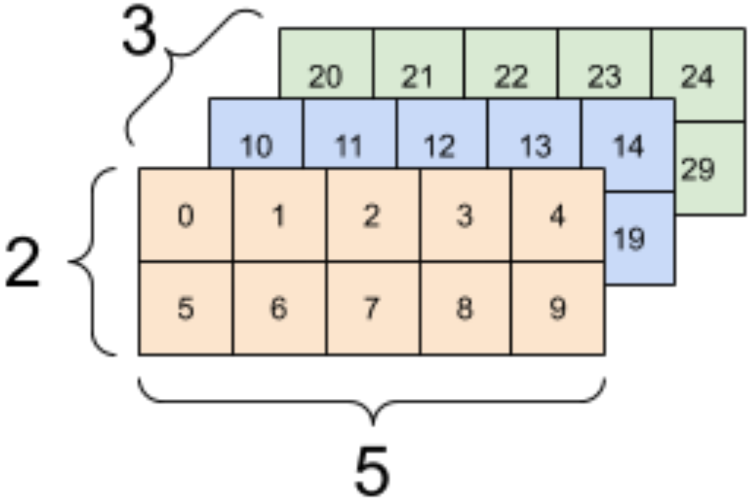


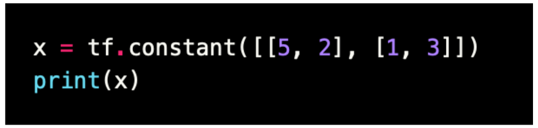
```
tf.Tensor(
[[5 2]
 [1 3]], shape=(2, 2), dtype=int32)
```

Tensors are N-Dimensional arrays, much like NumPy.

However, beyond parallel computing advantages, keras can automatically compute **derivates of tensor expressions**.

Question 3: Programming with Keras





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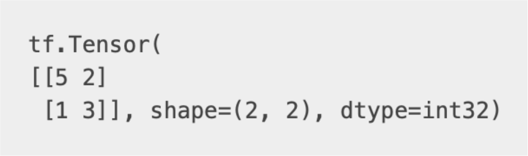

```
tf.Tensor(
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```
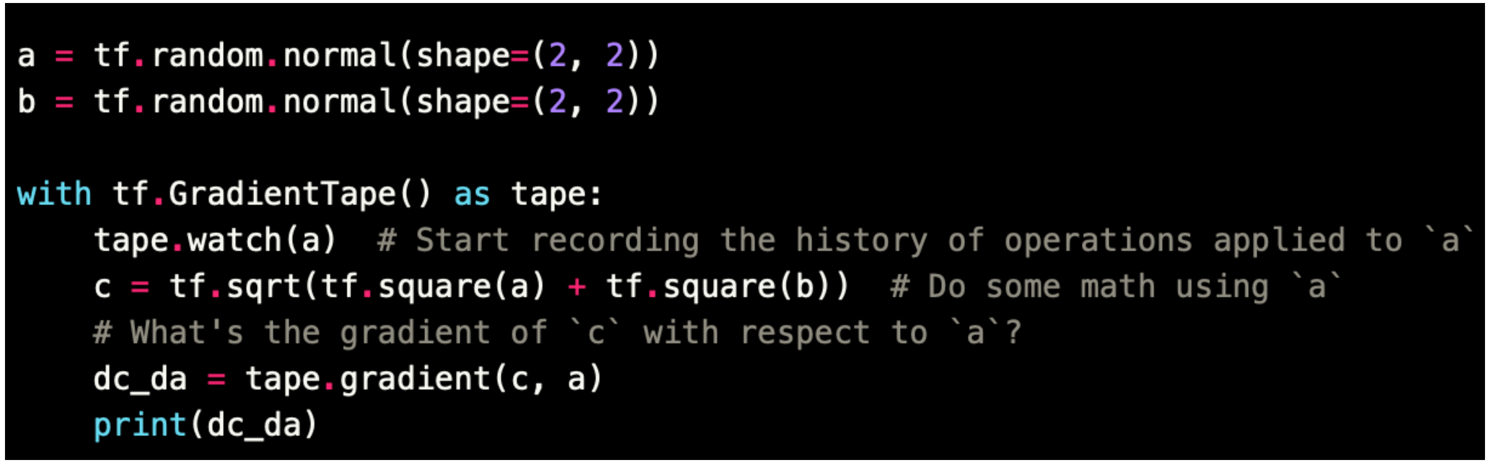

Variables are **mutable** N-Dimensional arrays, i.e., special tensors.

For example, to store the state of weights.

Question 3: Programming with Keras

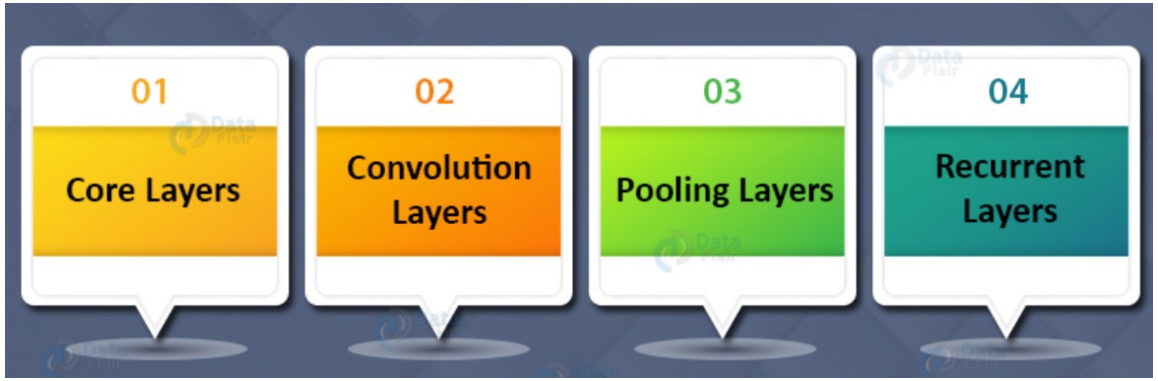


```
a = tf.random.normal(shape=(2, 2))
b = tf.random.normal(shape=(2, 2))

with tf.GradientTape() as tape:
    tape.watch(a)  # Start recording the history of operations applied to `a`
    c = tf.sqrt(tf.square(a) + tf.square(b))  # Do some math using `a`
    # What's the gradient of `c` with respect to `a`?
    dc_da = tape.gradient(c, a)
    print(dc_da)
```

Calculating **gradients** using tensors is quite easy using **GradientTape**.

But generally speaking not necessary as it is done automatically during training.

Question 3: Programming with Keras



The **Layer** class is the fundamental abstraction in Keras.

A **Layer** encapsulates a state (weights) and some computation (defined in the call method).

Contact

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