Deep Learning mit Keras und TensorFlow

Motivation

- Einführung Deep Learning
- Ein Neuronales Netz trainieren (Keras und TensorFlow)
- Selbststudium ermöglichen

Inhalt

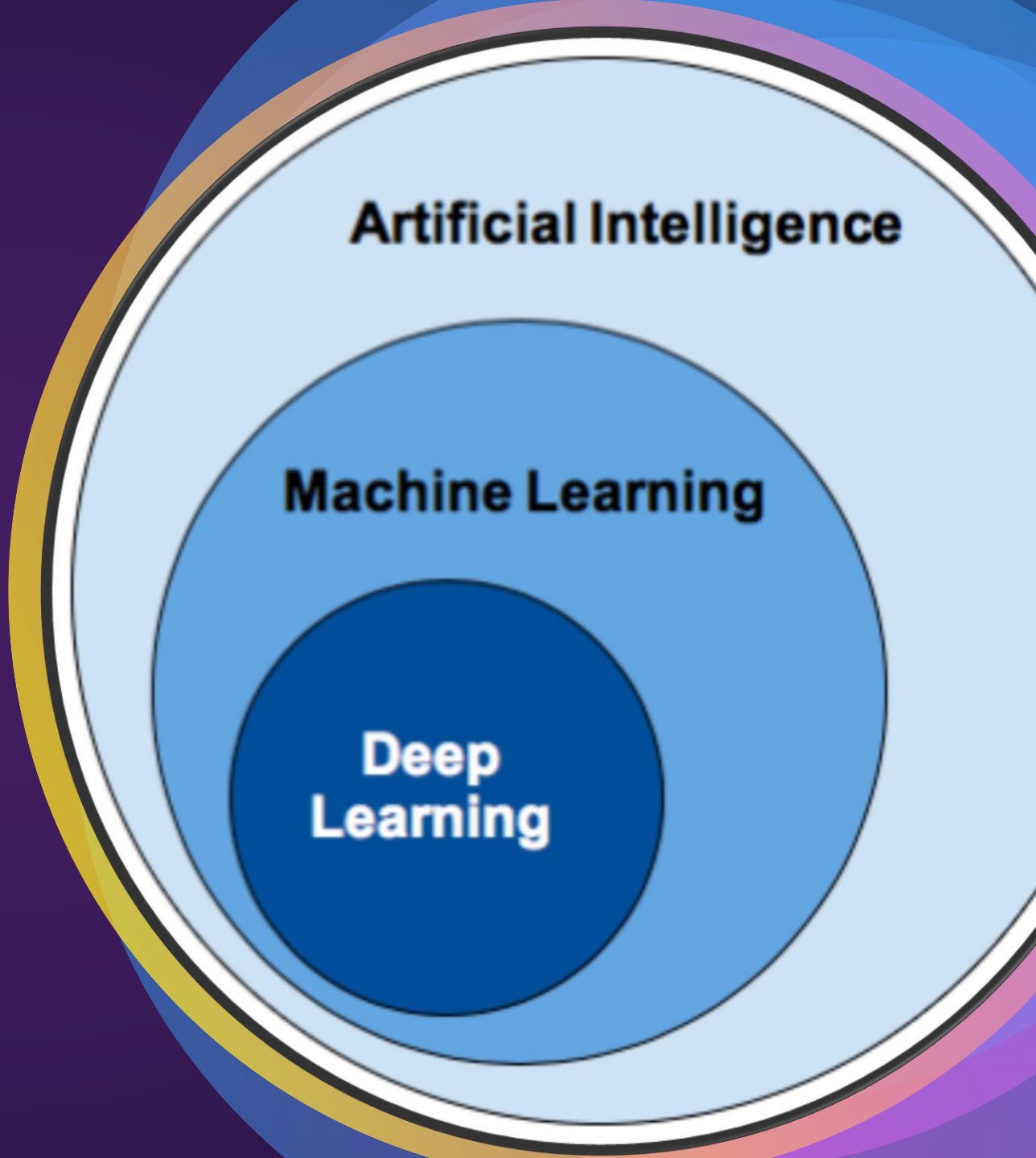
- Deep Learning
- Neuronales Netze
- Keras und TensorFlow (Python)
- Google Colab (Jupyter Notebook)

Deep Learning

Deep Learning

Was ist

Deep Learning



https://www.sumologic.com/blog/machine-learning-deep-learning/

Deep Learning

Warum brauchen wir

Deep Learning

https://hackernoon.com/

Deep Learning

https://www.zooroyal.de/magazin/katzen/kosten-katze/

Typische

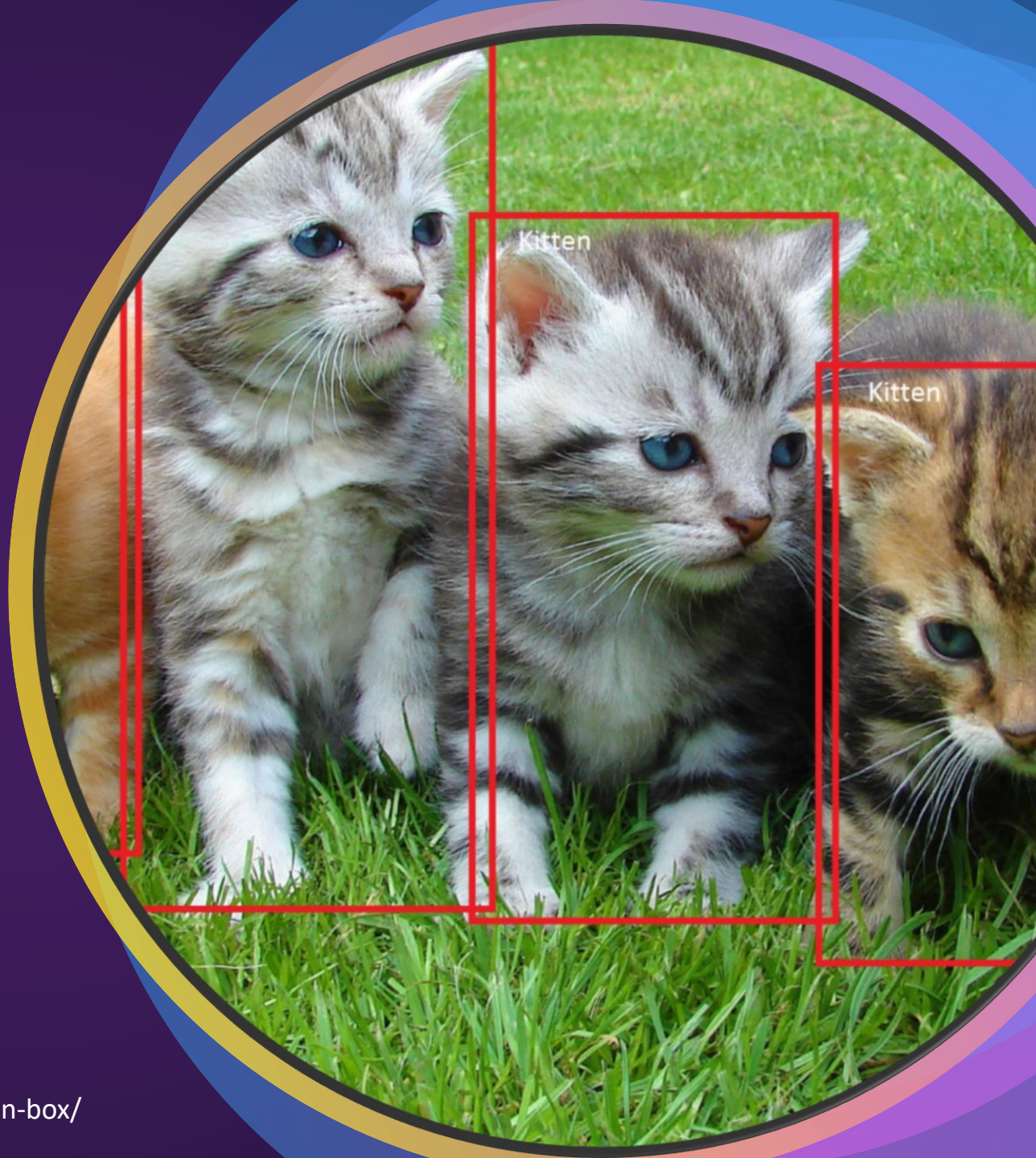
Deep Learning

Probleme

https://praxistipps.focus.de/nierendiaet-fuer-hunde-alle-infos_107467

Deep Learning

Typische Deep Learning Probleme



https://www.microsoft.com/developerblog/2017/04/10/end-end-object-detection-box/

Deep Learning

Typische

Deep Learning

Probleme

Hey Alexa...

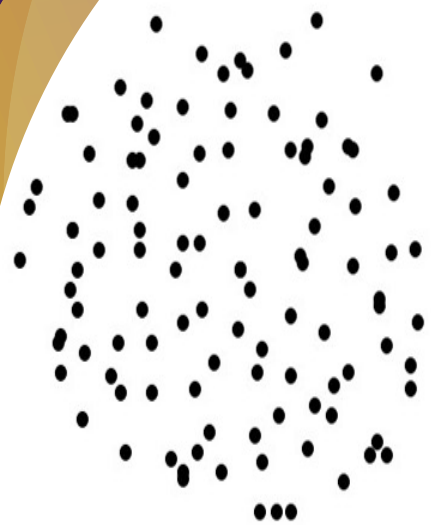
Deep Learning

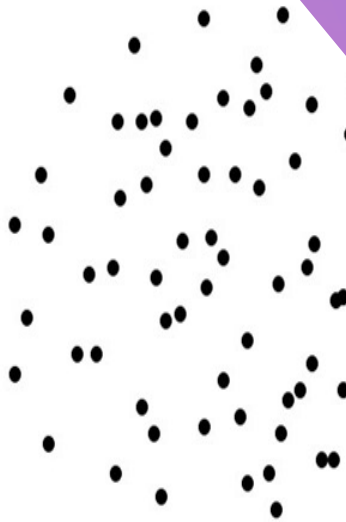
Typische
Deep Learning
Probleme

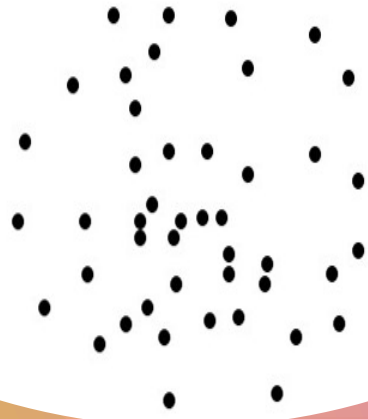
https://medium.com/mlreview/a-simple-deep-learning-model-for-stock-price-prediction-using-tensorflow-30505541d877

Deep Learning

Typische Deep Learning Probleme



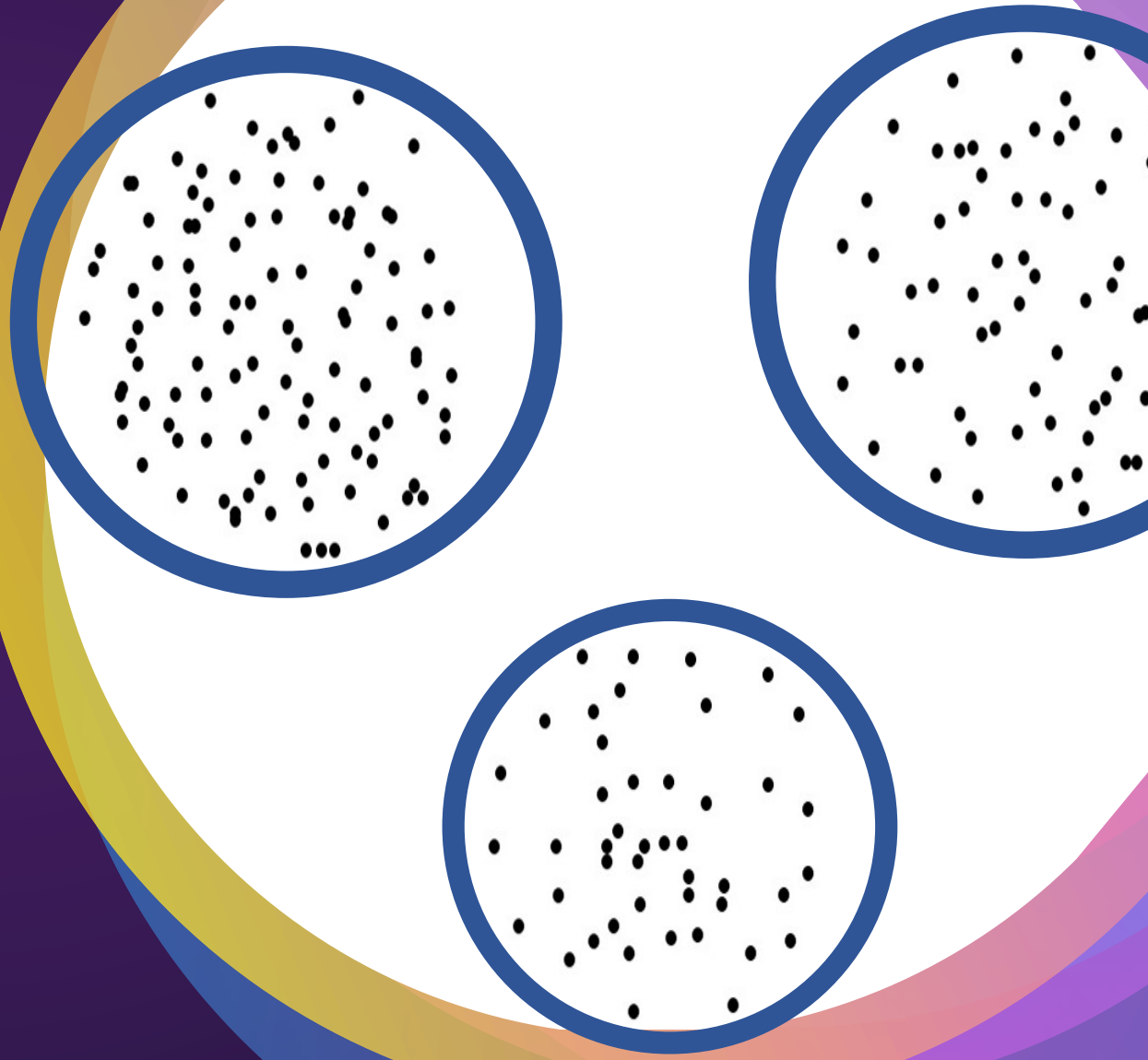




https://www.geeksforgeeks.org/clustering-in-machine-learning/

Deep Learning

Typische Deep Learning Probleme



https://www.geeksforgeeks.org/clustering-in-machine-learning/

Deep Learning

https://www.heikovaneckert.de/schach-oder-erfolgreiche-verhandlung/

Typische

Deep Learning

Probleme

https://www.fotocommunity.de/photo/go-spiel-natacha-juliette-b/22762438

Deep Learning

Wie funktioniert

Deep Learning

Deep Learning

https://theleadershipnetwork.com/

Wie funktioniert

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https://theleadershipnetwork.com/

http://farefwd.com/

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http://farefwd.com/

Wie funktioniert

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https://medium.com/@datamonsters/

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https://medium.com/@datamonsters/

https://oupeltglobalblog.com/2018/03/27/

Deep Learning

Wie funktioniert

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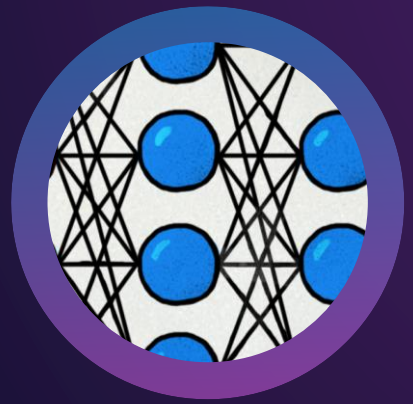
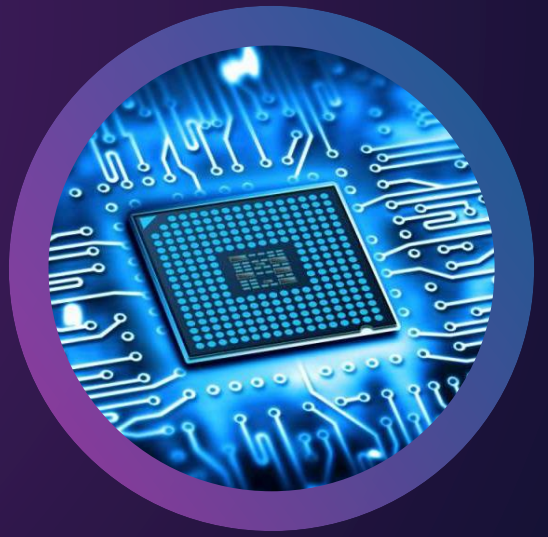
http://farefwd.com/



https://medium.com/@datamonsters/

https://oupeltglobalblog.com/2018/03/27/



https://www.pc-magazin.de/

Neuronale Netze

Neuronale Netze

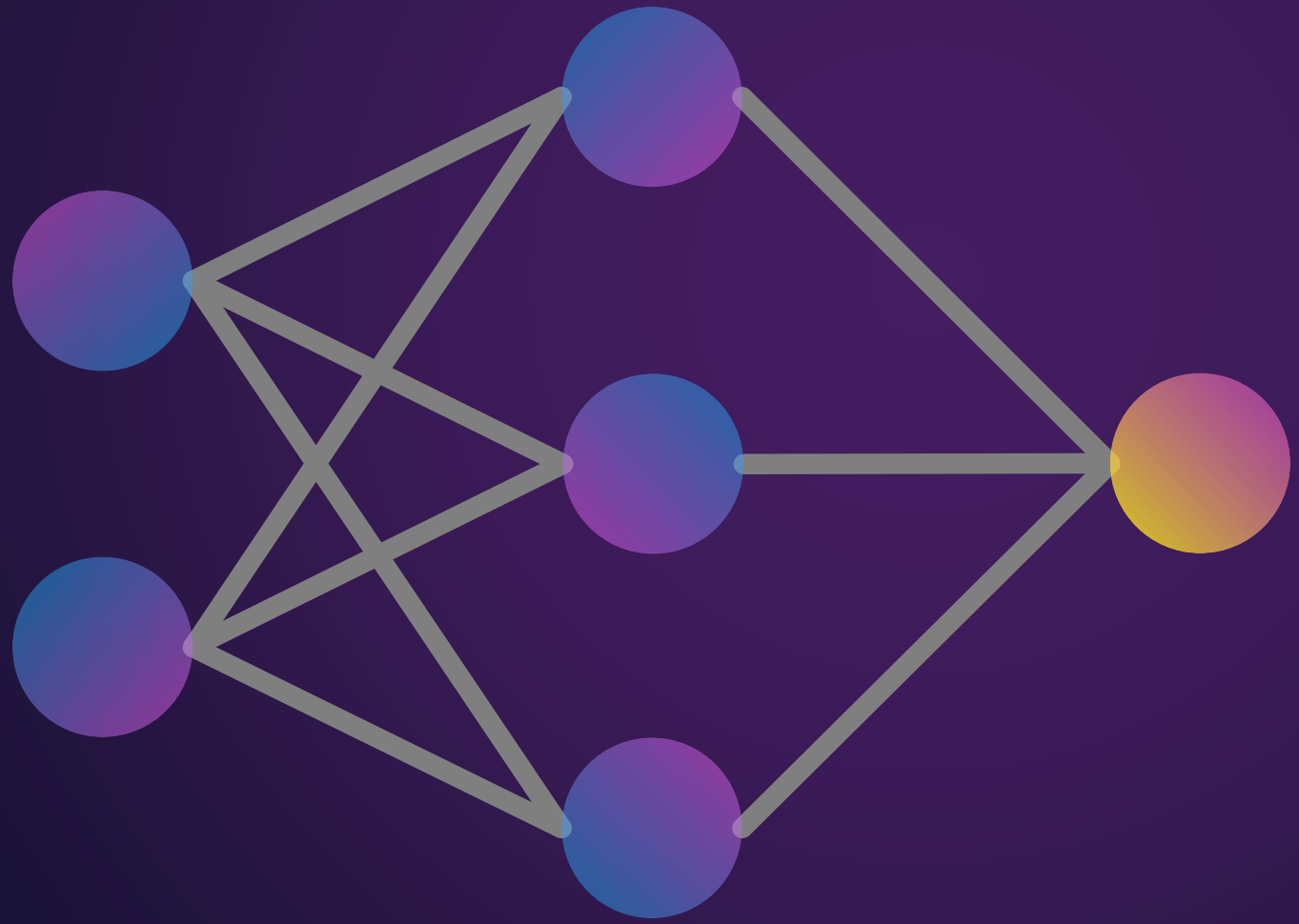
Und ihre

Geschichte

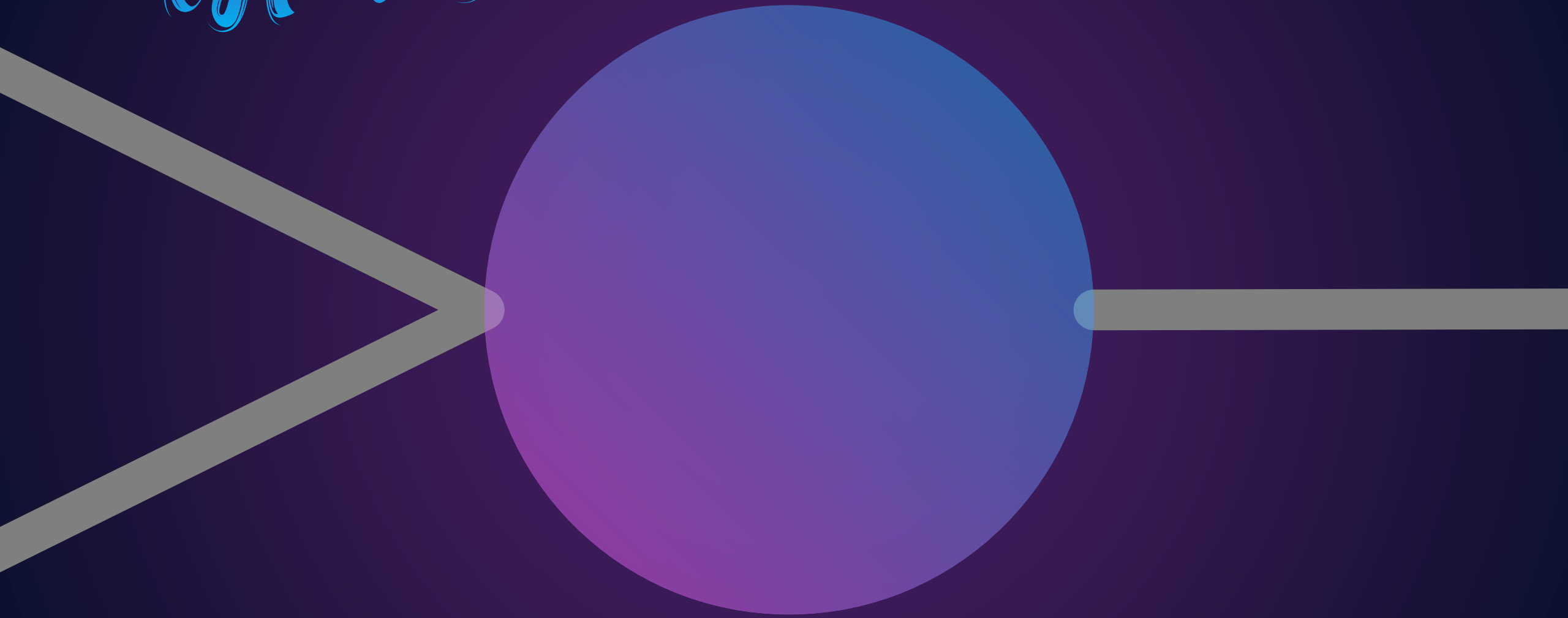
- Approximation belibiger Funktion
- 1943: Mathematisches Modell
- 1986: Stabiler Lernalgorithmus
- ‘loosely modeled after the human brain‘
- Vielzahl an Architecturen

Neuronale Netze

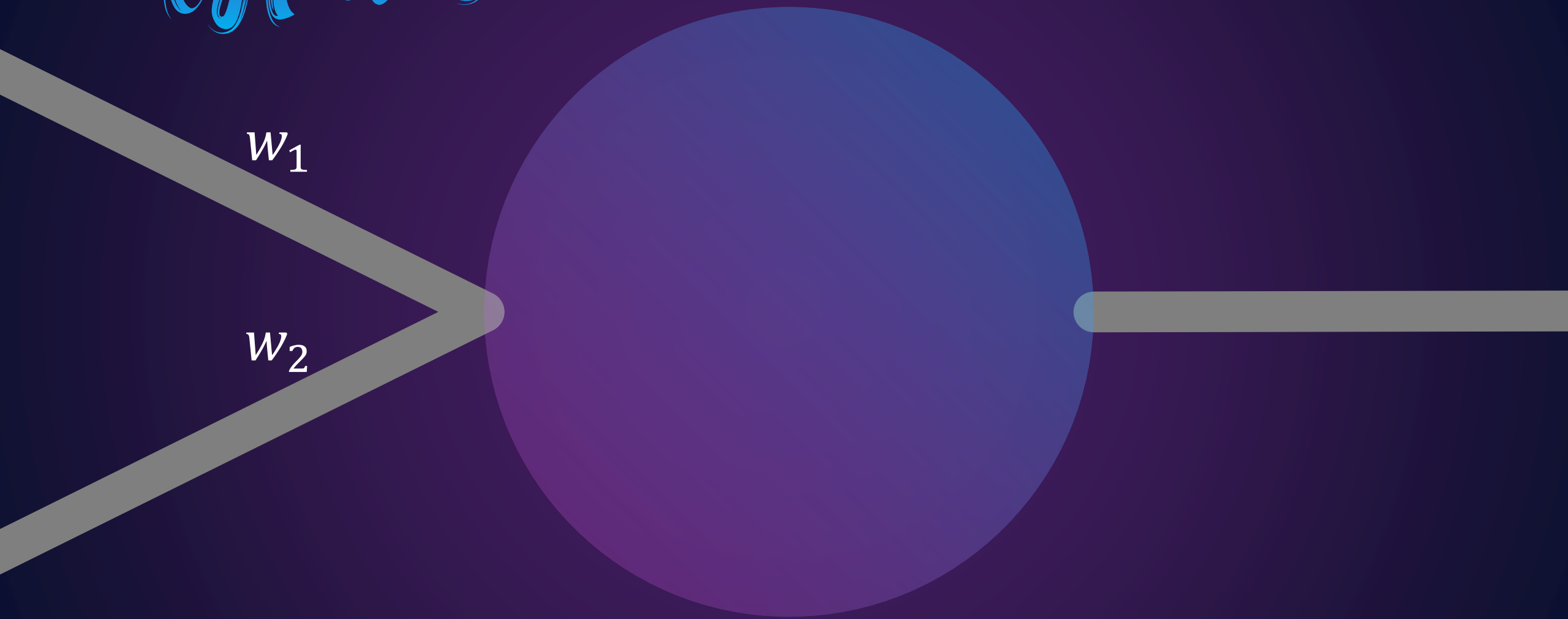
Neuronale Netze

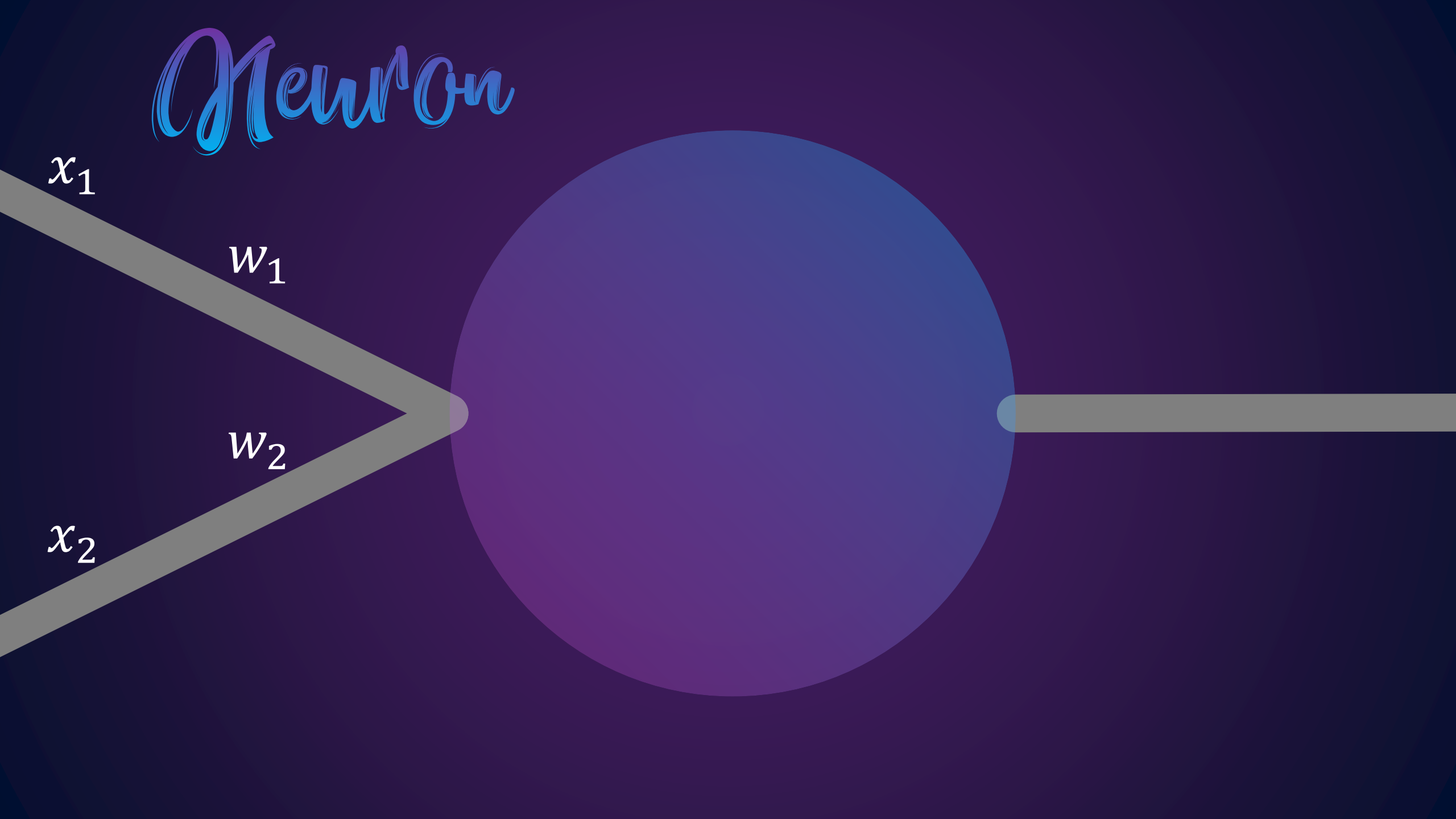


Neuron

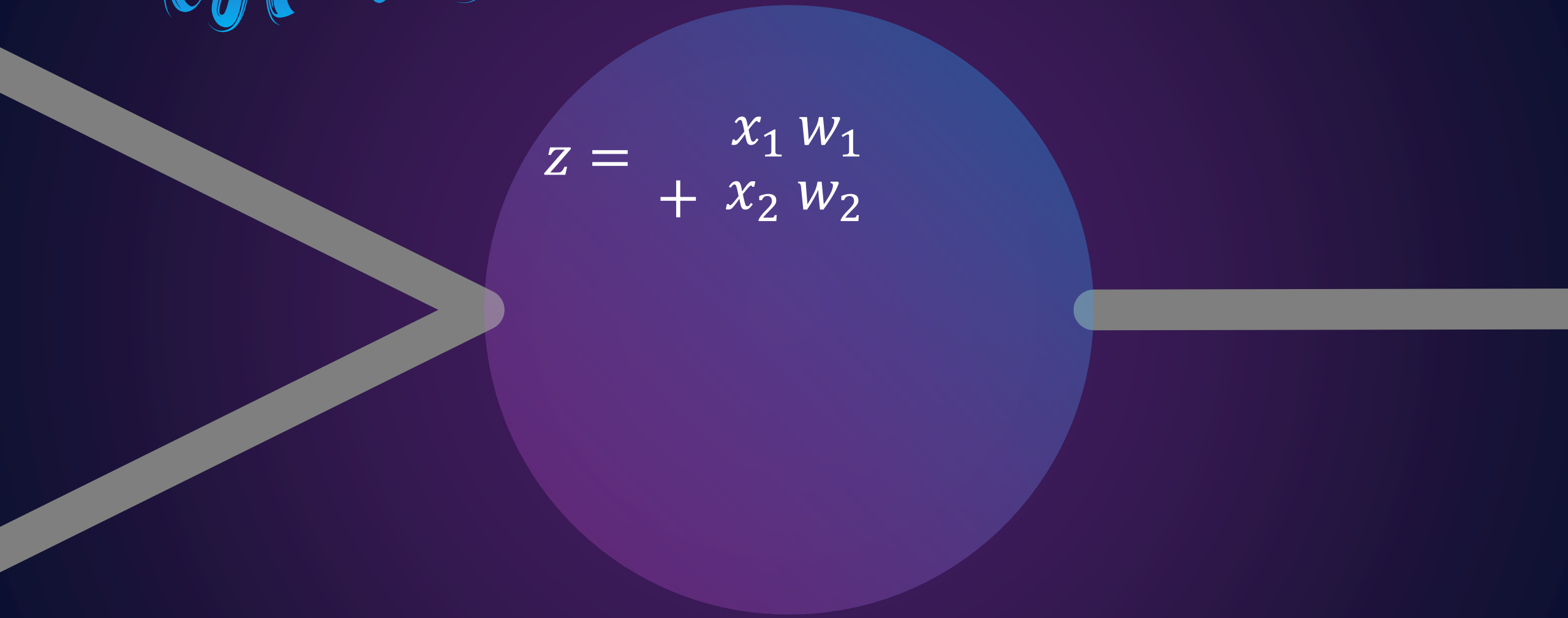


Neuron

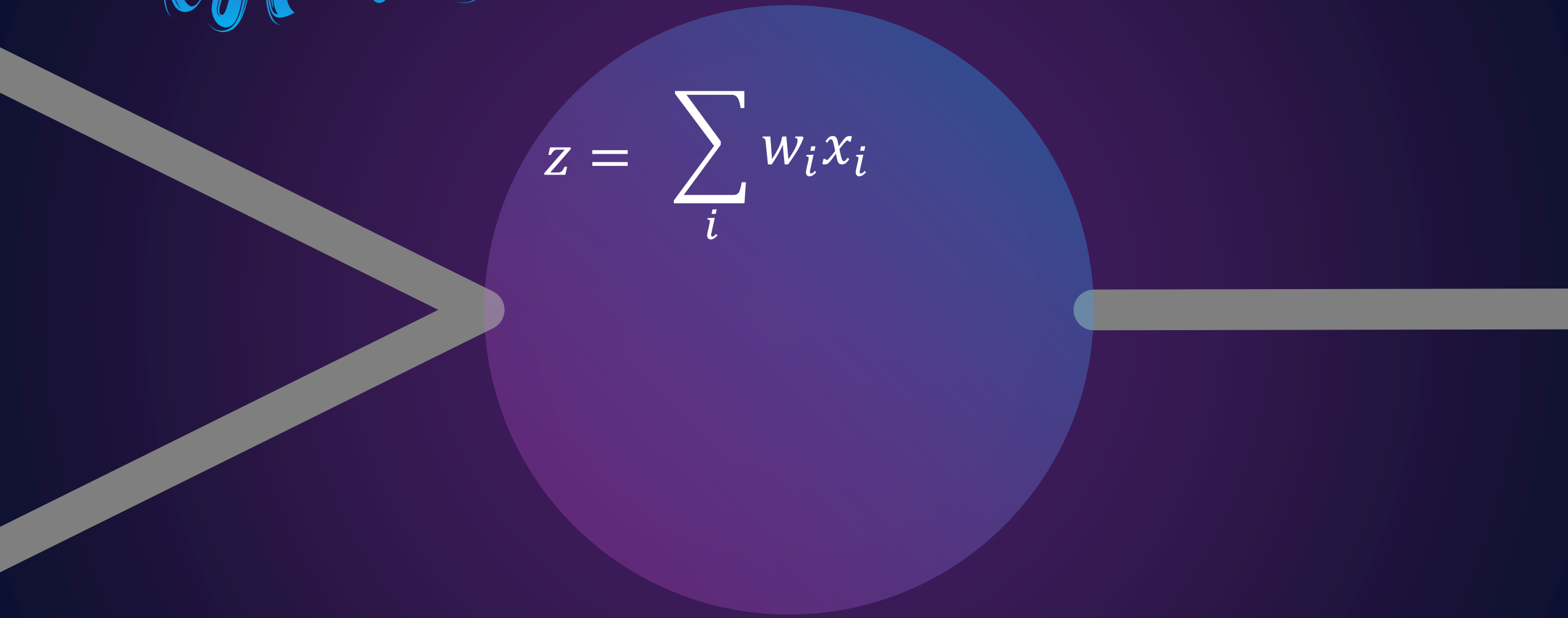



Neuron
x_1
w_1
w_2
x_2

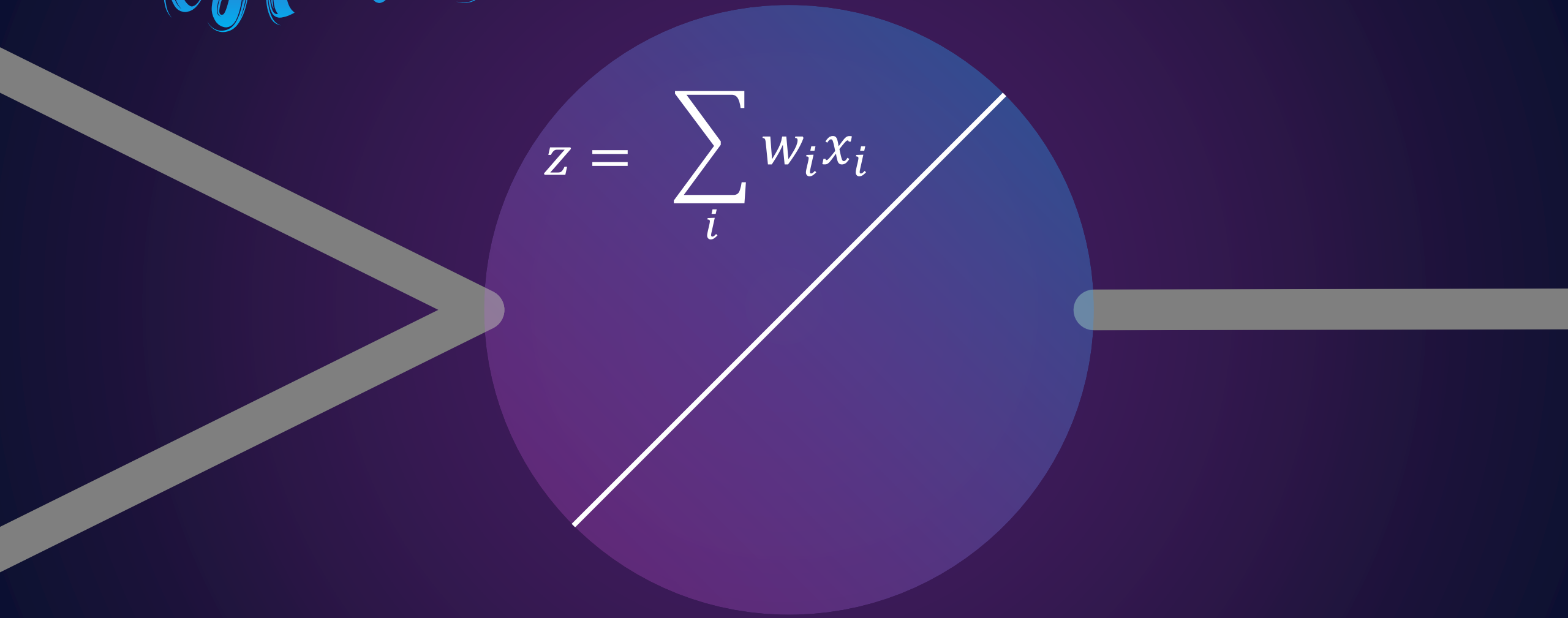
Neuron



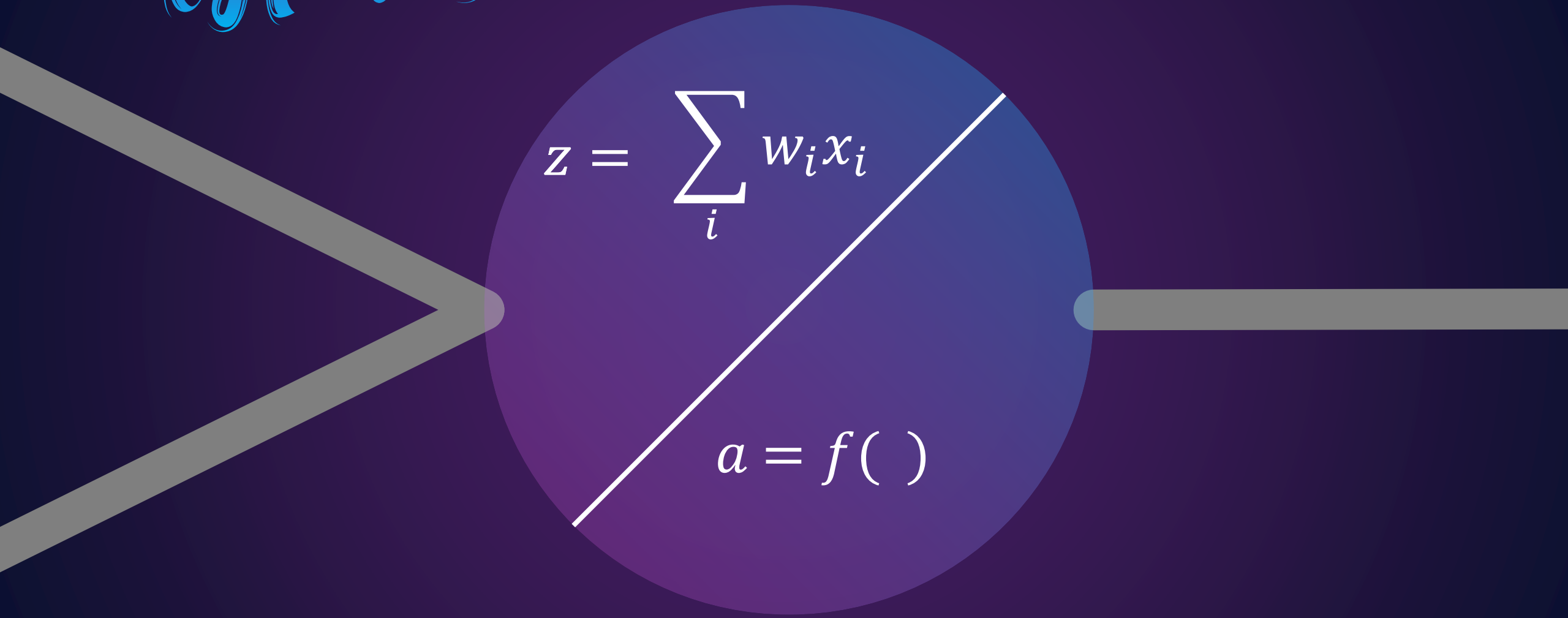
Neuron



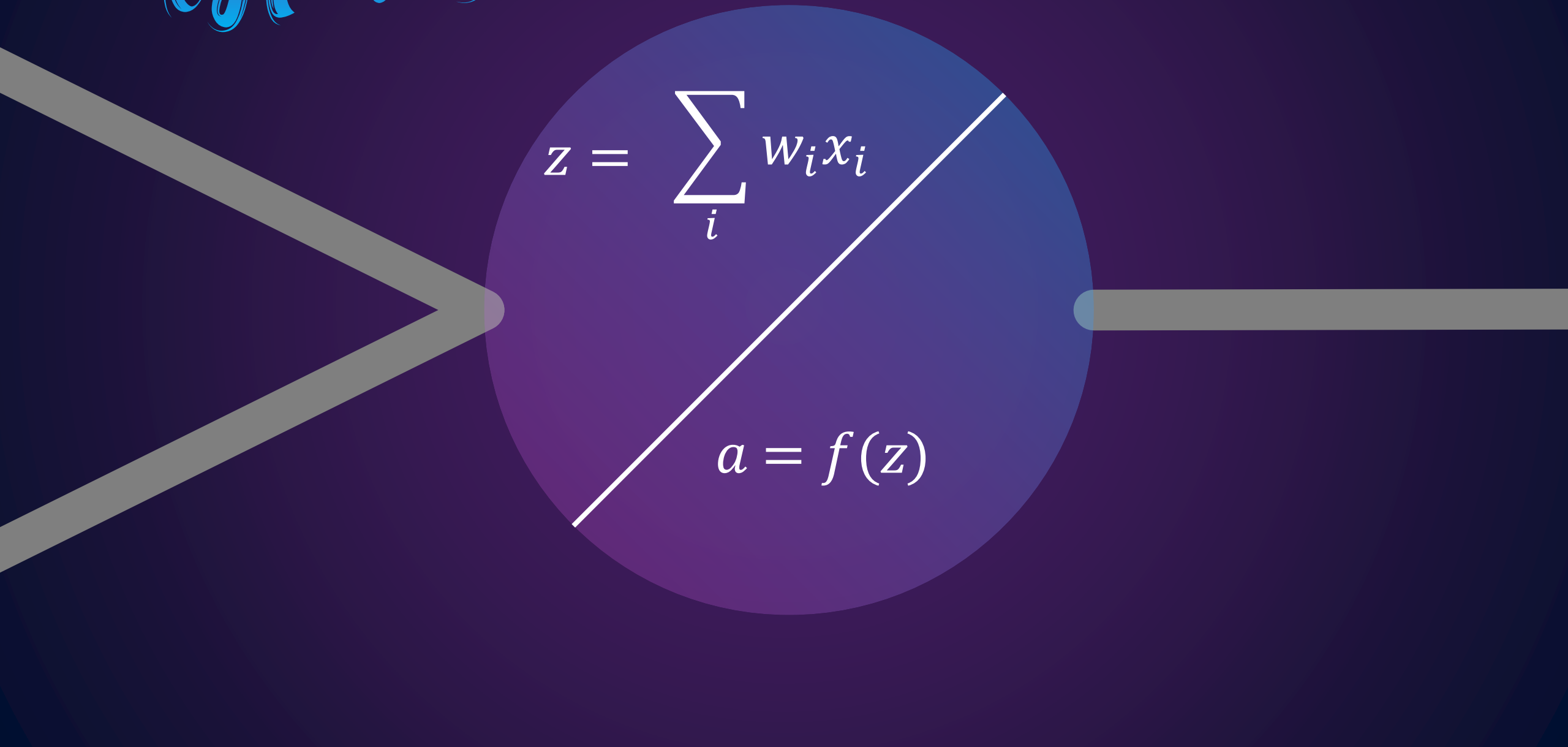
Neuron



Neuron

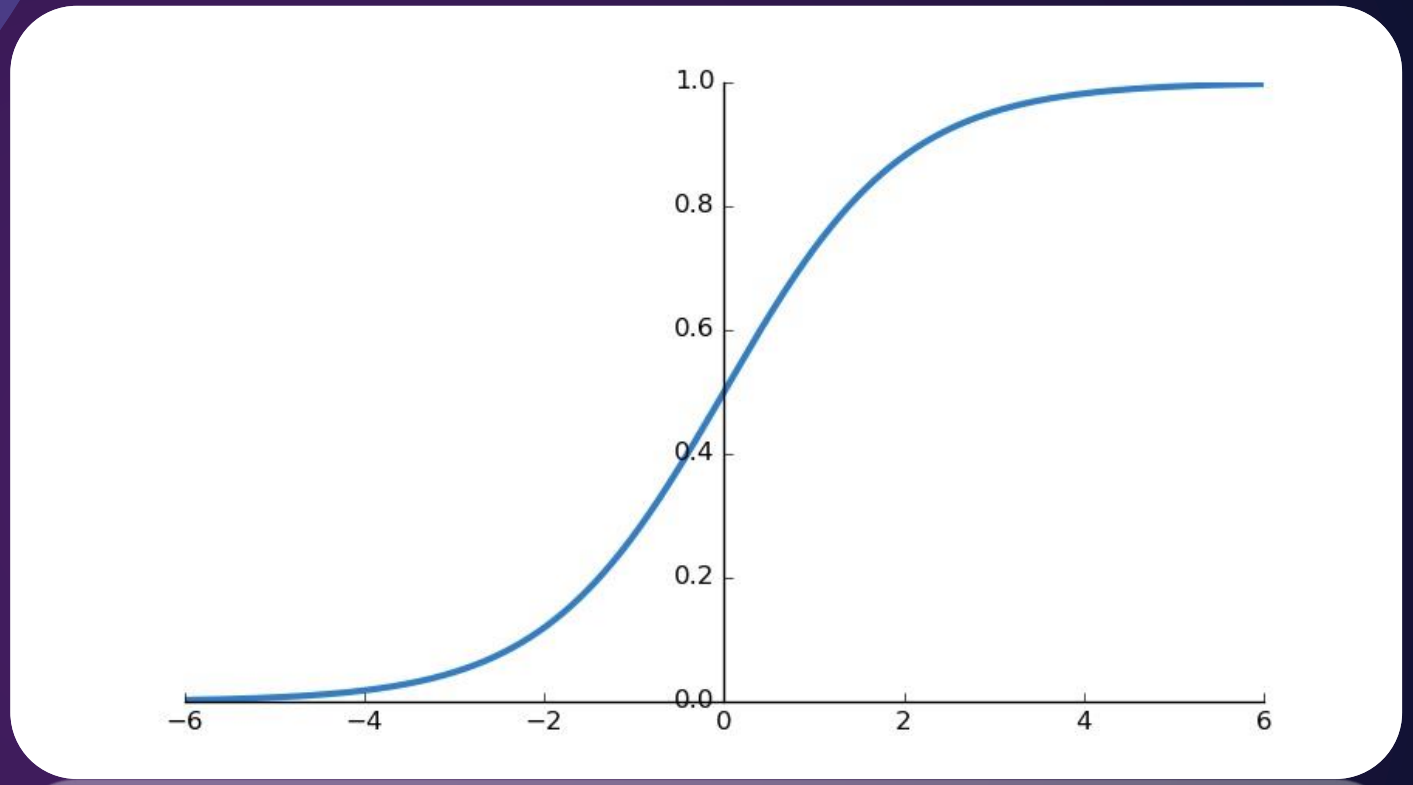


Neuron



$$a = f(z)$$

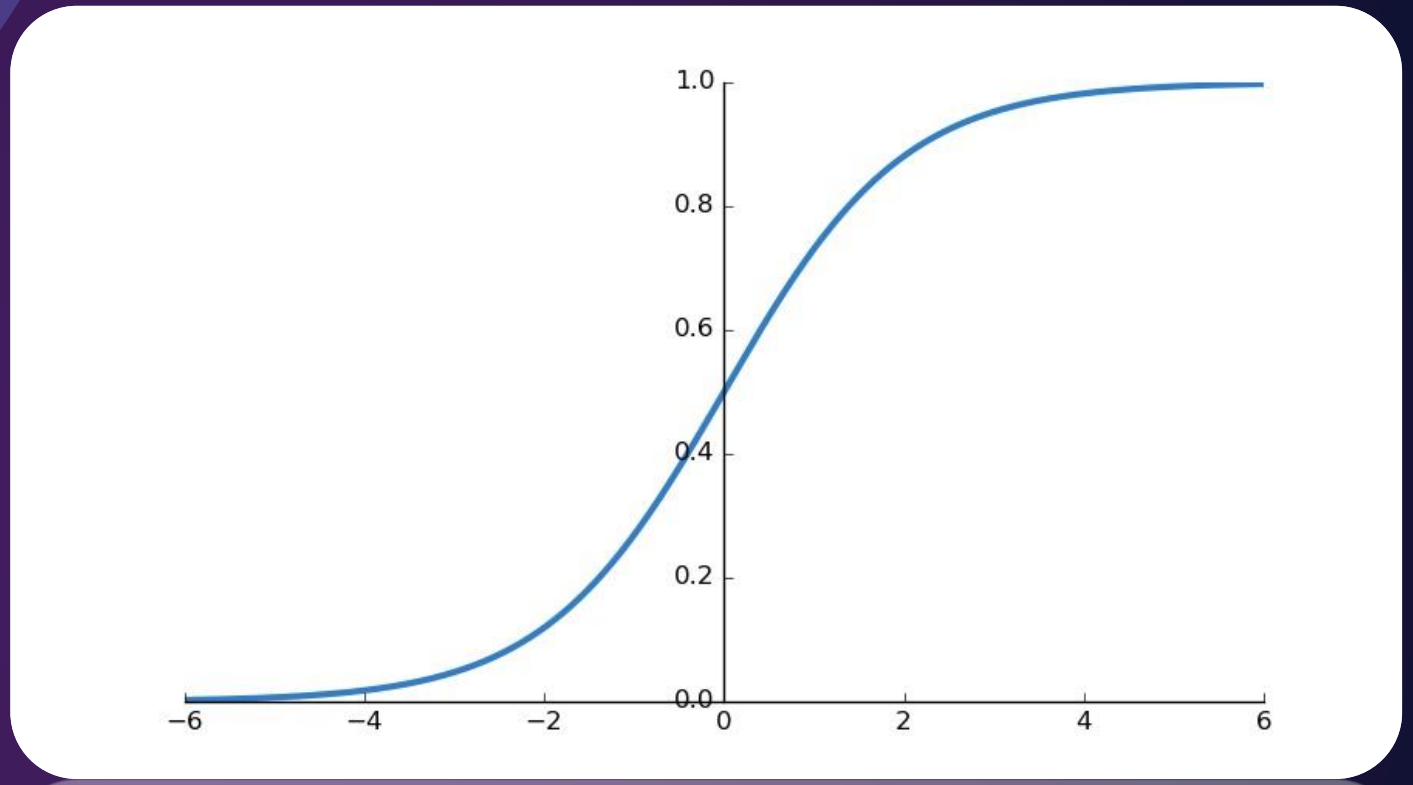
Aktivierungsfunktion



http://ronny.rest/blog/post_2017_08_10_sigmoid/

$$a = f(z)$$

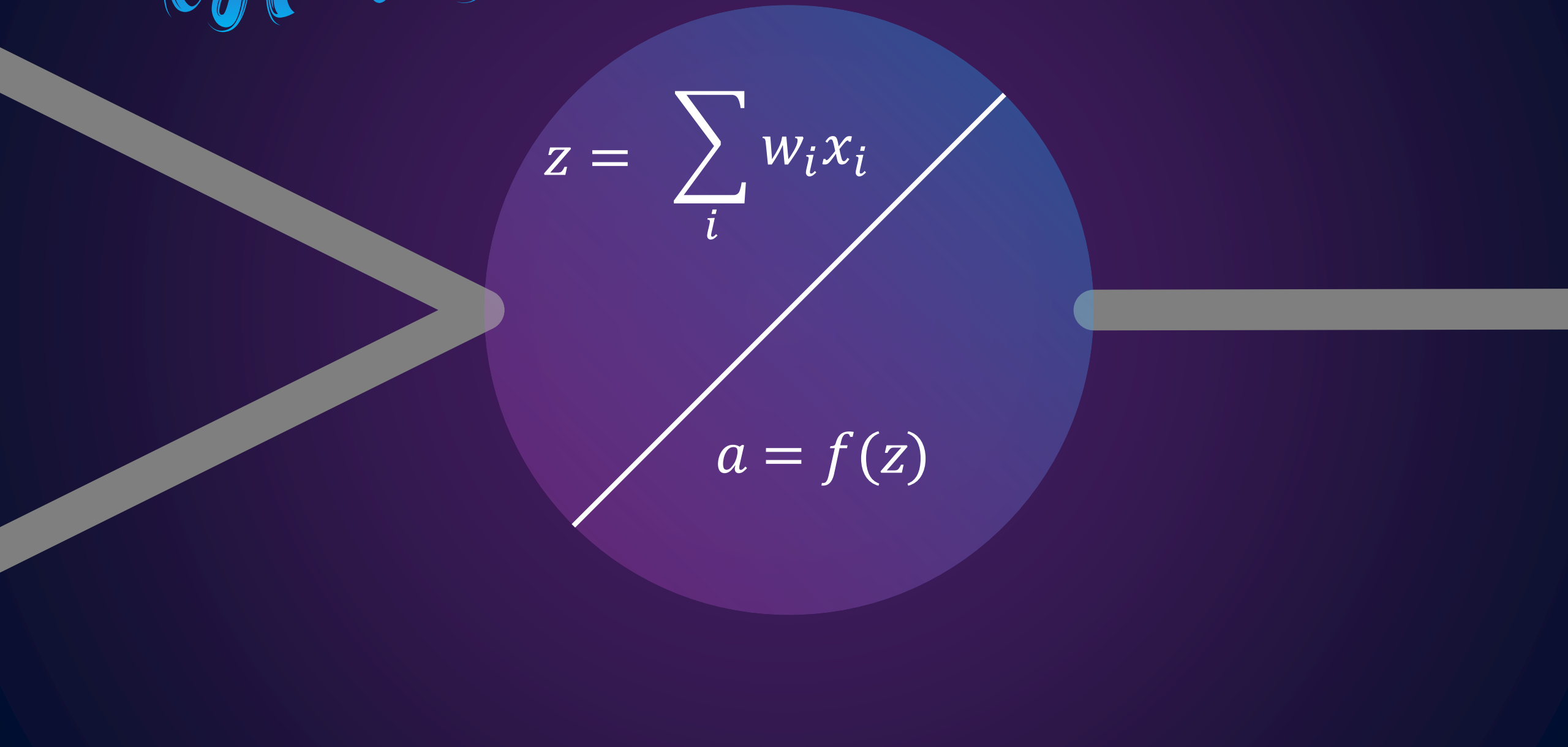
Aktivierungsfunktion



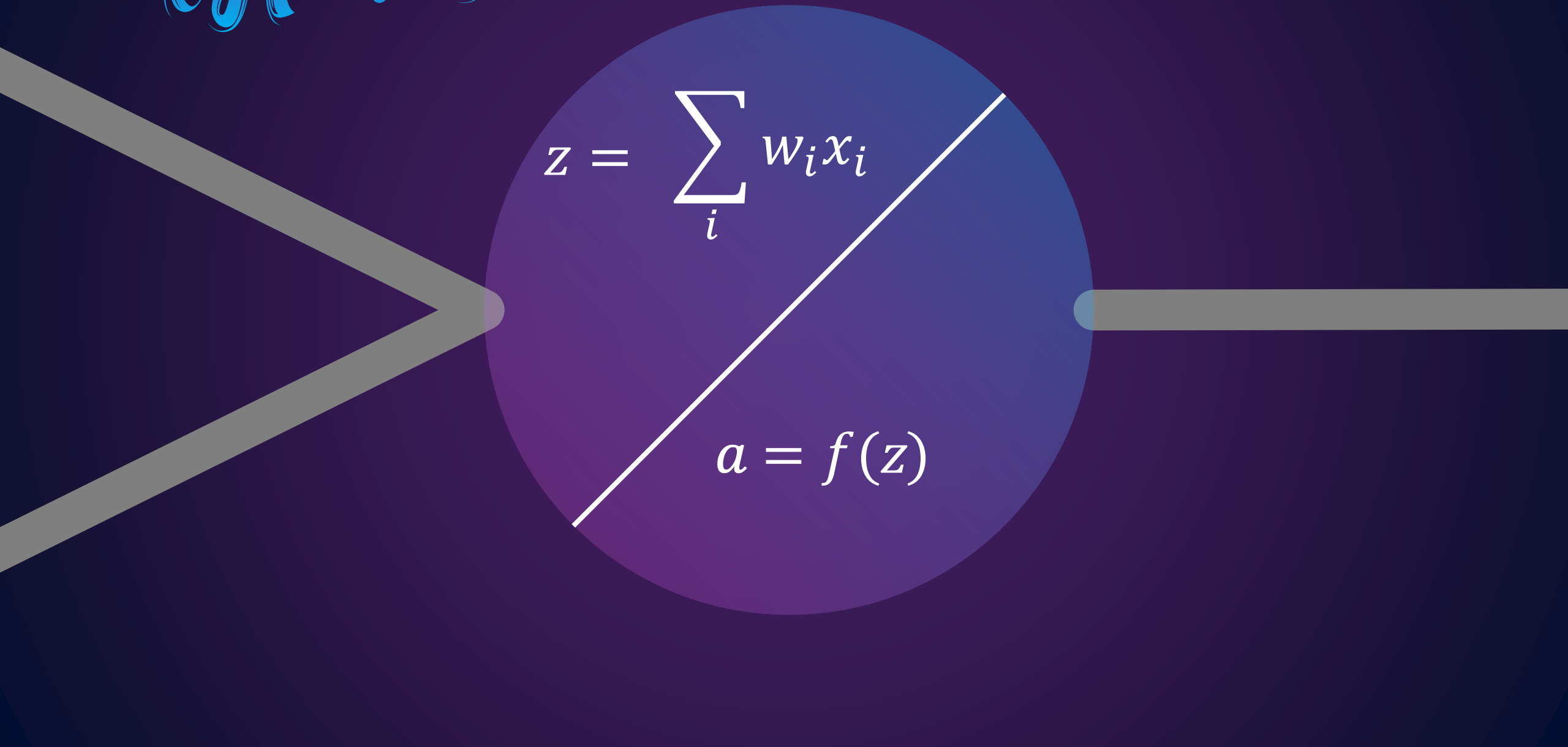
http://ronny.rest/blog/post_2017_08_10_sigmoid/

$$f(x) = \frac{1}{1 \cdot e^{-x}}$$

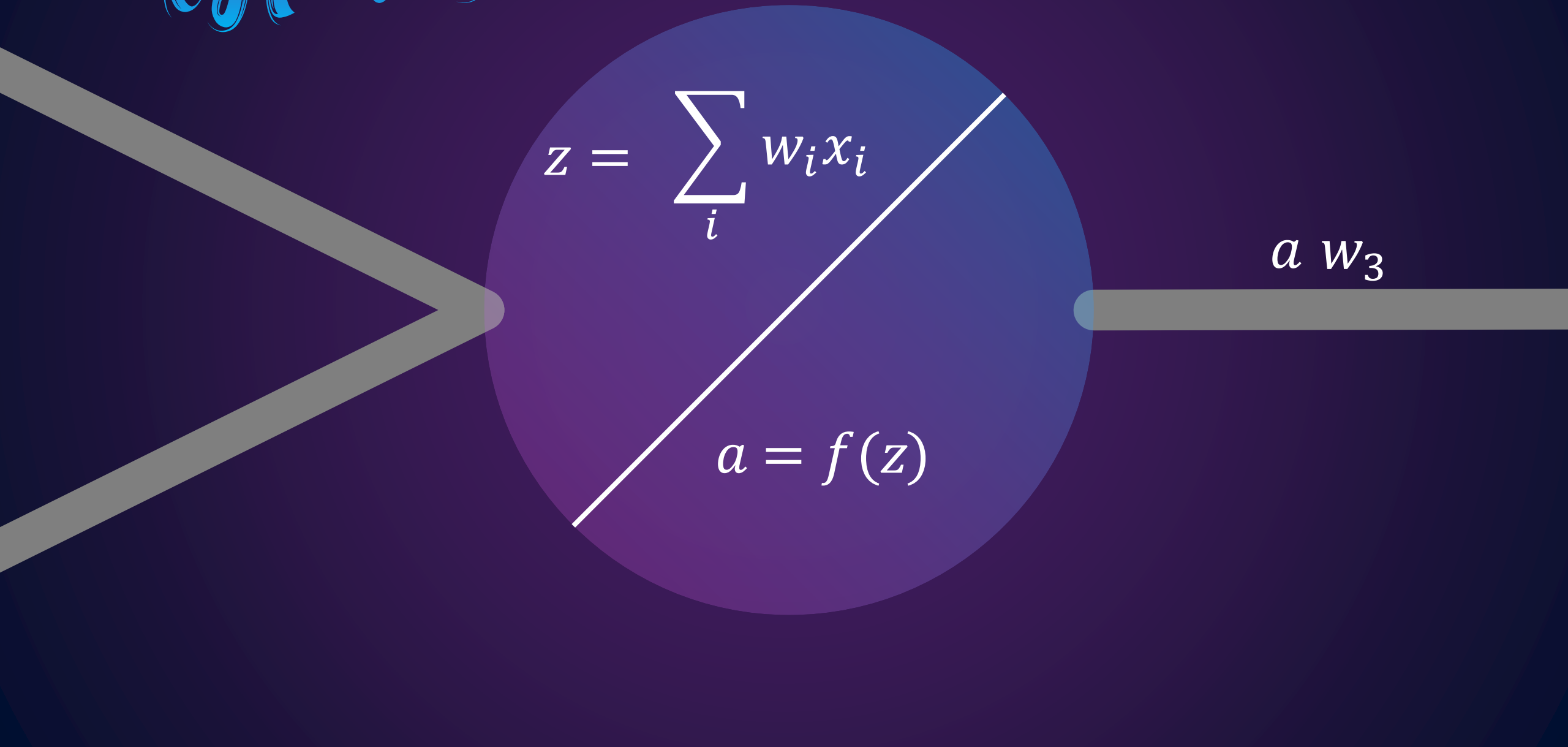
Neuron



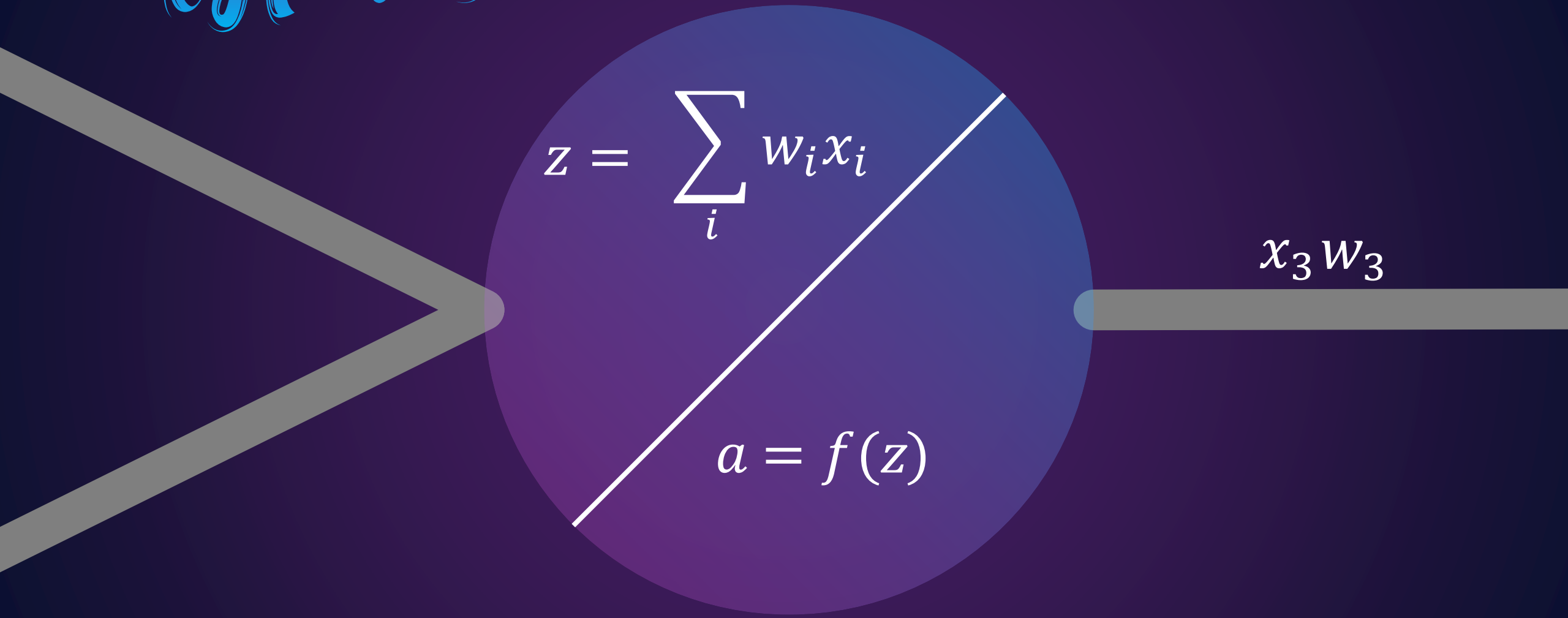
Neuron



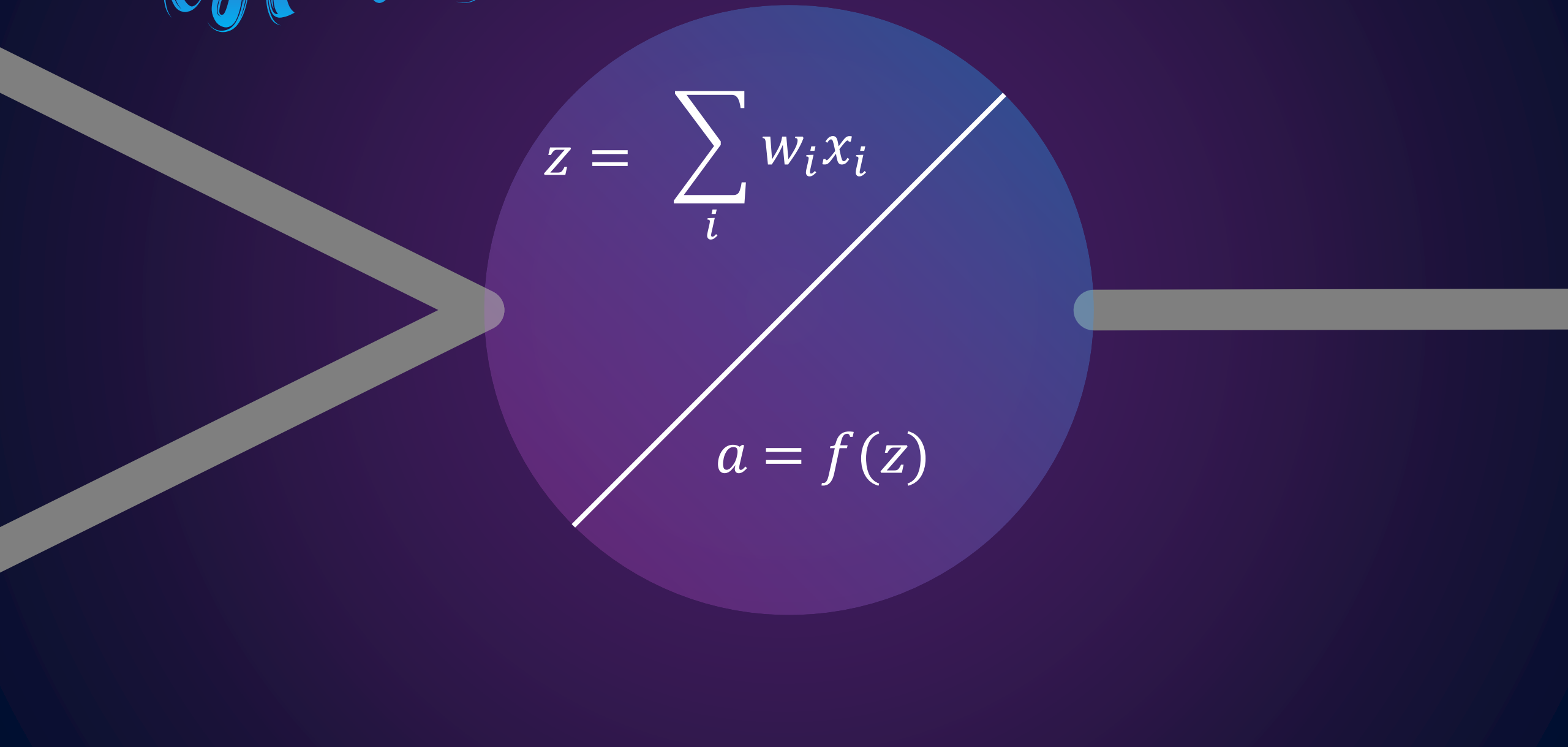
Neuron

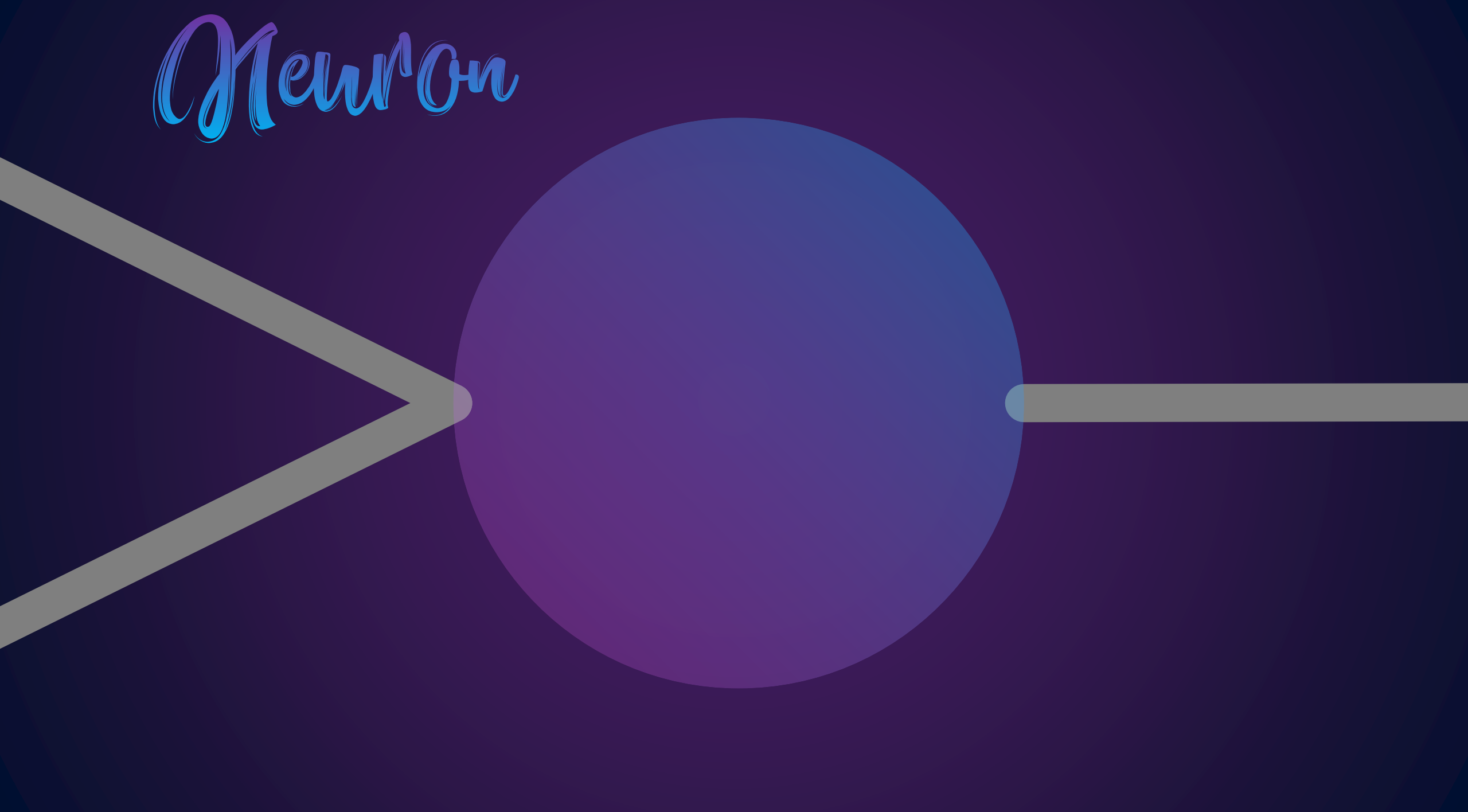


Neuron

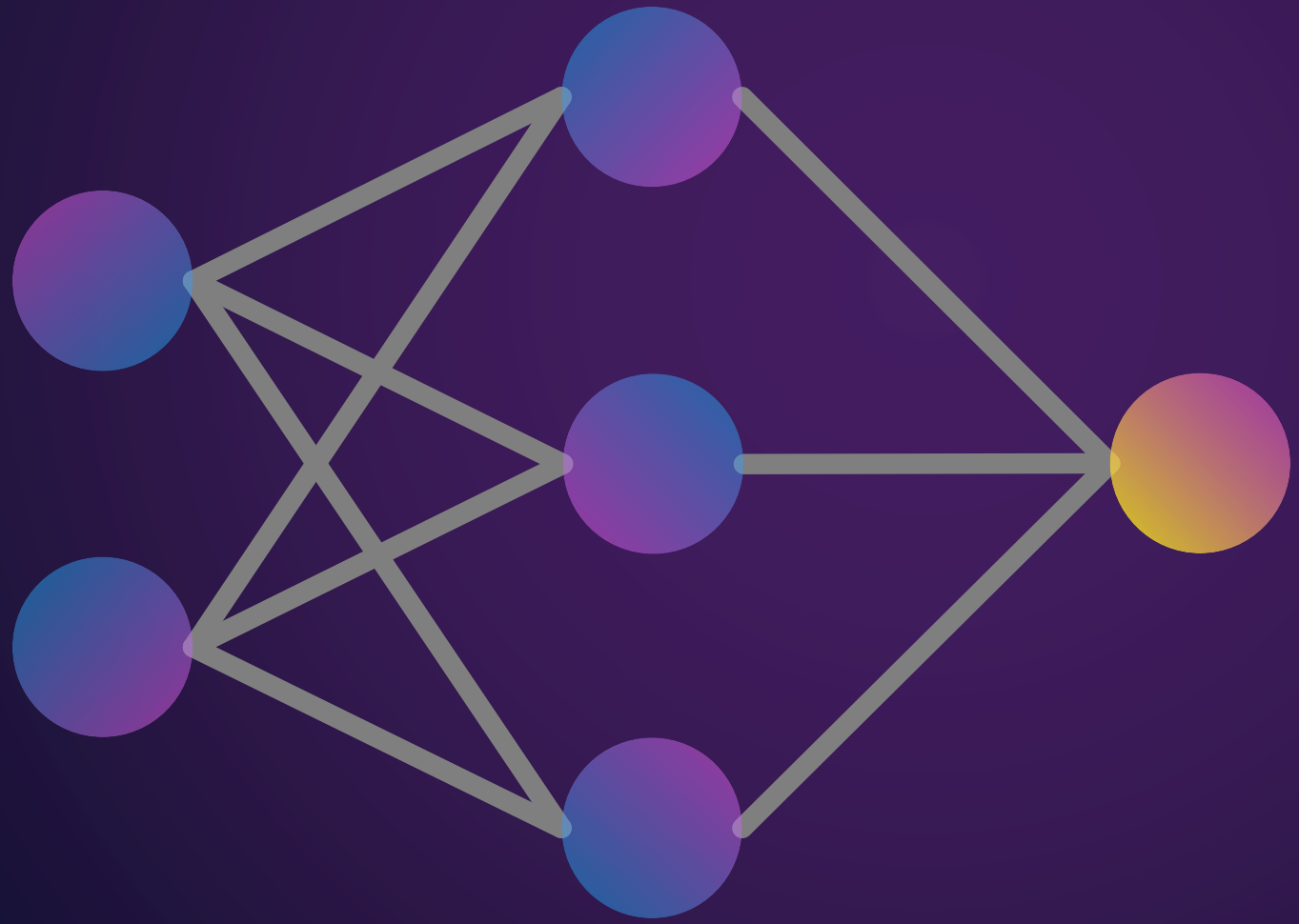


Neuron




Neuron

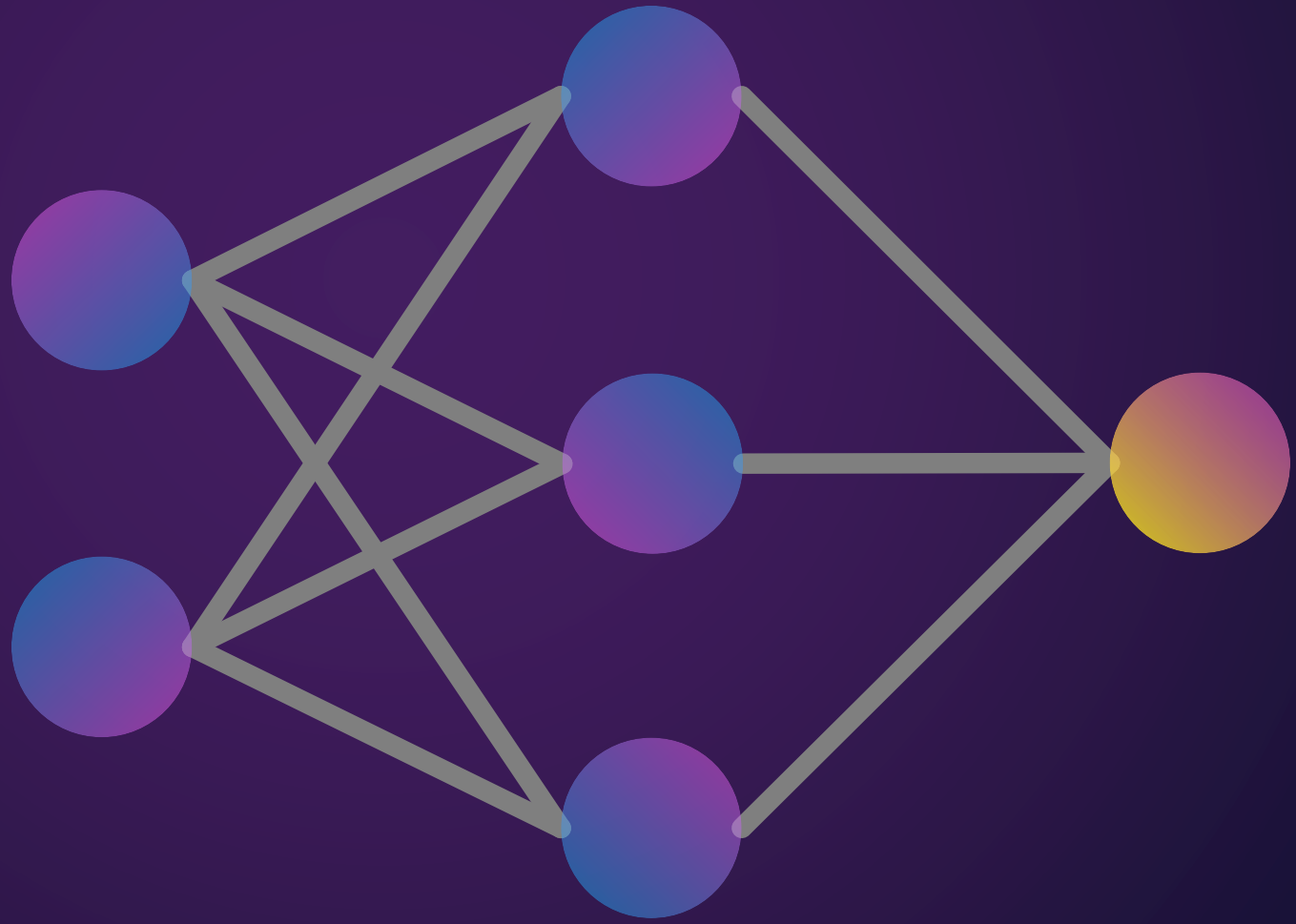
Neuronale Netze



Lernalgorithmus

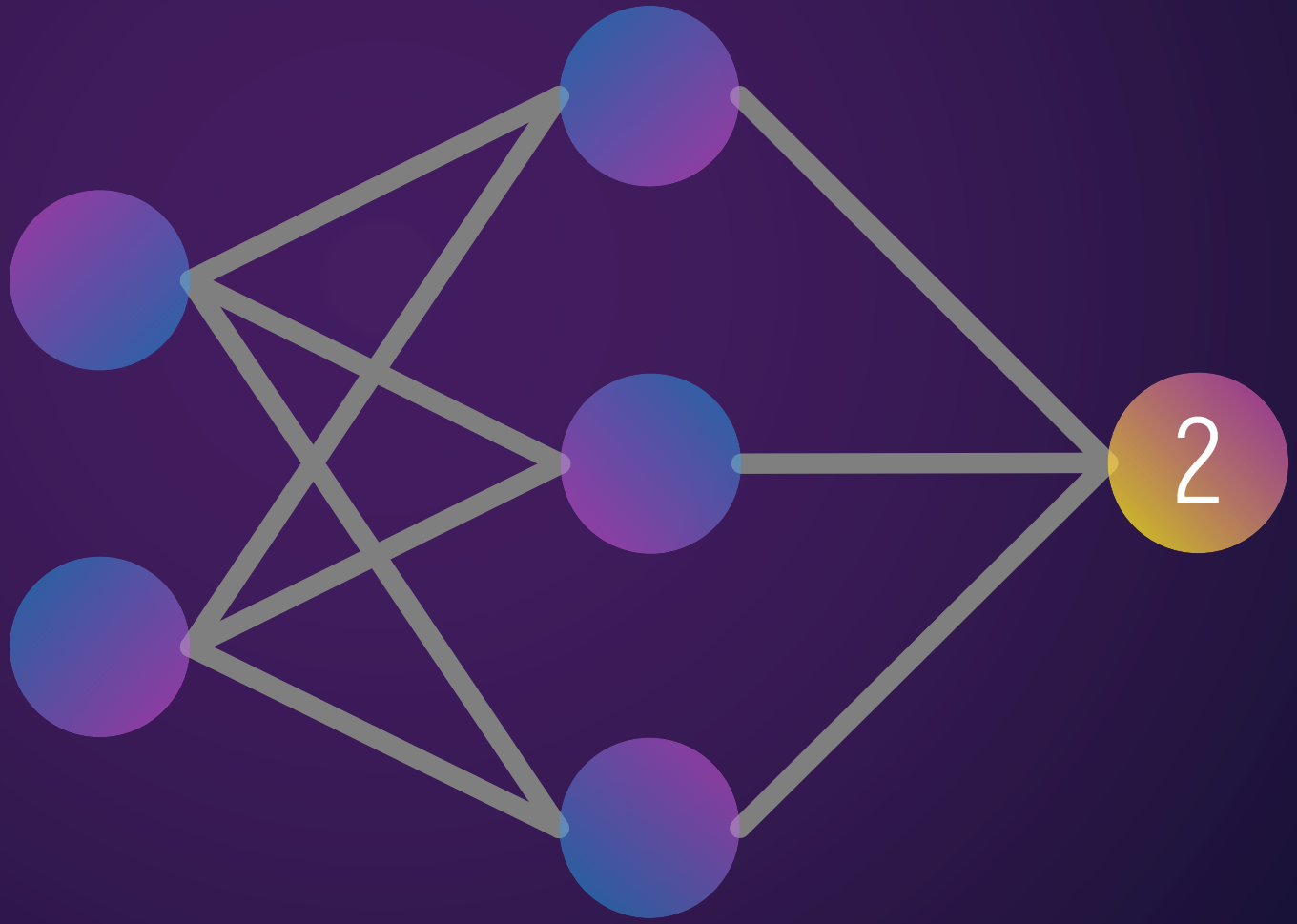
Lernalgorithmus

Supervised
Learning



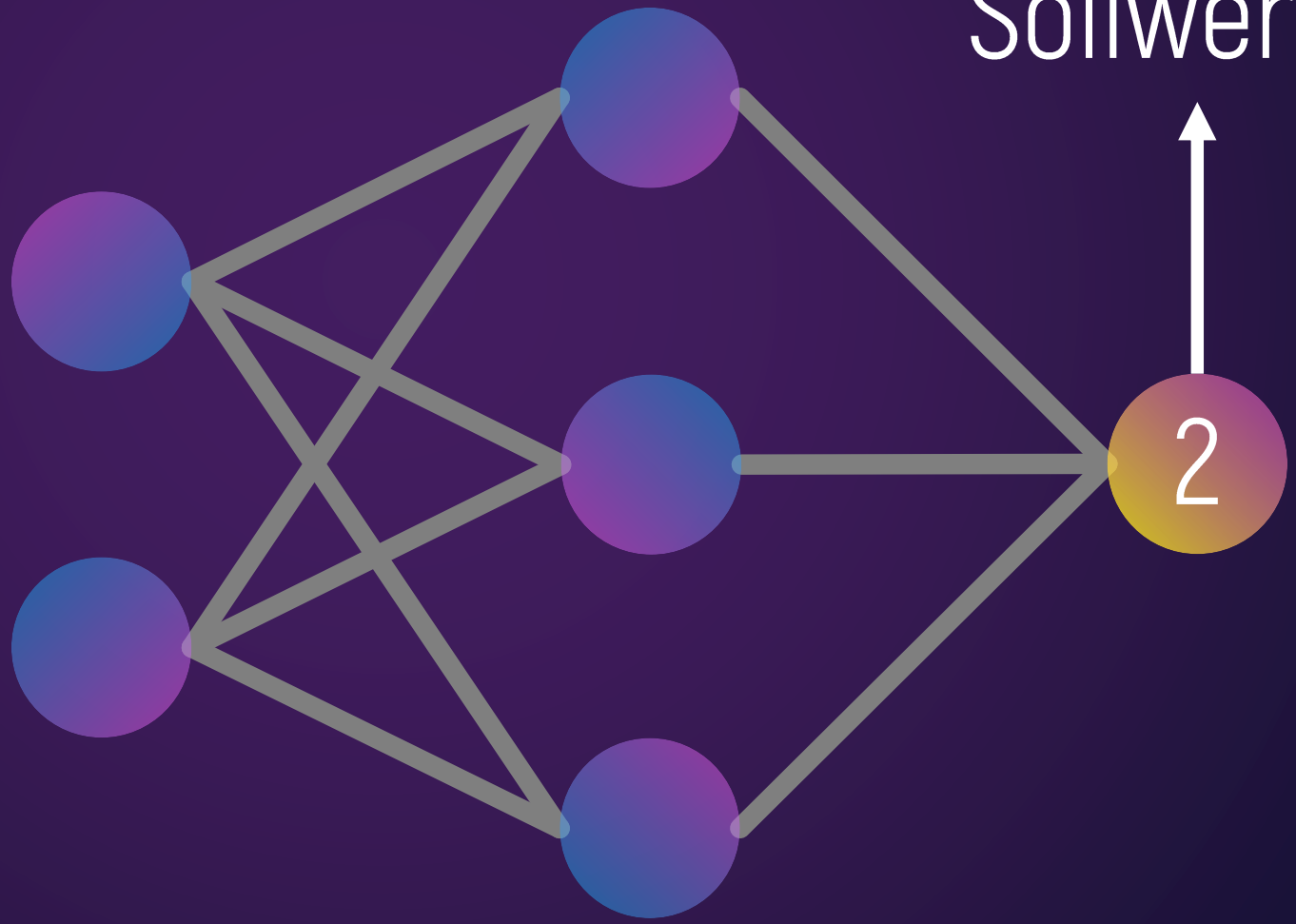
Lernalgorithmus

Supervised
Learning



Lernalgorithmus

Supervised
Learning



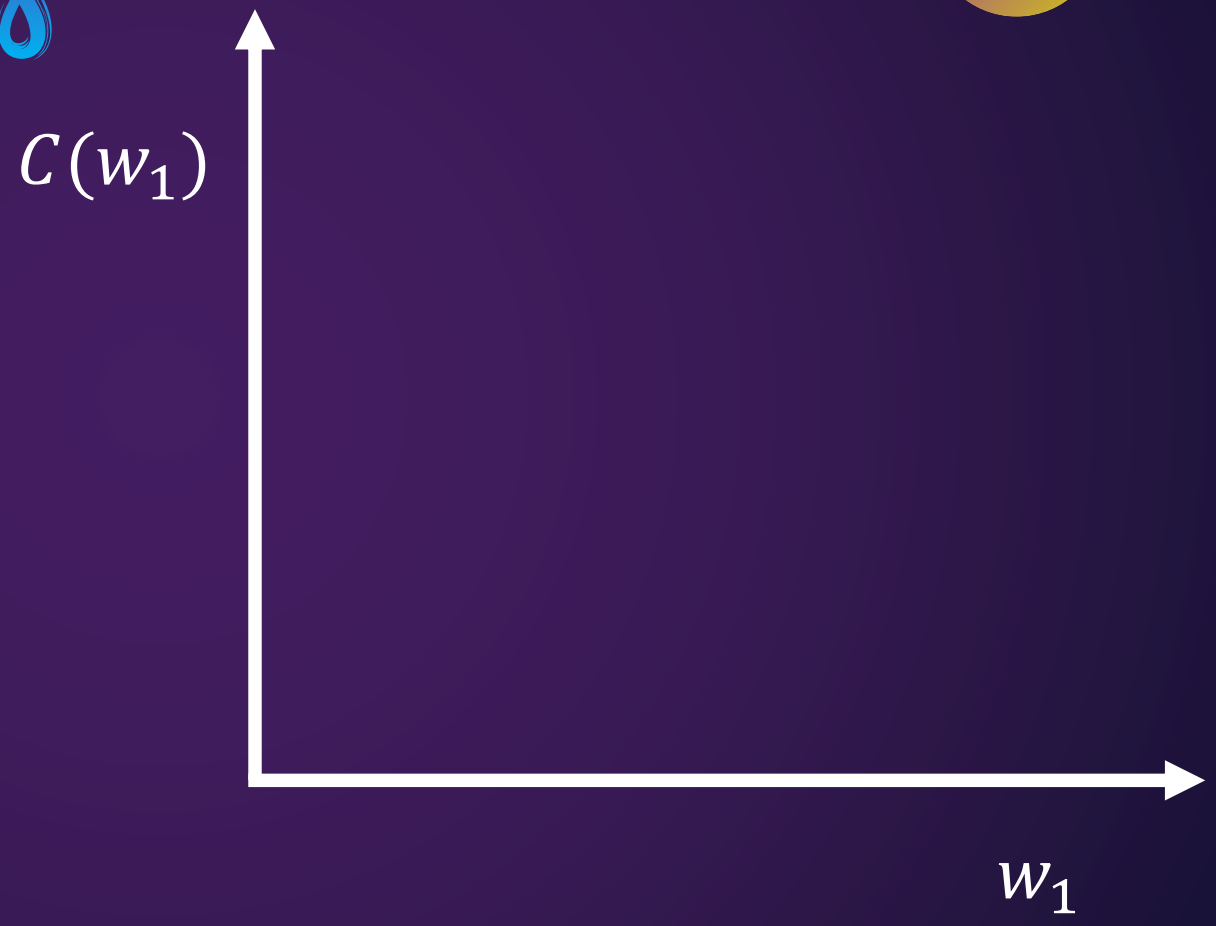
Lernalgorithmus

Gradient Descent

Lernalgorithmus

Gradient

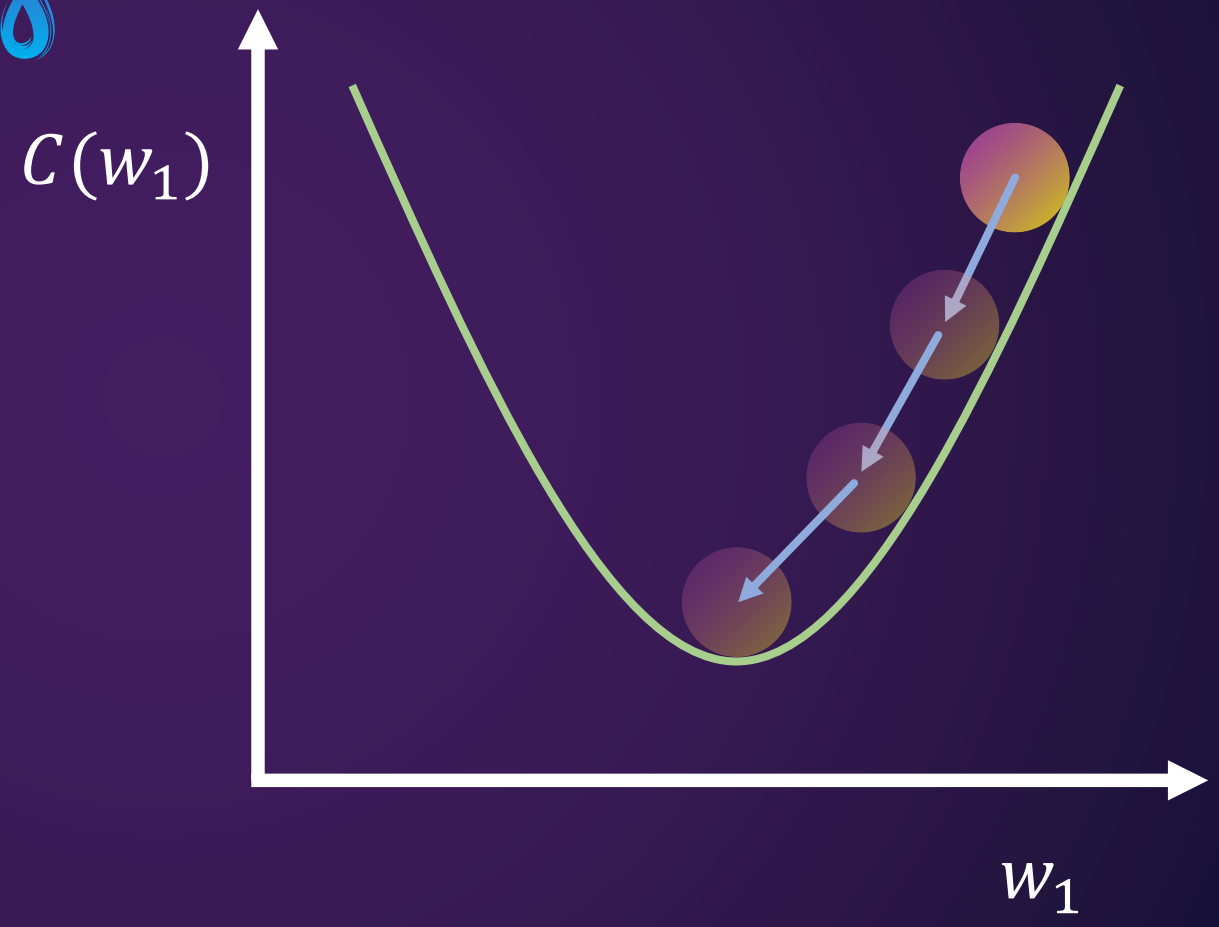
Descent



Lernalgorithmus

Gradient

Descent



Lernalgorithmus

Hyper-

Parameter

Lernalgorithmus

Hyper-
Parameter

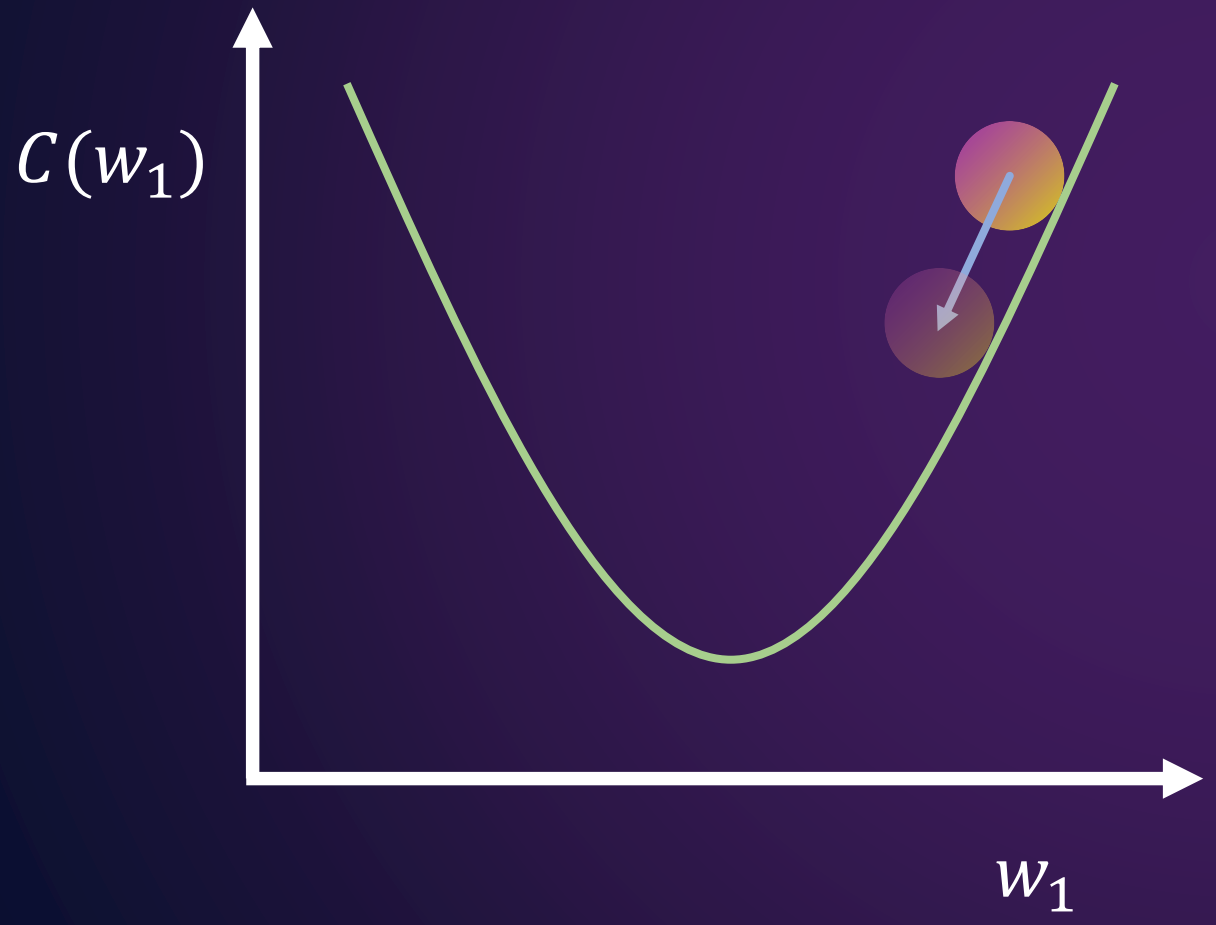
Epochen

Lernalgorithmus

Hyper-
Parameter

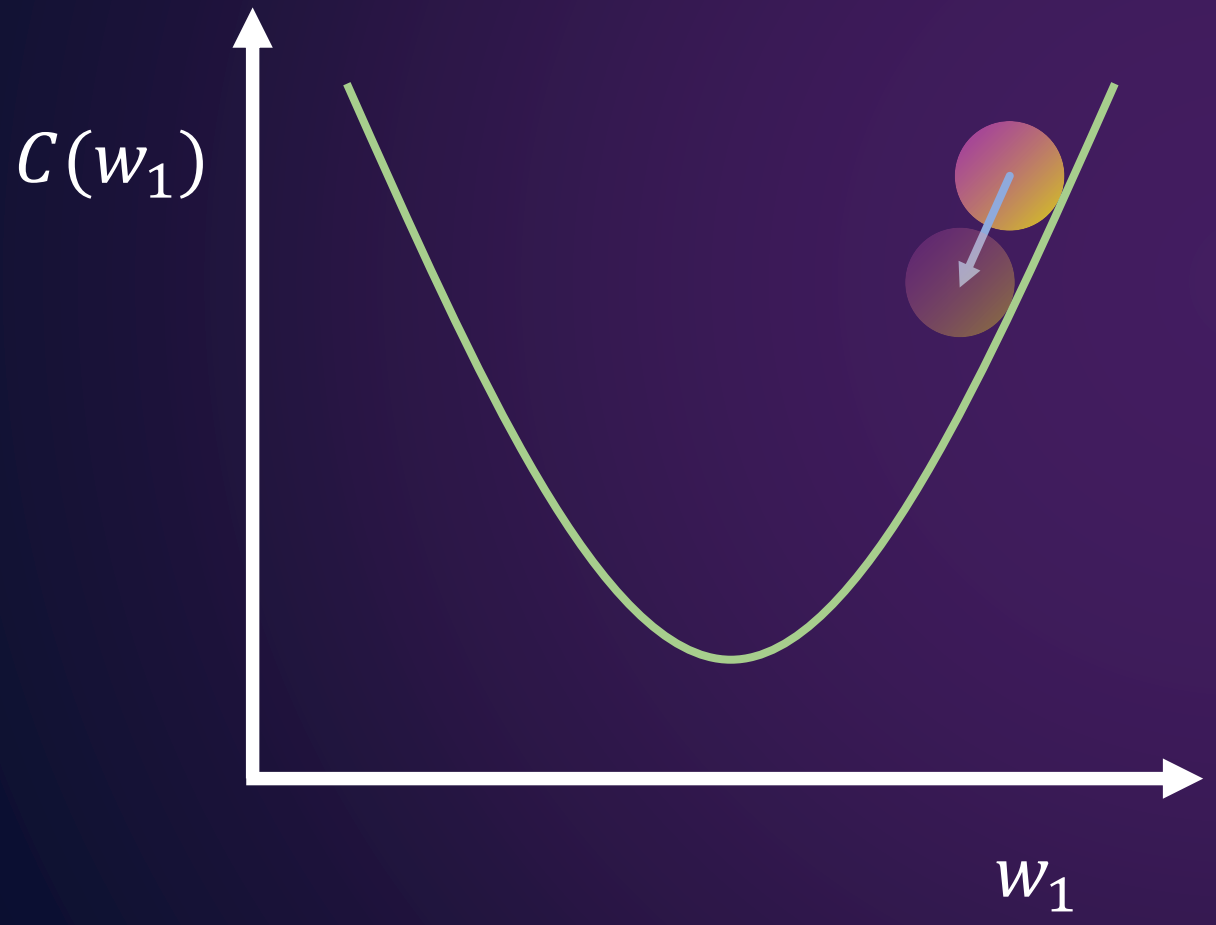
Lernrate

Lernalgorithmus



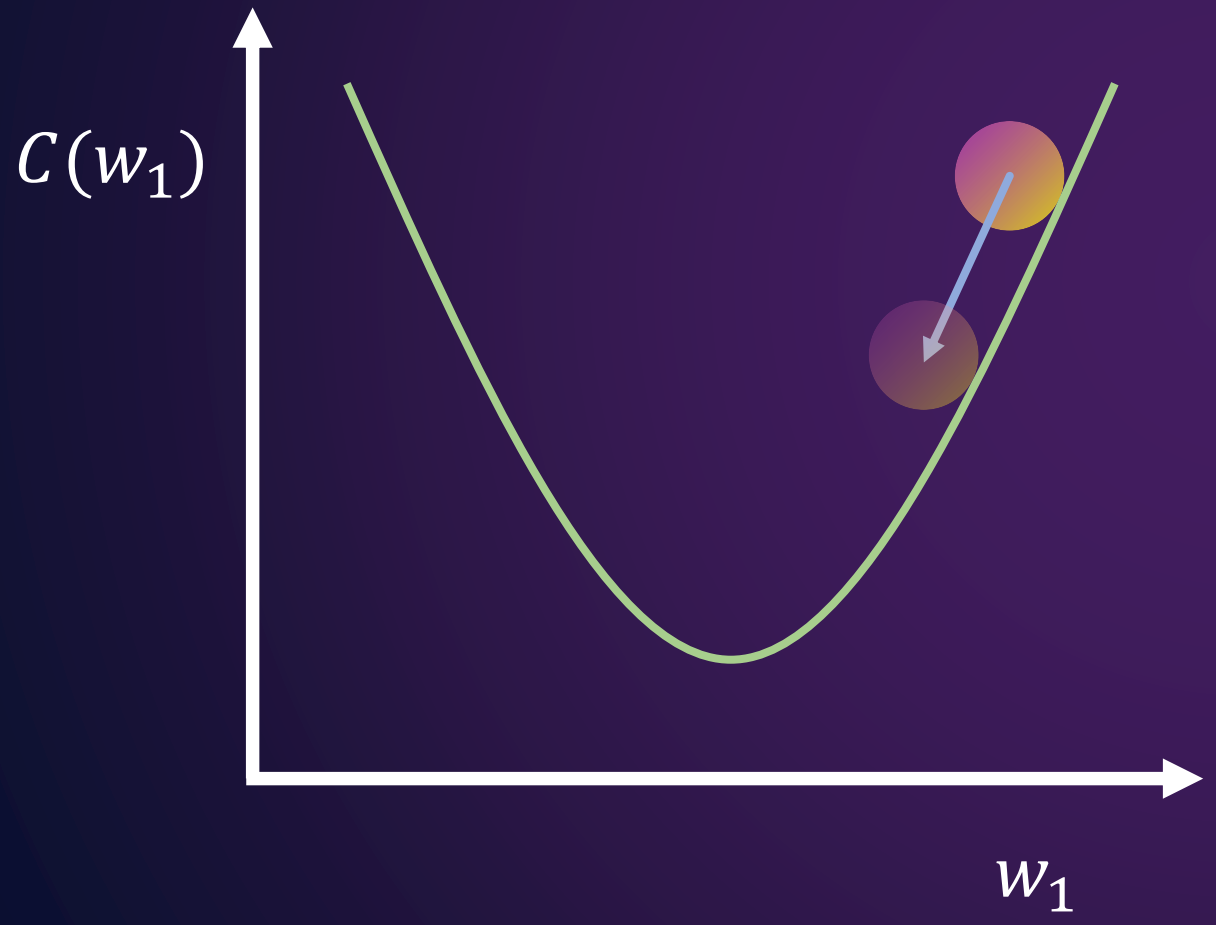
Lernrate

Lernalgorithmus



Lernrate

Lernalgorithmus



Lernrate

Lernalgorithmus

Hyper-
Parameter

Lernrate

Lernalgorithmus

Hyper-
Parameter

Batch Size

Lernalgorithmus

Hyper-
Parameter

Anzahl der Schichten

Lernalgorithmus

Hyper-
Parameter

Anzahl der Neuronen

Lernalgorithmus

Hyper-

Parameter

Daten


Training
Test


Tensor
Flow


Tensor


Flow

Tensor

Was ist ein
Tensor

Was ist ein Tensor

Eine Zahl

$$s = a$$

Was ist ein Tensor

Ein Vektor

$$\vec{v} = \begin{bmatrix} a \\ b \\ c \end{bmatrix}$$

Was ist ein Tensor

Eine Matrix

$$M = \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix}$$

Was ist ein Tensor

N-Dimensional

$$T = \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix}$$


Tensor
Flow


Tensor
Flow

Flow

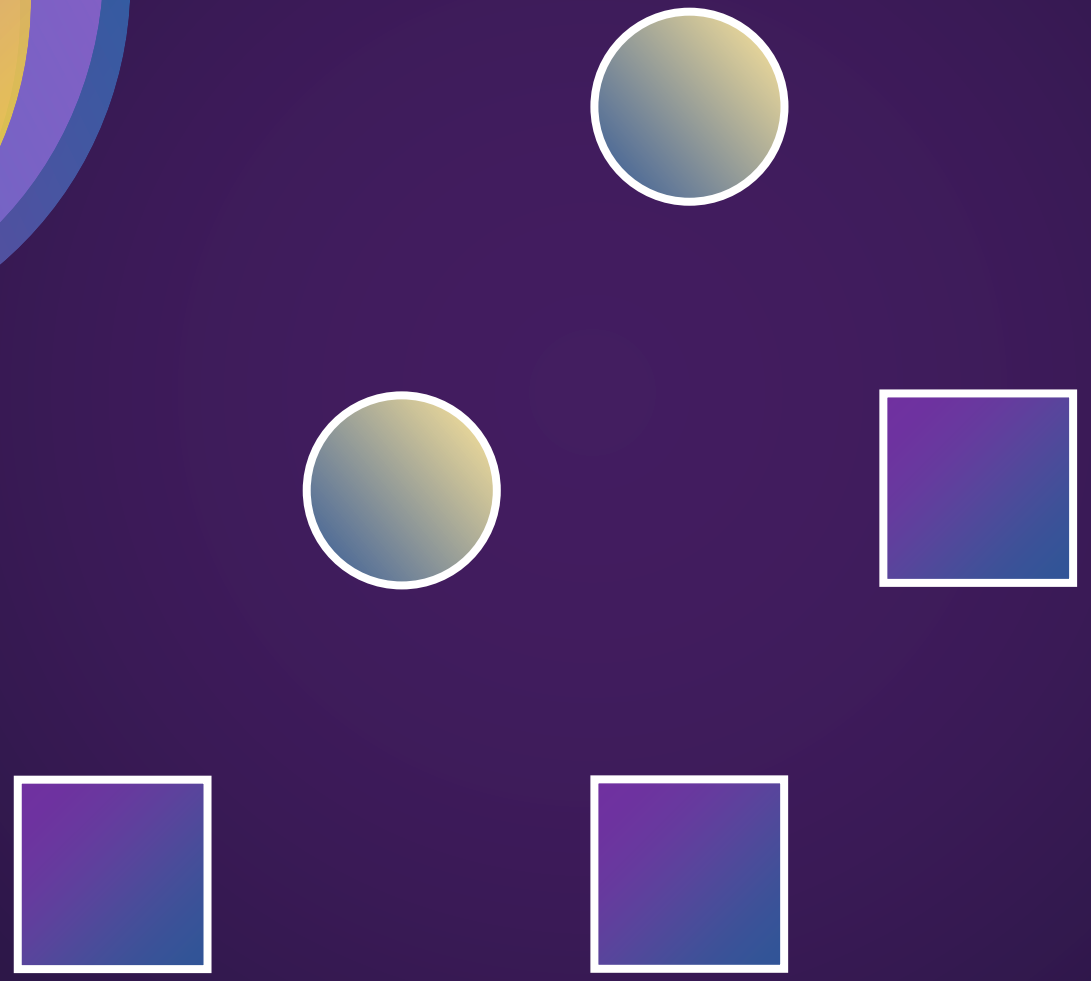
Wie fließen Tensor

Wie fließen
Tensor

Tensor

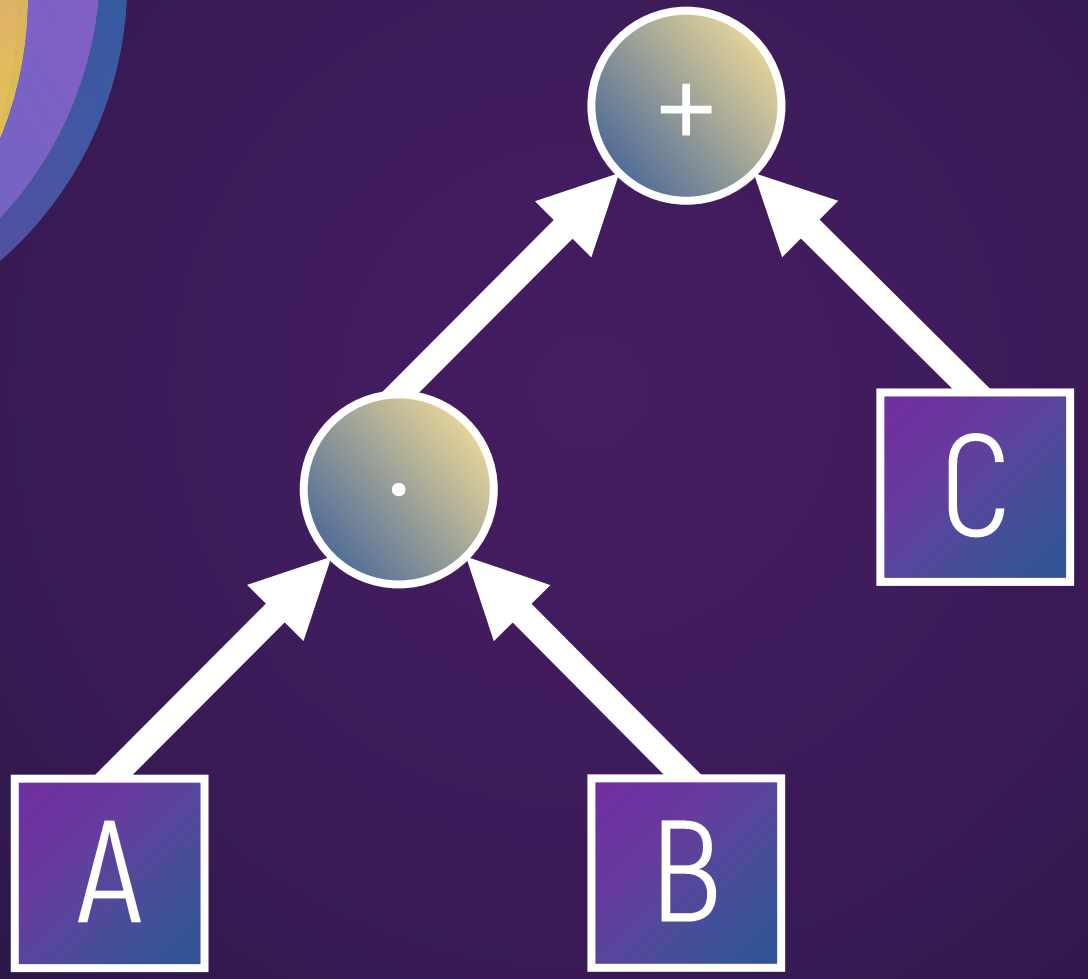
Operation

Wie fließen Tensor



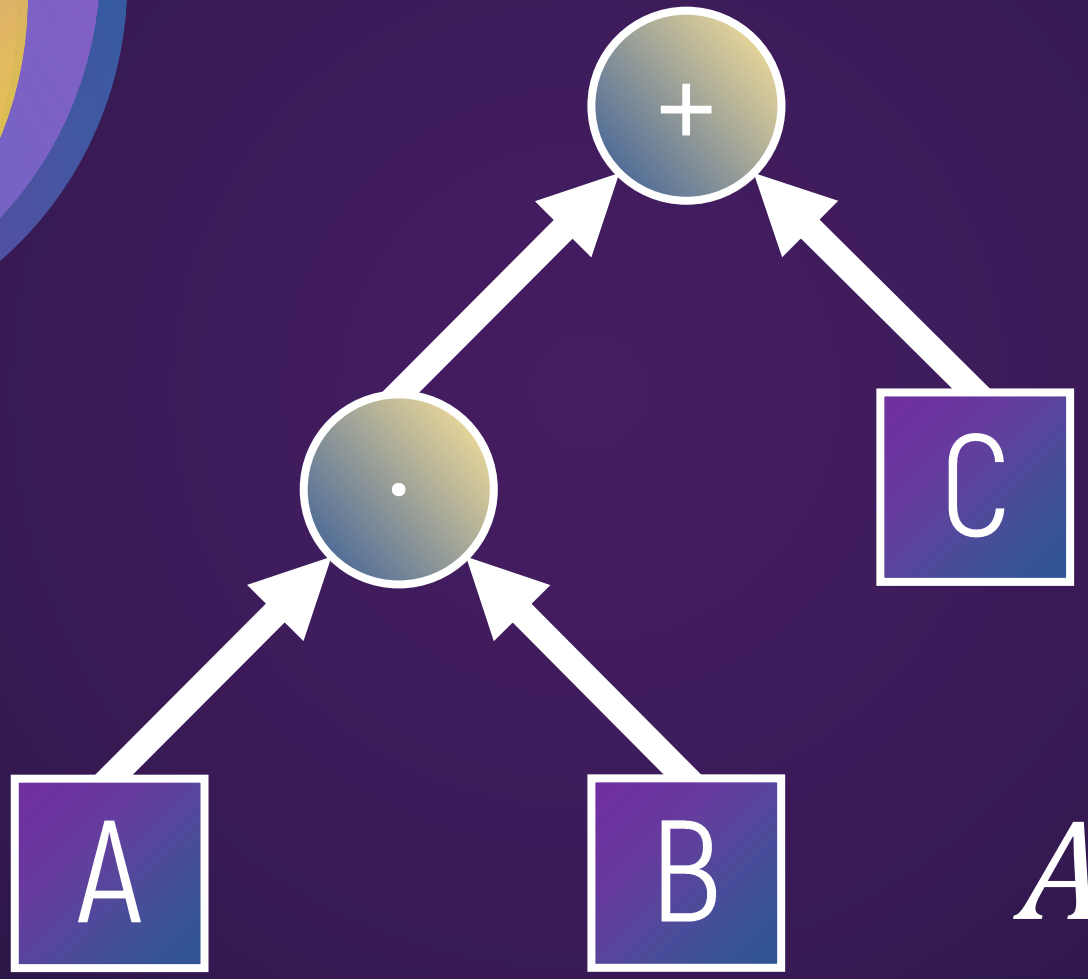
Flow

Wie fließen Tensor



Flow

Wie fließen Tensor



$$A \cdot B + C$$

Was

Tensoren

Wie

Operationen

Was

Tensoren

Wie

Operationen

Keras


TensorFlow


Keras

TensorFlow

Keras

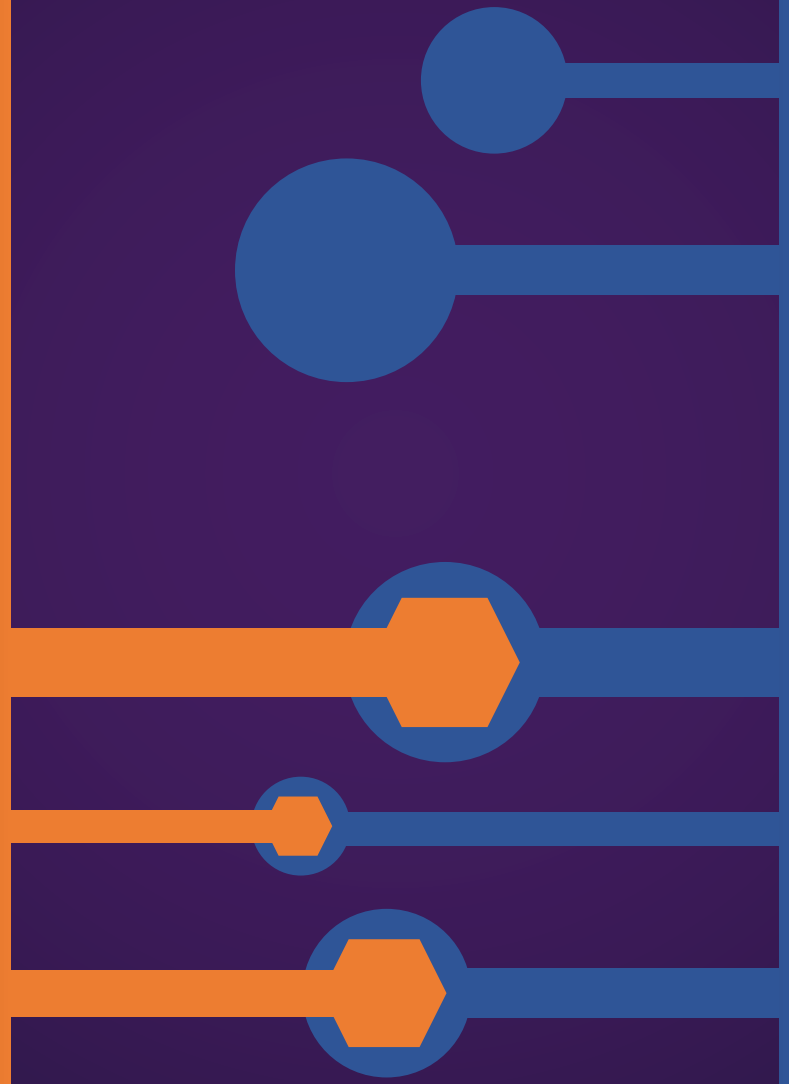
TensorFlow

Keras

TensorFlow

Keras

TensorFlow



Keras

Versus

+ Schneller
+ Flexibler

+ Leserlicher
+ Abstrakter

In der Sprache

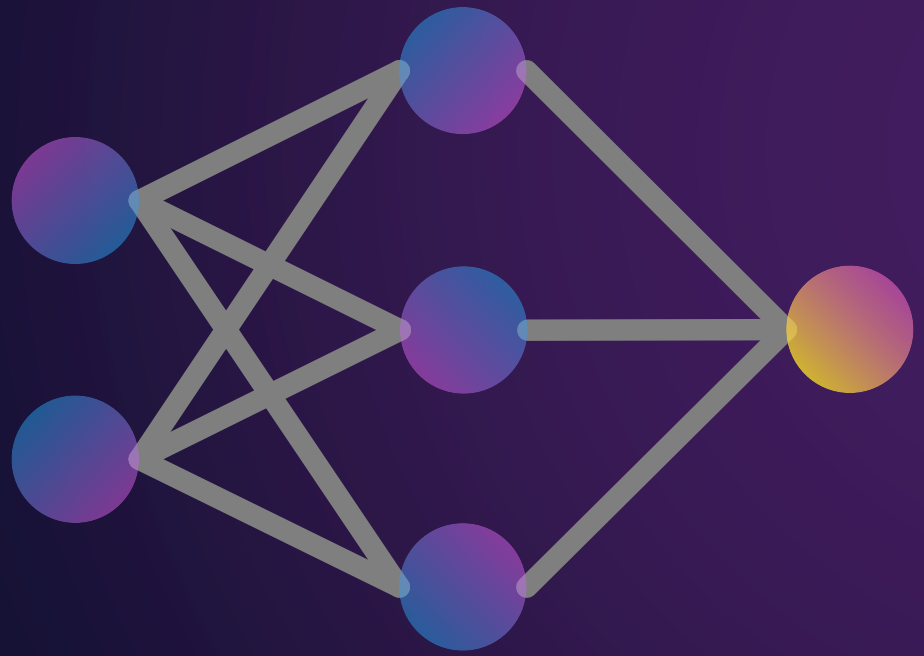
Python

- Neuronales Netz
- Quellcode der das Netz erzeugt und trainiert
- Vergleich von Keras und TensorFlow Code

Modell

Keras

Modell



Keras

Modell

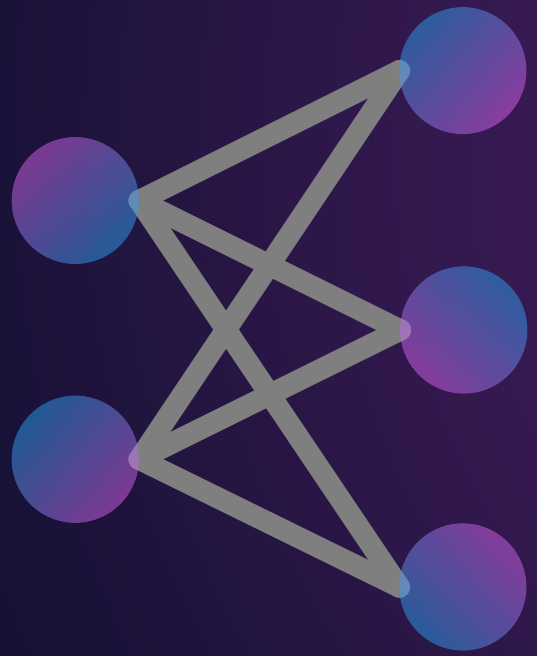
Keras

Modell

Keras

```
model = Sequential()
```

Modell

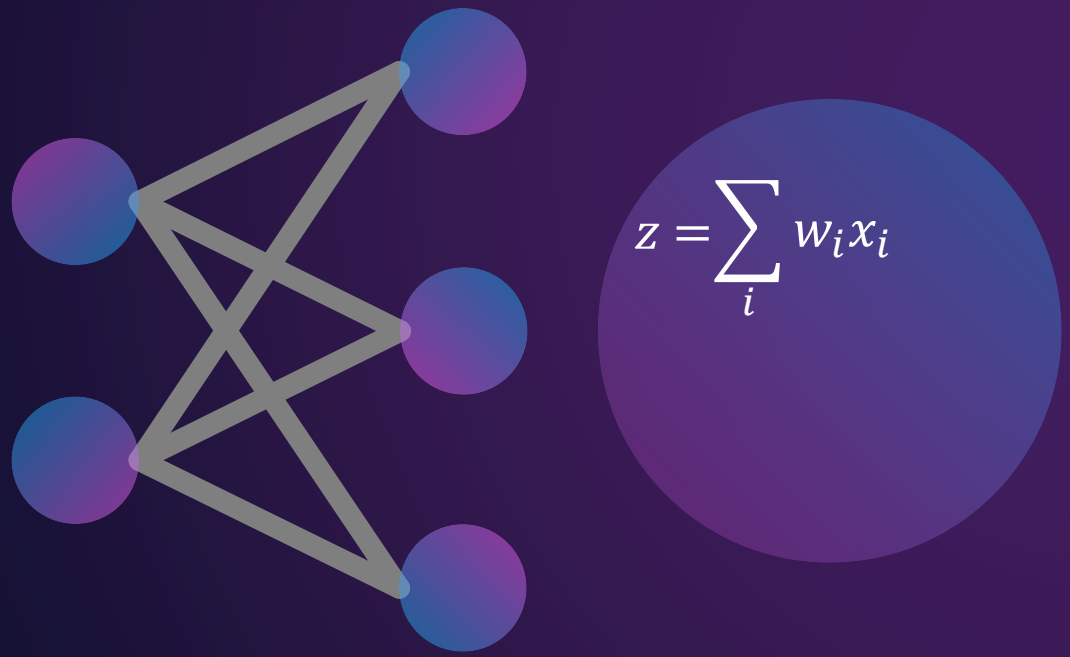


Keras

```
model = Sequential()

model.add(Dense(3, input_dim=2))
```

Modell



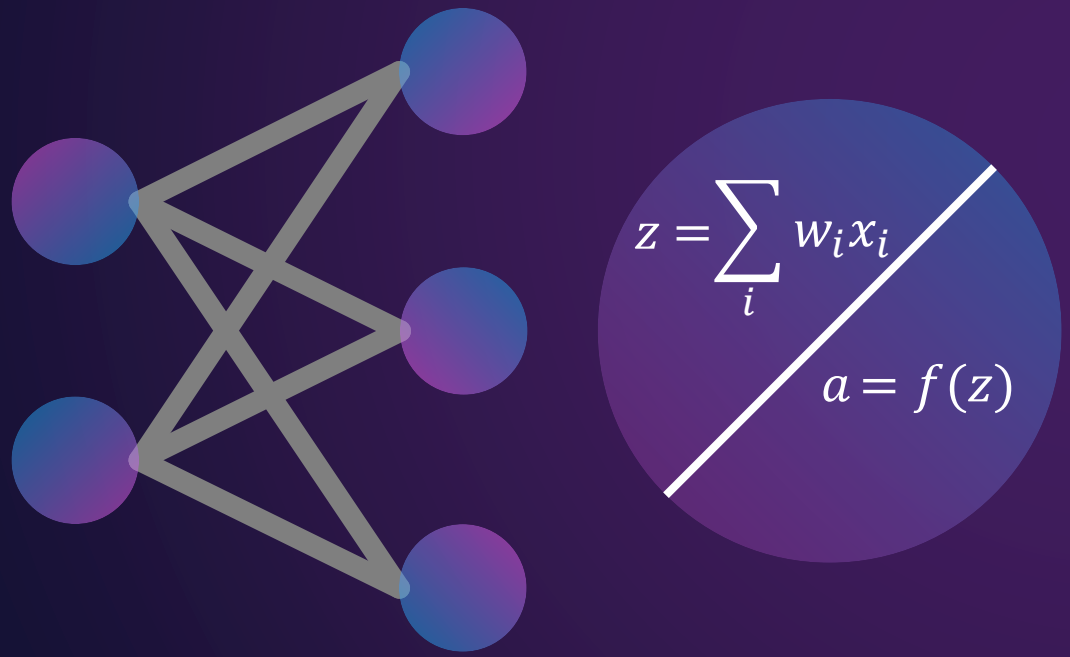
$$z = \sum_i w_i x_i$$

Keras

```
model = Sequential()

model.add(Dense(3, input_dim=2))
```

Modell

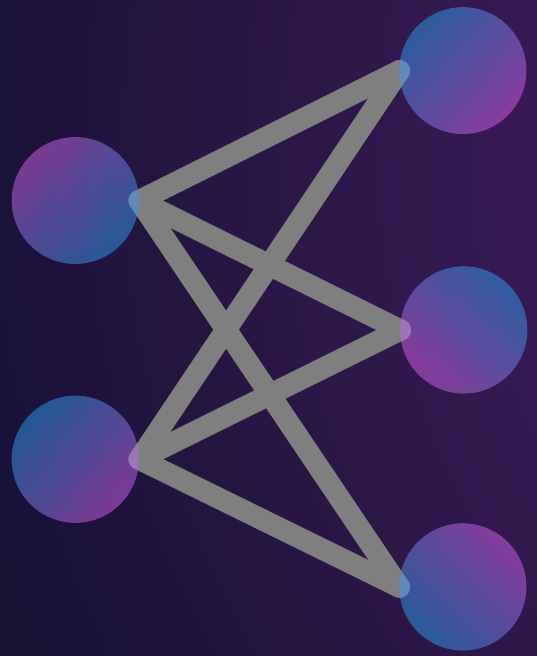


Keras

```
model = Sequential()

model.add(Dense(3, input_dim=2))
model.add(Activation('sigmoid'))
```

Modell

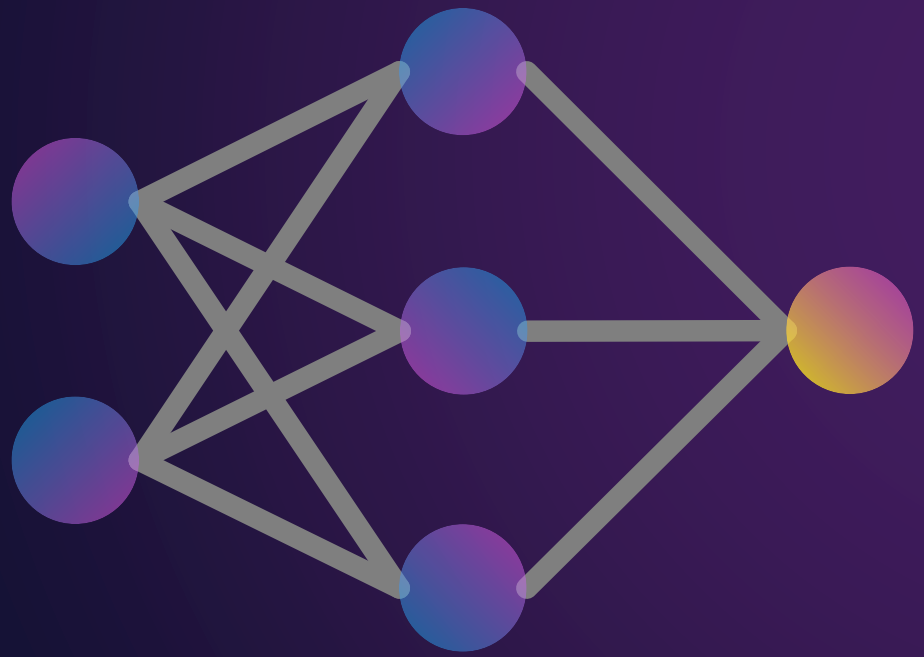


Keras

```
model = Sequential()

model.add(Dense(3, input_dim=2))
model.add(Activation('sigmoid'))
```

Modell



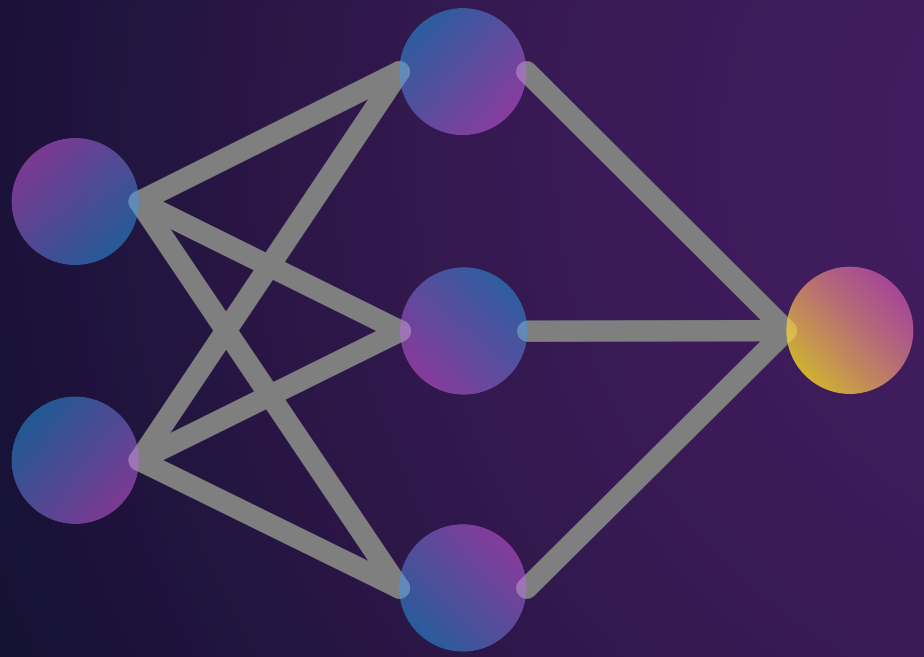
Keras

```
model = Sequential()

model.add(Dense(3, input_dim=2))
model.add(Activation('sigmoid'))

model.add(Dense(1))
```

Modell



Keras

```
model = Sequential()

model.add(Dense(3, input_dim=2))
model.add(Activation('sigmoid'))

model.add(Dense(1))
model.add(Activation('sigmoid'))
```

Keras

```
model = Sequential()

model.add(Dense(3, input_dim=2))
model.add(Activation('sigmoid'))

model.add(Dense(1))
model.add(Activation('sigmoid'))
```

TensorFlow

Keras

```
model = Sequential()

model.add(Dense(3, input_dim=2))
model.add(Activation('sigmoid'))

model.add(Dense(1))
model.add(Activation('sigmoid'))
```

TensorFlow

```
x = tf.placeholder(
        shape=[None, 2],
        dtype=tf.float32)
```

Keras

```
model = Sequential()

model.add(Dense(3, input_dim=2))
model.add(Activation('sigmoid'))

model.add(Dense(1))
model.add(Activation('sigmoid'))
```

TensorFlow

```
x = tf.placeholder(
        shape=[None, 2],
        dtype=tf.float32)
l1 = tf.layers.dense(x, 3,
        activation=tf.nn.sigmoid)
```

Keras

```
model = Sequential()

model.add(Dense(3, input_dim=2))
model.add(Activation('sigmoid'))

model.add(Dense(1))
model.add(Activation('sigmoid'))
```

TensorFlow

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```

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```

Keras

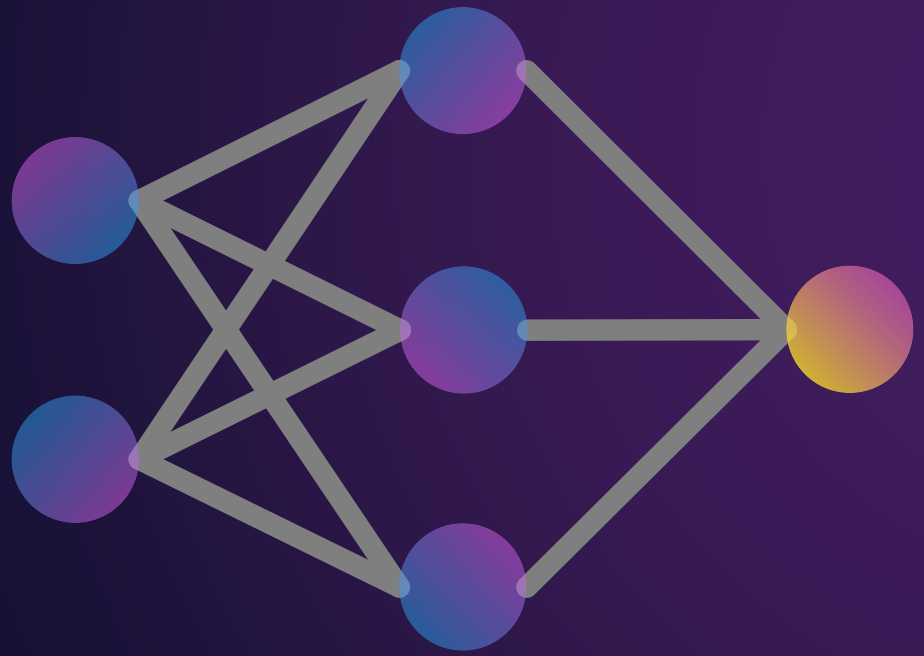
TensorFlow

Keras

TensorFlow

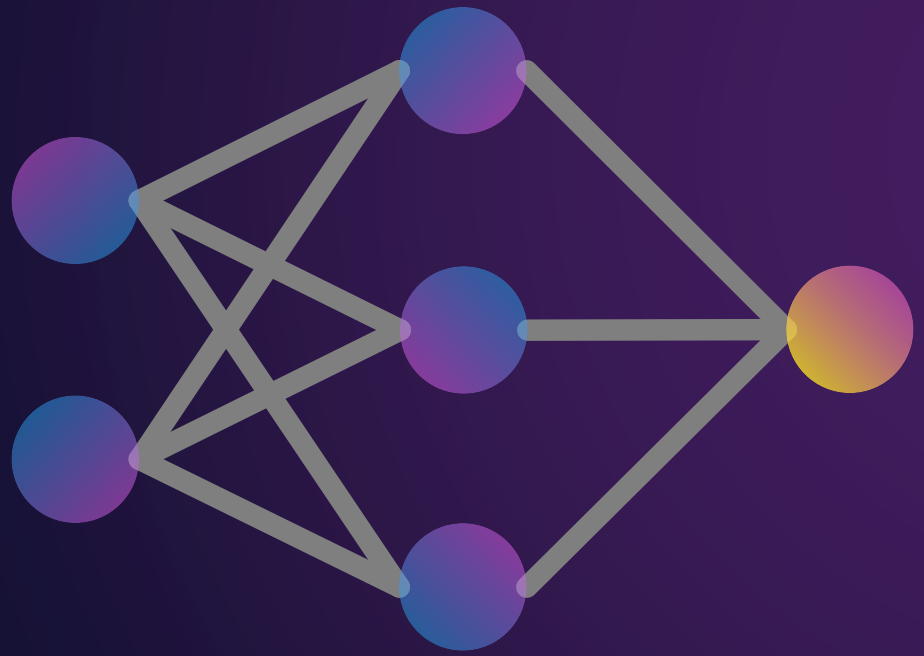
“dense (from tensorflow.python.layers.core) is deprecated and will be removed in a future version.”

Modell



Keras

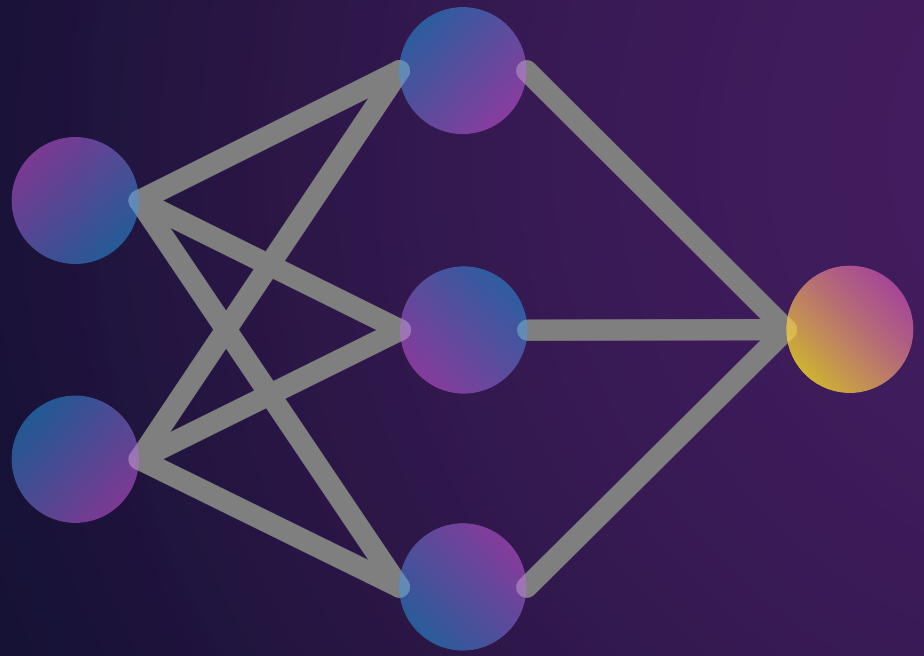
Modell



Keras

```
model.compile(loss='mse',
              optimizer=adam(lr=0.001),
              metrics=['accuracy'])
```

Modell

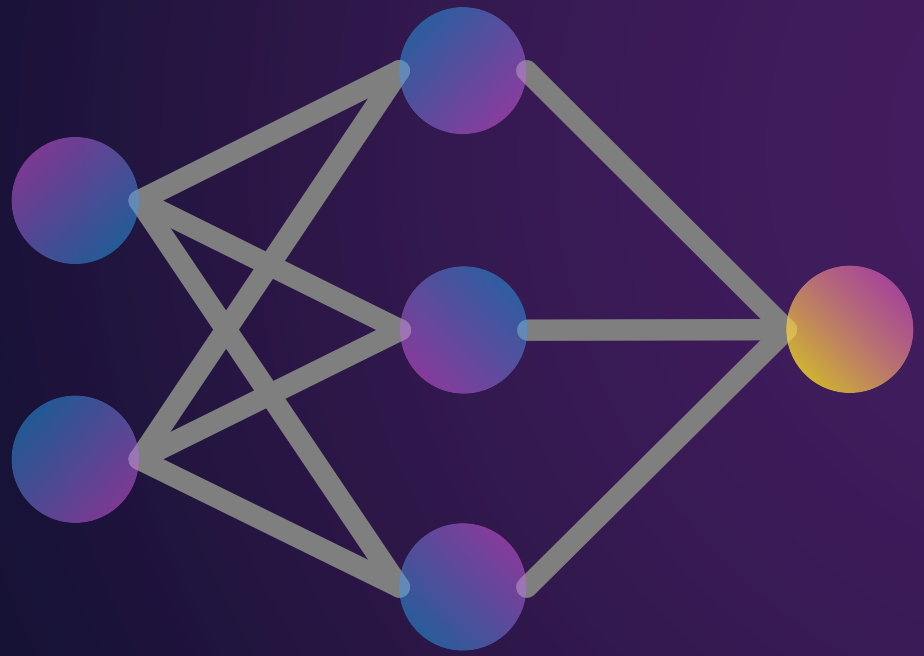


Keras

```
model.compile(loss='mse',
              optimizer=adam(lr=0.001),
              metrics=['accuracy'])

model.fit(x=x_train, y=y_train,
          batch_size=128,
          epochs=10)
```

Modell



Keras

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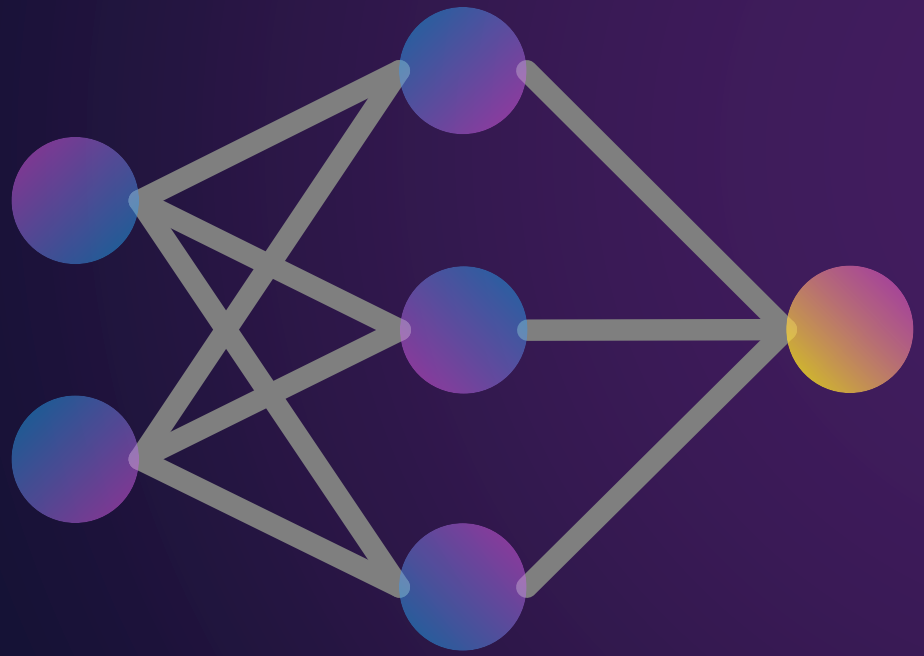
              metrics=['accuracy'])

model.fit(x=x_train, y=y_train,
          batch_size=128,
          epochs=10)

model.evaluate(x=x_test, y=y_test)
```

Modell



Keras

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              optimizer=adam(lr=0.001),
              metrics=['accuracy'])

model.fit(x=x_train, y=y_train,
          batch_size=128,
          epochs=10)

model.evaluate(x=x_test, y=y_test)
```

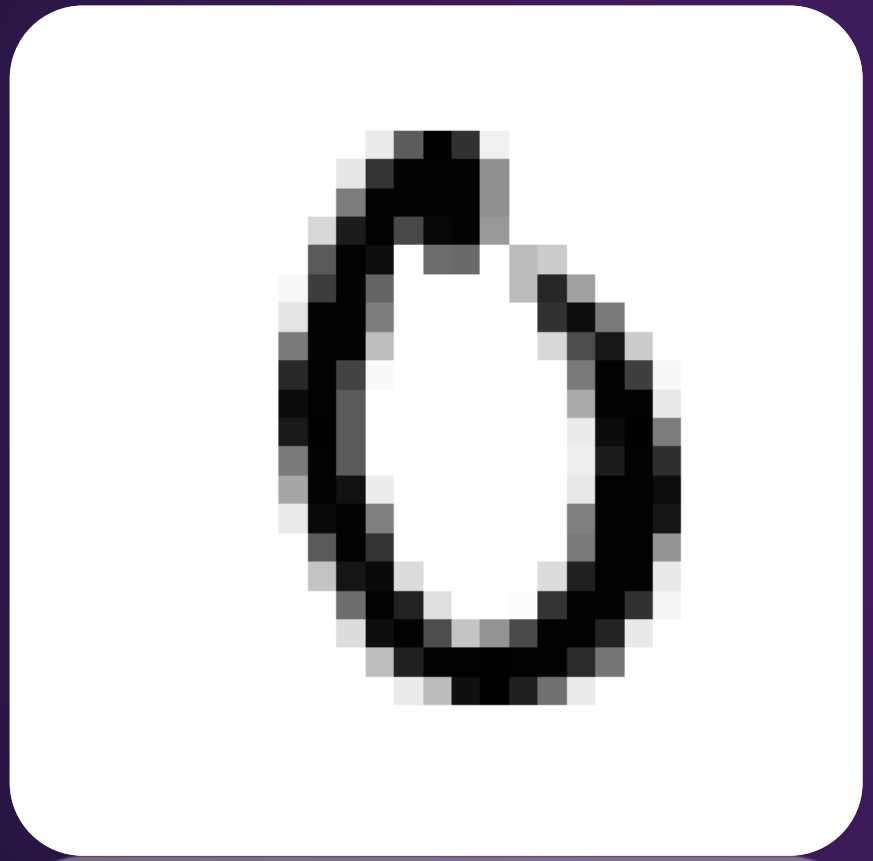
Problem

Problem

Handgeschriebene
Zahlen
klassifizieren

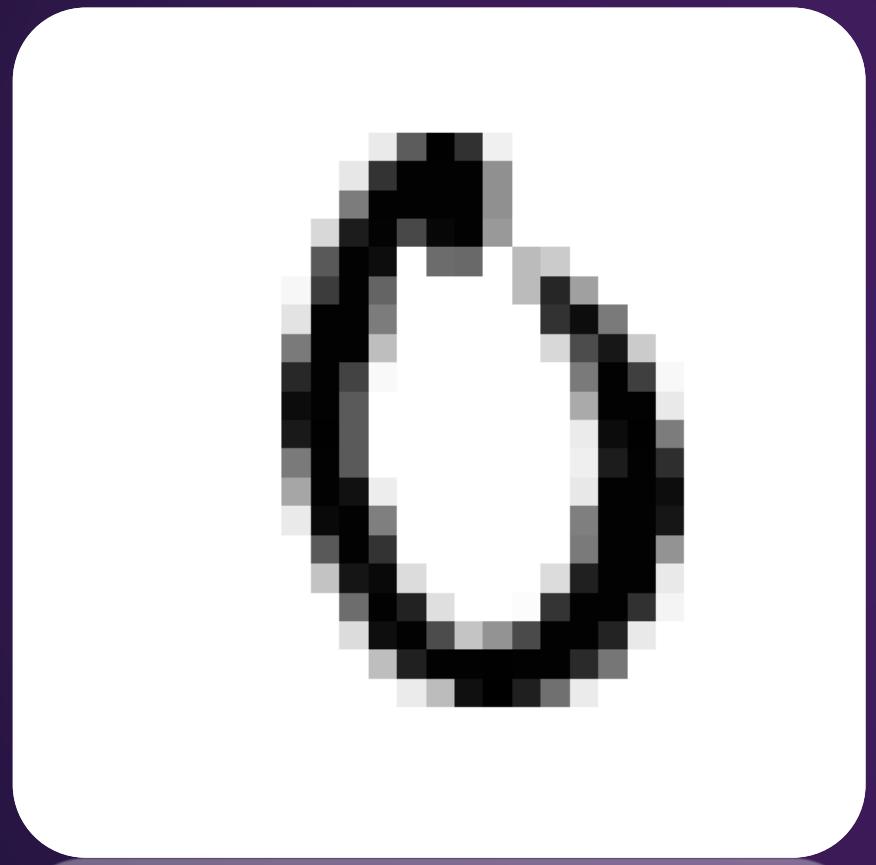
0 1 2 3 4

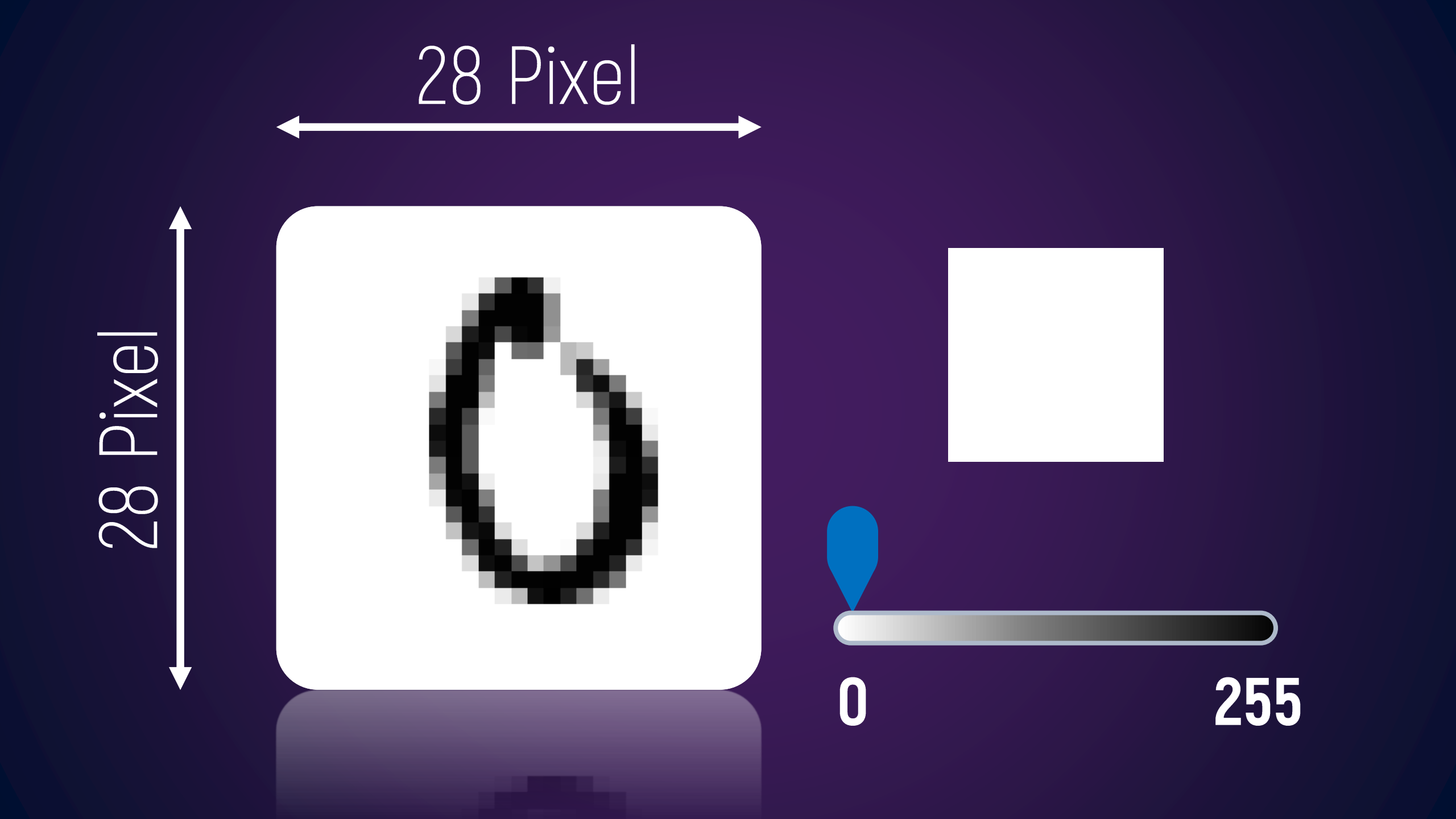
5 6 7 8 9



28 Pixel

28 Pixel




28 Pixel
28 Pixel
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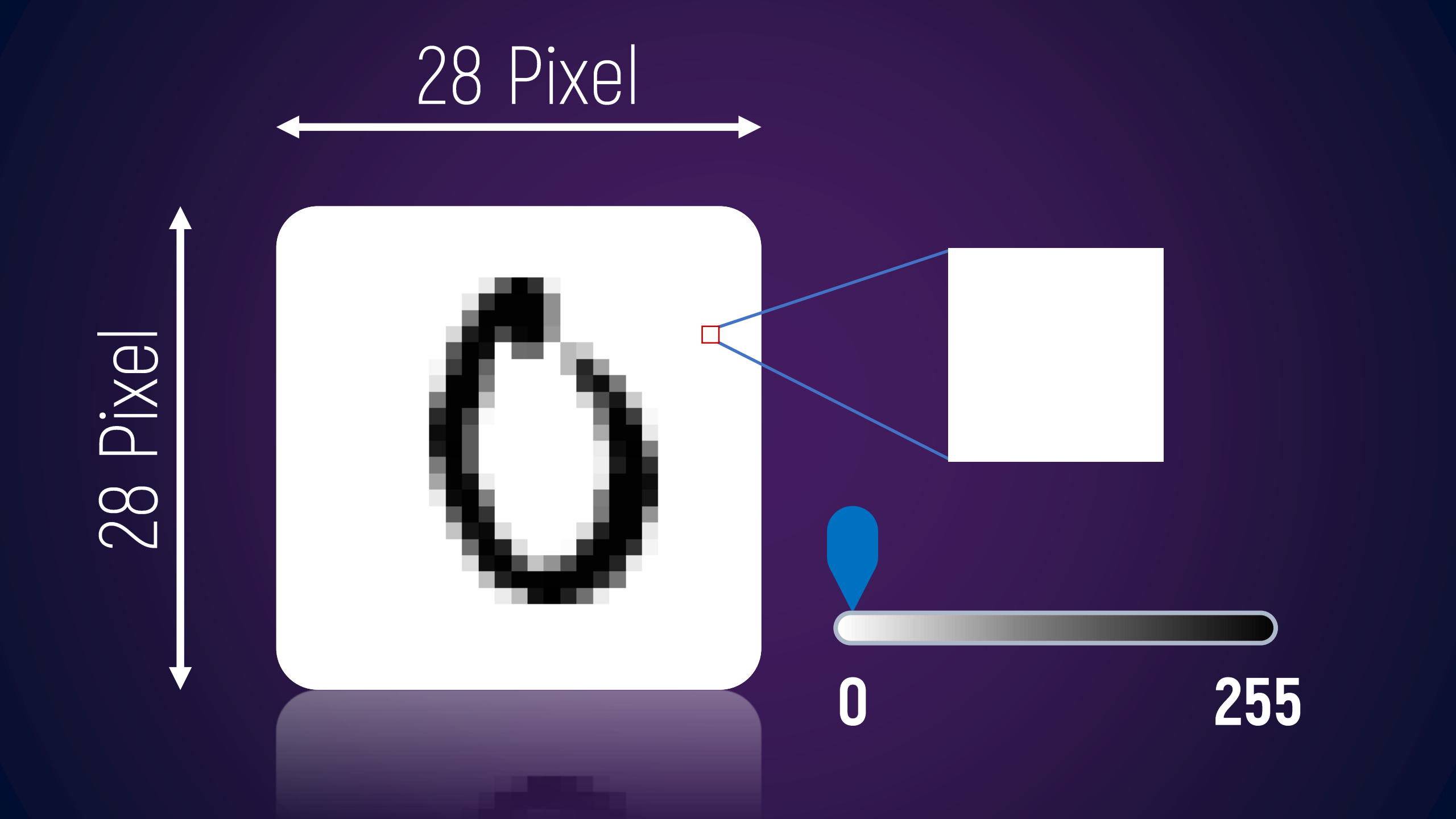
255


28 Pixel
28 Pixel
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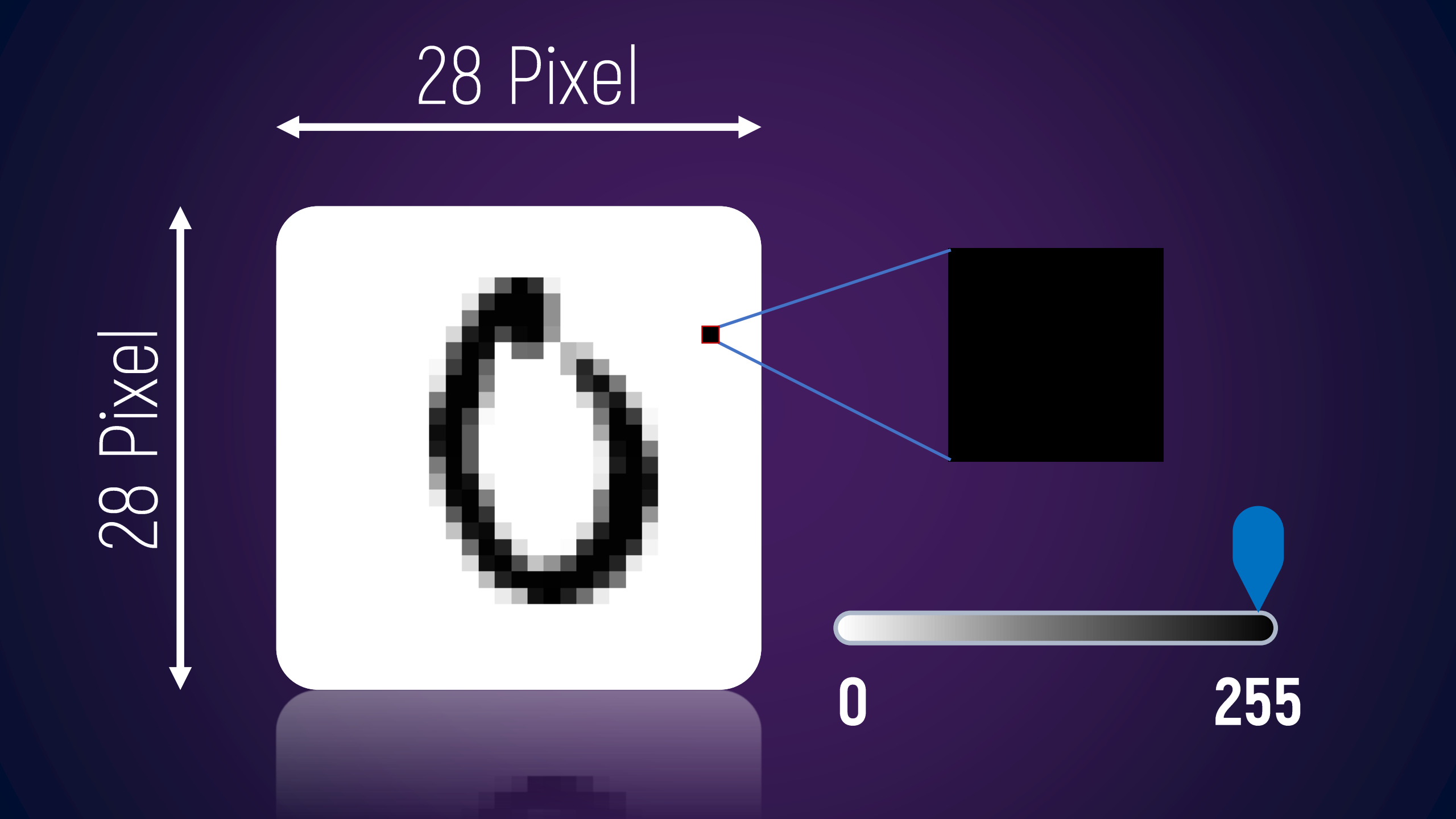
255


28 Pixel
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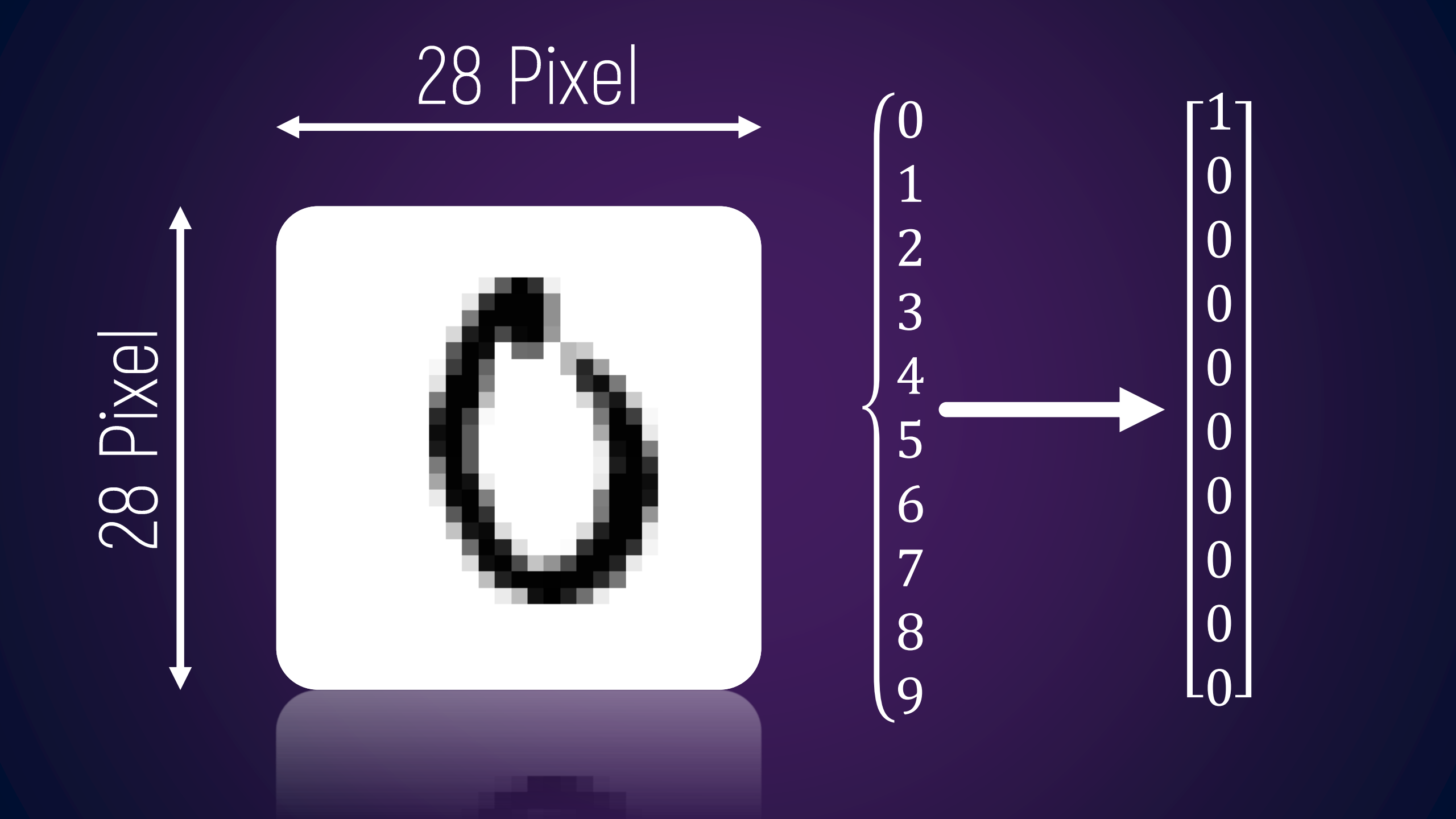
28 Pixel
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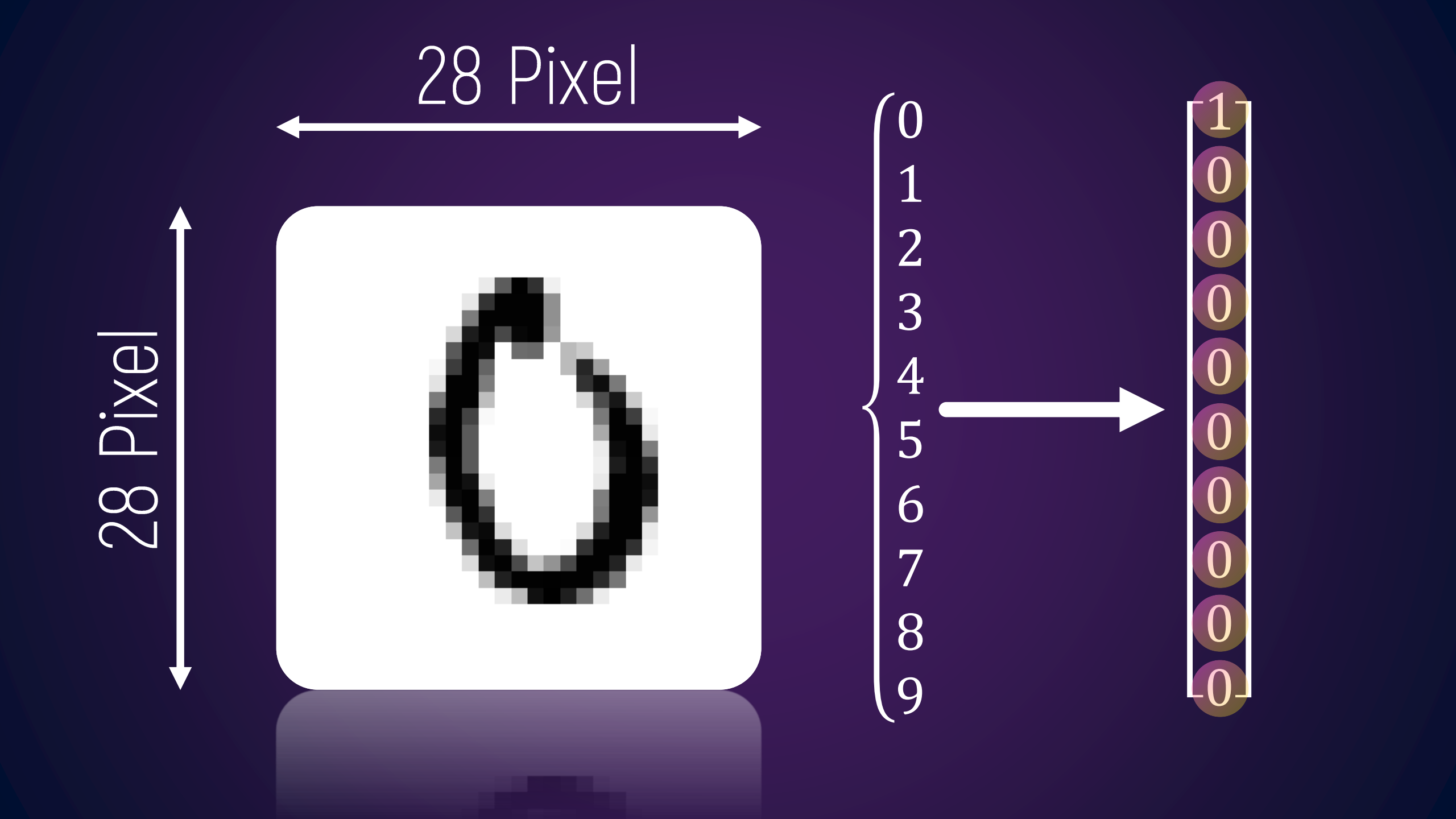
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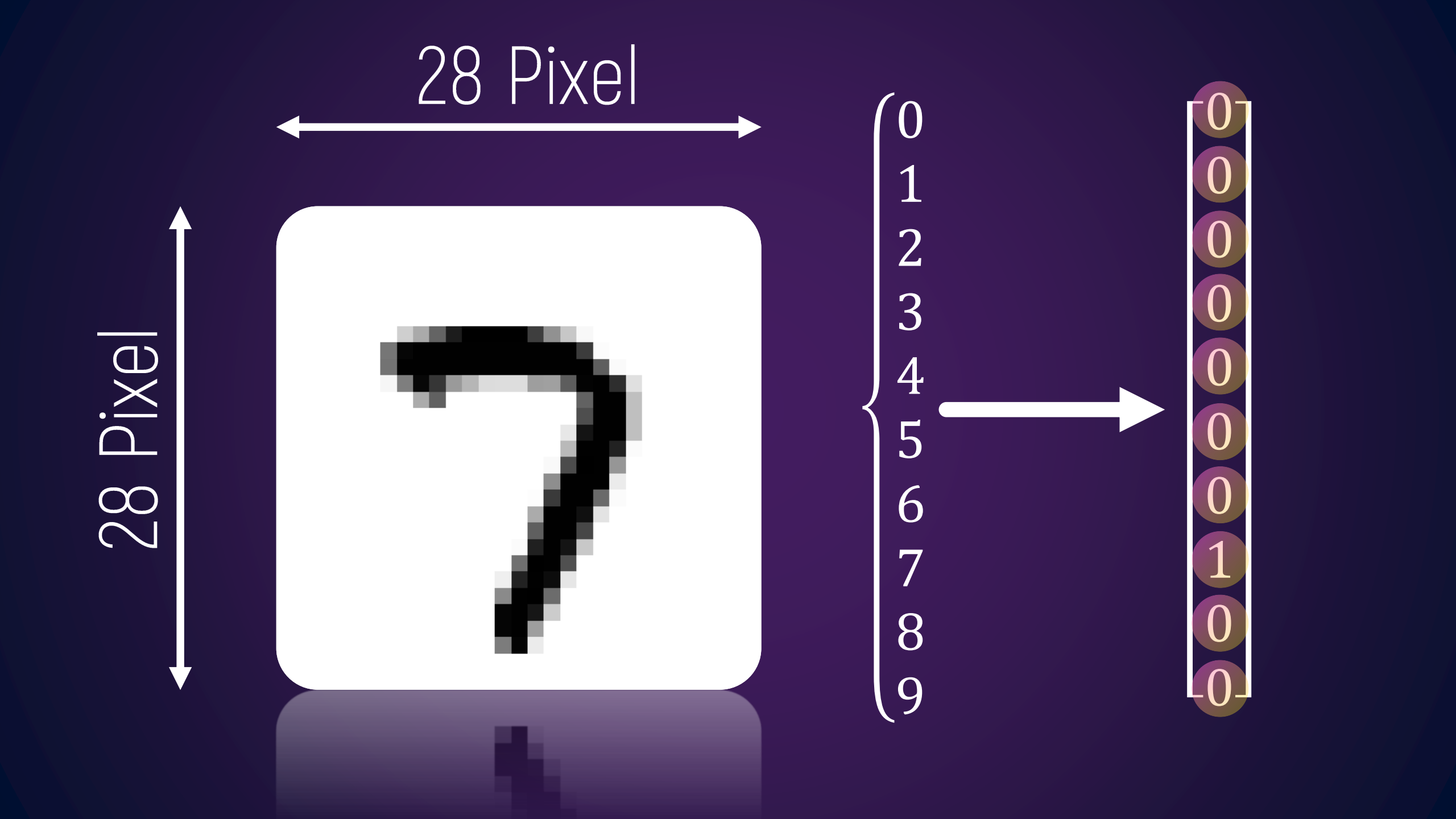
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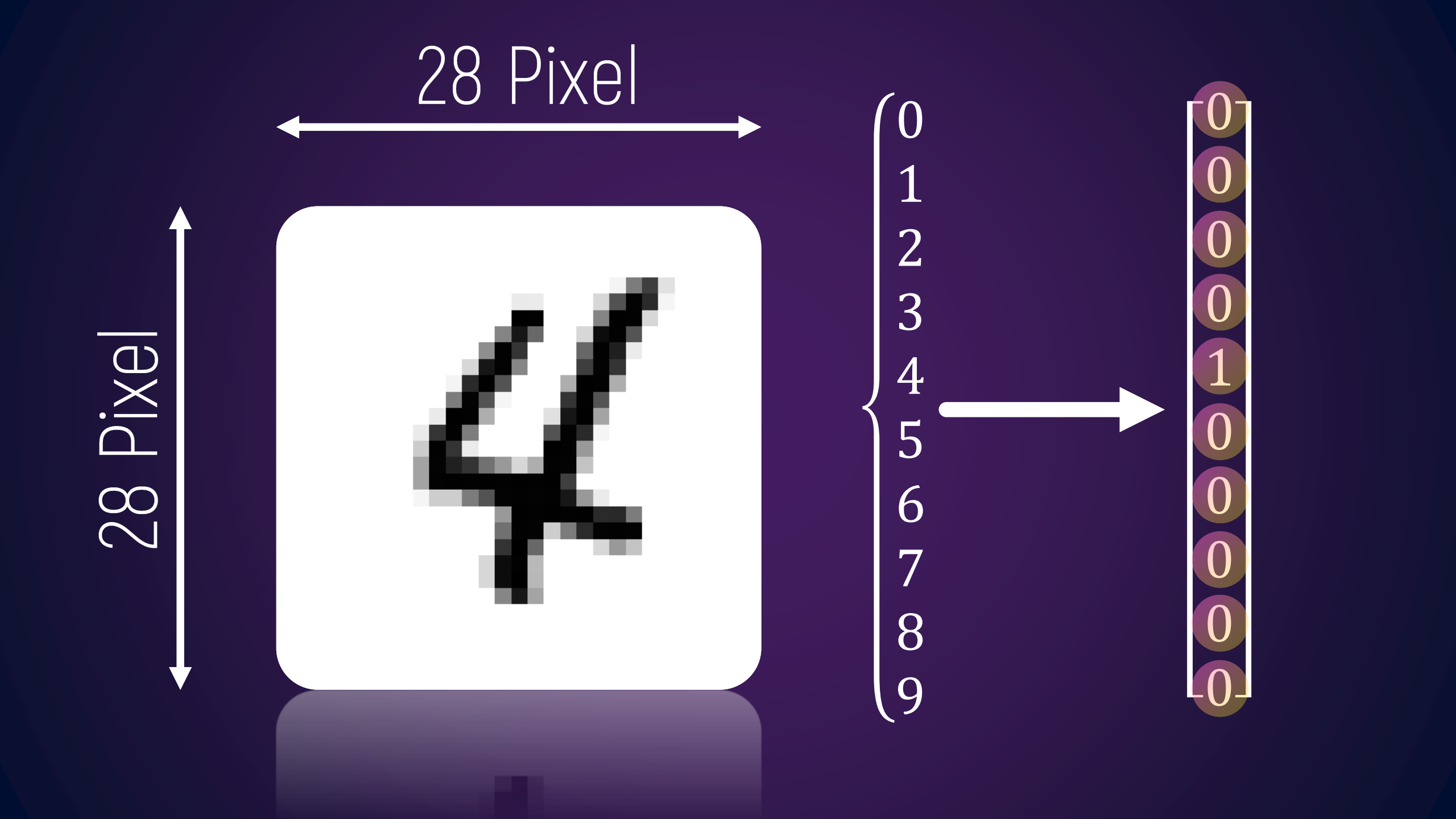
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Live Demo

Deep Learning

Summary

- Was ist Deep Learning
- Warum brauchen wir Deep Learning
- Typische Deep Learning Probleme
- Wie funktioniert Deep Learning

Neuronales Netze

Summary

- Geschichte
- Aufbau
  - Schichten
  - Neuronen

Lernalgorithmus

- Supervised Learning
- Gradient Descent
- Hyperparameter

Summary

Keras und TensorFlow

Summary

- TensorFlow - Namensgebung
- Keras baut auf TensorFlow auf
- Vor- und Nachteile von Keras und TensorFlow

Programmieren einer KI in Keras

Summary

- Quellcode
- Keras und TensorFlow Codevergleich
- Neuronales Netz in Keras trainieren

Inhalt

- Resourcen für Selbststudium
- Das eben gezeigt Jupyter Notebook
- Diese Präsentation im PDF-Format

Fragen