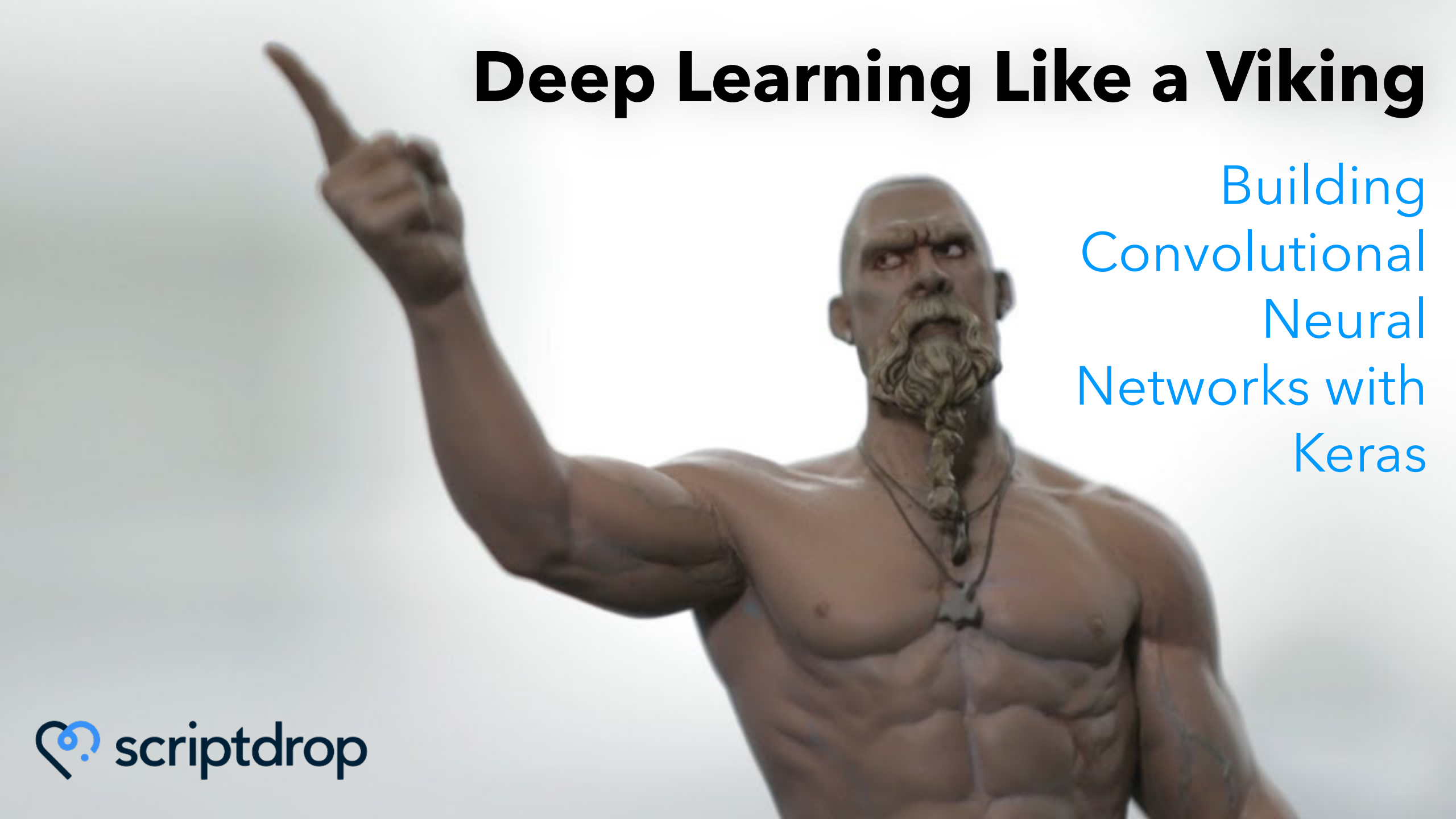
Deep Learning Like a Viking

Building Convolutional Neural Networks with Keras



scriptdrop

Guy Royse

Engineering Manager

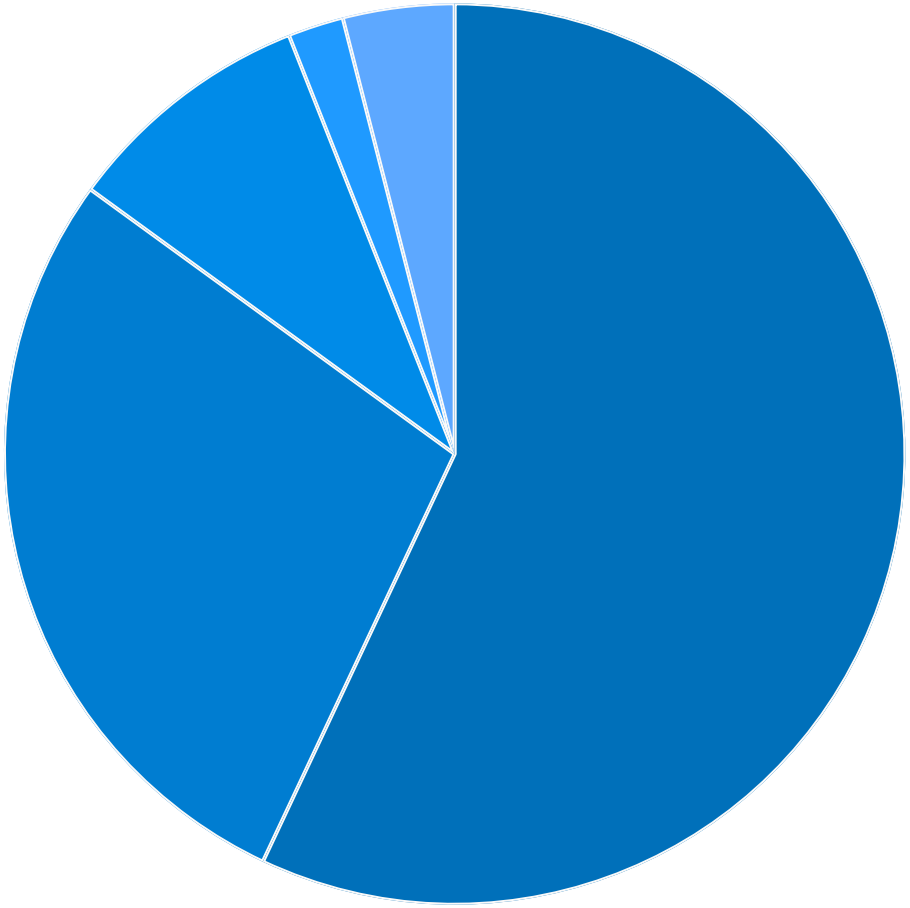
ScriptDrop

guyroyse

code.guy.dev

guy.dev

IANADS



British Isles	57%
German	28%
Iberian	9%
Uncertain	4%
Scandinavian	2%
Guy	100%

The Younger Futhark

ᚠ	ᚢ	ᚦ	ᚬ	ᚱ	ᚴ	ᚼ	ᚾ	ᛁ	ᛅ	ᛋ	ᛏ	ᛒ	ᛘ	ᛚ	ᛦ
fe	ur	thurs	as	reith	kaun	hagall	nauthr	isa	ar	sol	tyr	bjork	mathr	logr	yr

ᚴᚅᛁ᛫ᚱᚬᛁᚋ

(Kai Rais)

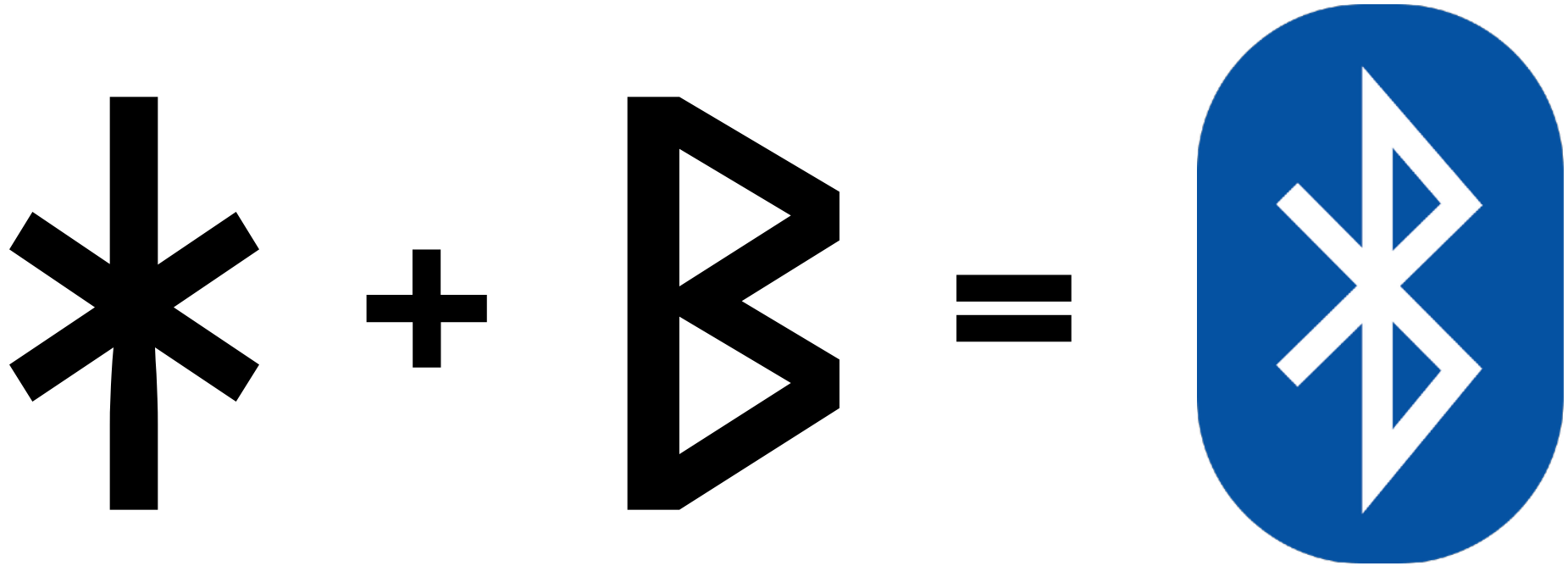
Lingsberg Runestones

Danr and Húskarl and Sveinn and Holmfríðr, the mother and (her) sons, had this stone erected in memory of Halfdan, the father of Danr and his brothers; and Holmfríðr in memory of her husbandman.

Lingsberg Runestones

Danr and Húskarl and Sveinn and **Holmfríðr**, the mother and (her) sons, had this stone erected in memory of Halfdan, the father of Danr and his brothers; and **Holmfríðr** in memory of her husbandman.

Harald Bluetooth



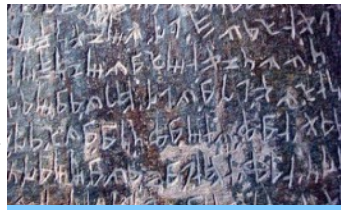
Younger Futhark vs. Latin & Greek

ᚠ	ᚢ	ᚦ	ᚬ	ᚱ	ᚴ	ᚼ	ᚾ	ᛁ	ᛅ	ᛋ	ᛏ	ᛒ	ᛘ	ᛚ	ᛦ
fe	ur	thurs	as	reith	kaun	hagall	nauthr	isa	ar	sol	tyr	bjork	mathr	logr	yr

F	U			R				I		S	T	B		L	
		Θ		P				I		Σ	T	B		Λ	

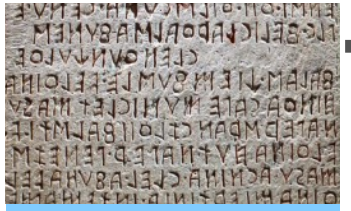
Common Ancestors

Egyptian

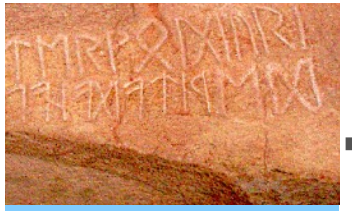


Proto-Canaanite

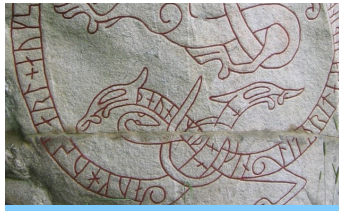
Ancient Greek



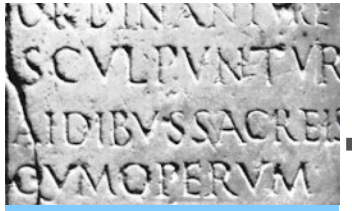
Etruscan



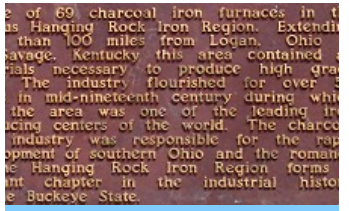
Elder Futhark



Younger Futhark

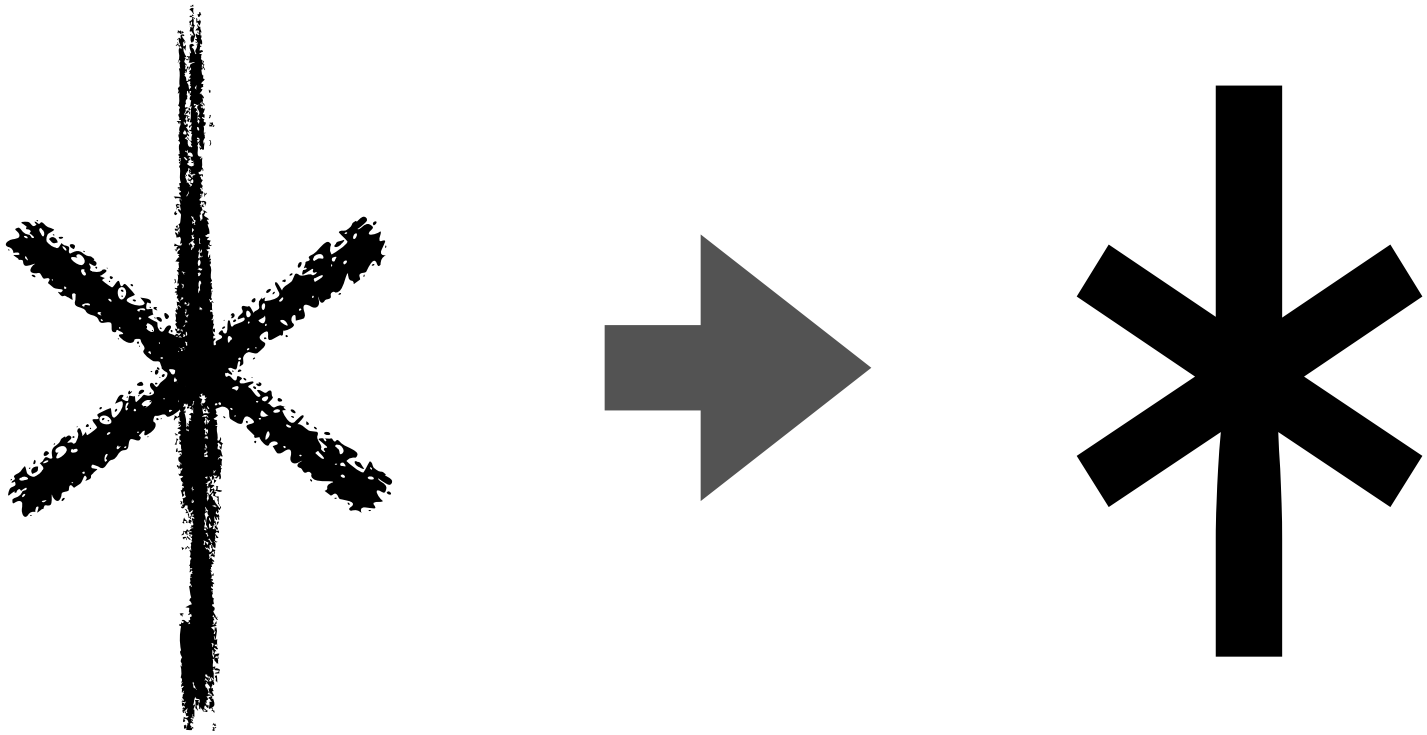


Latin

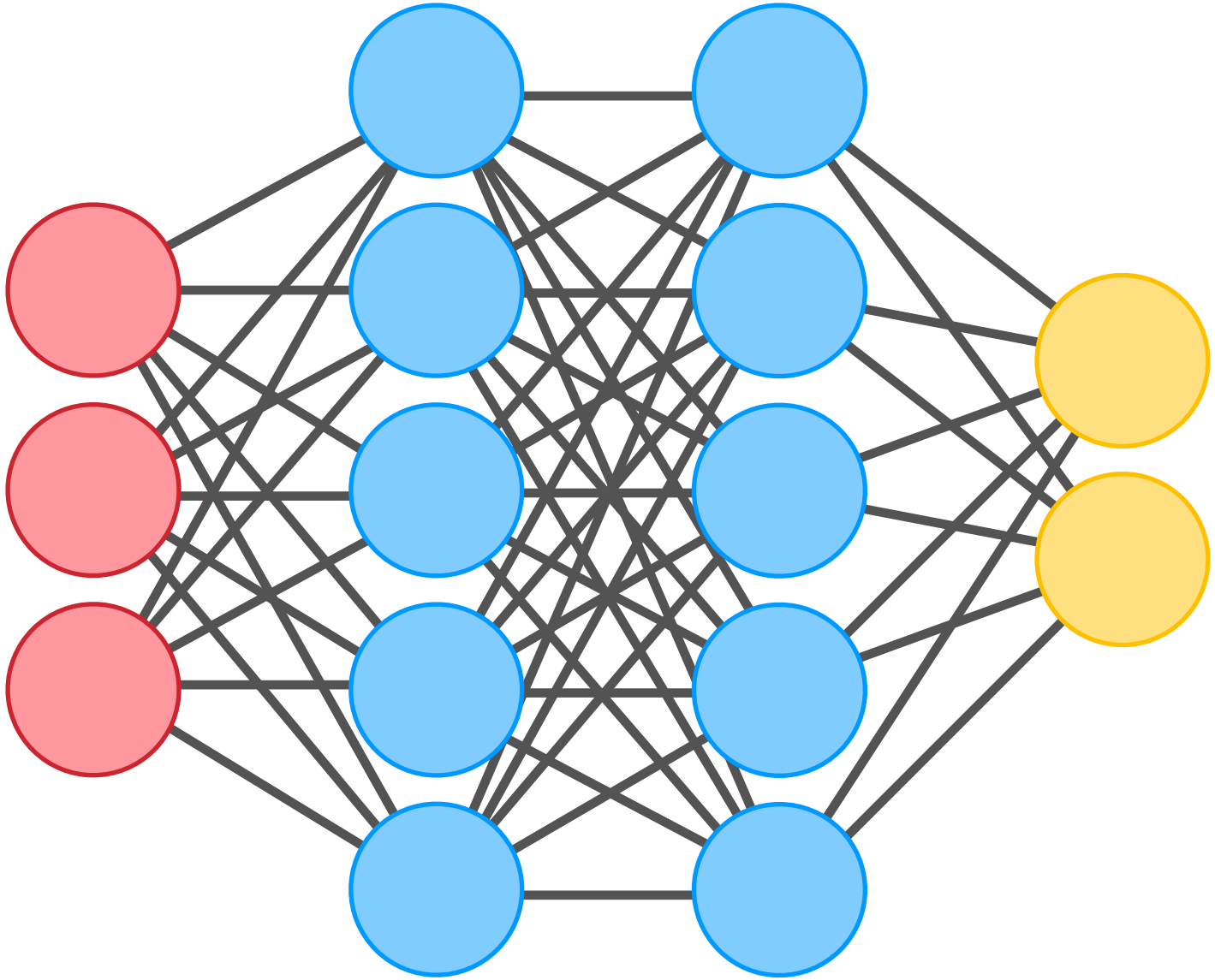


Modern Latin

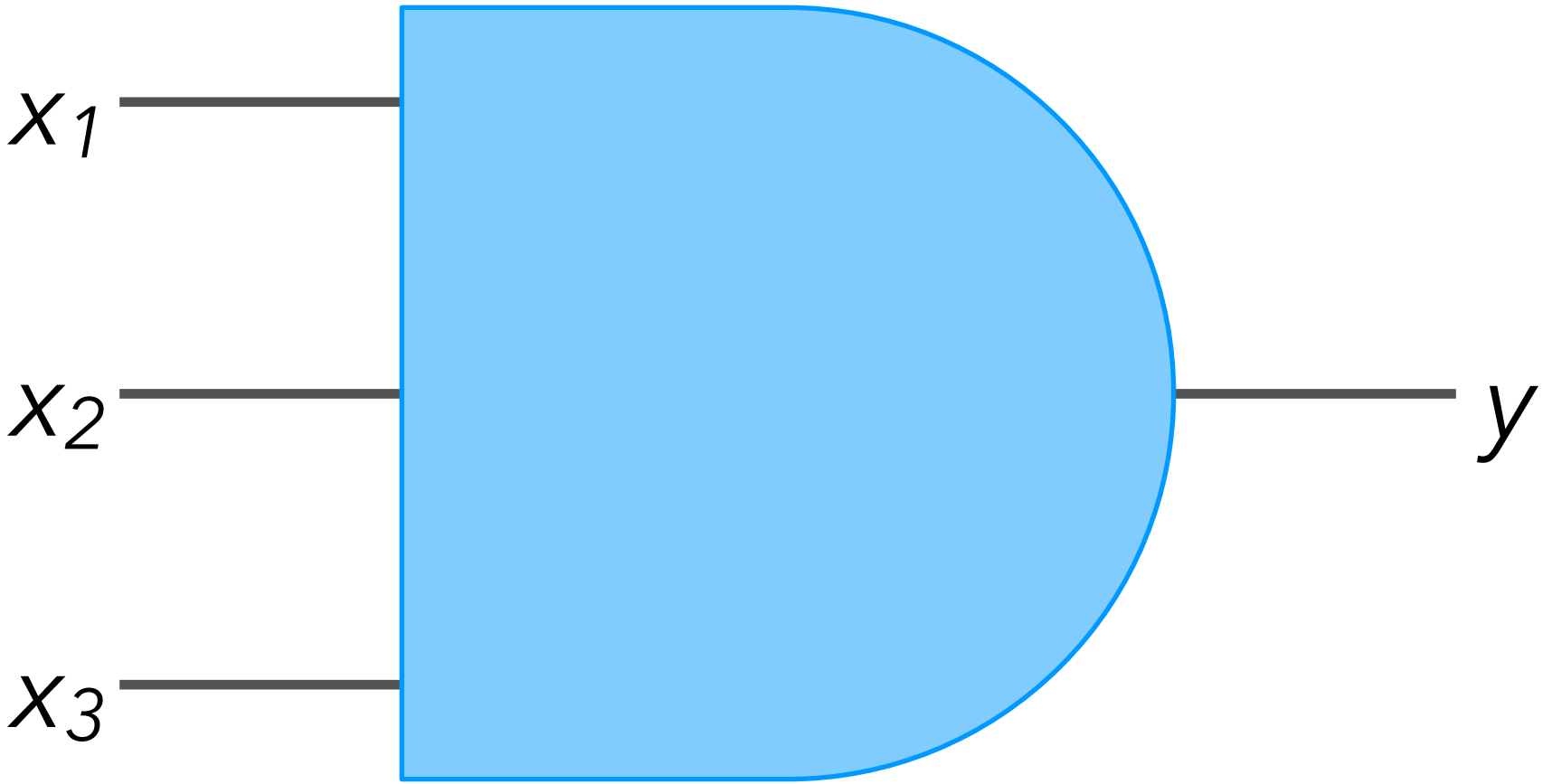
Recognizing Runes



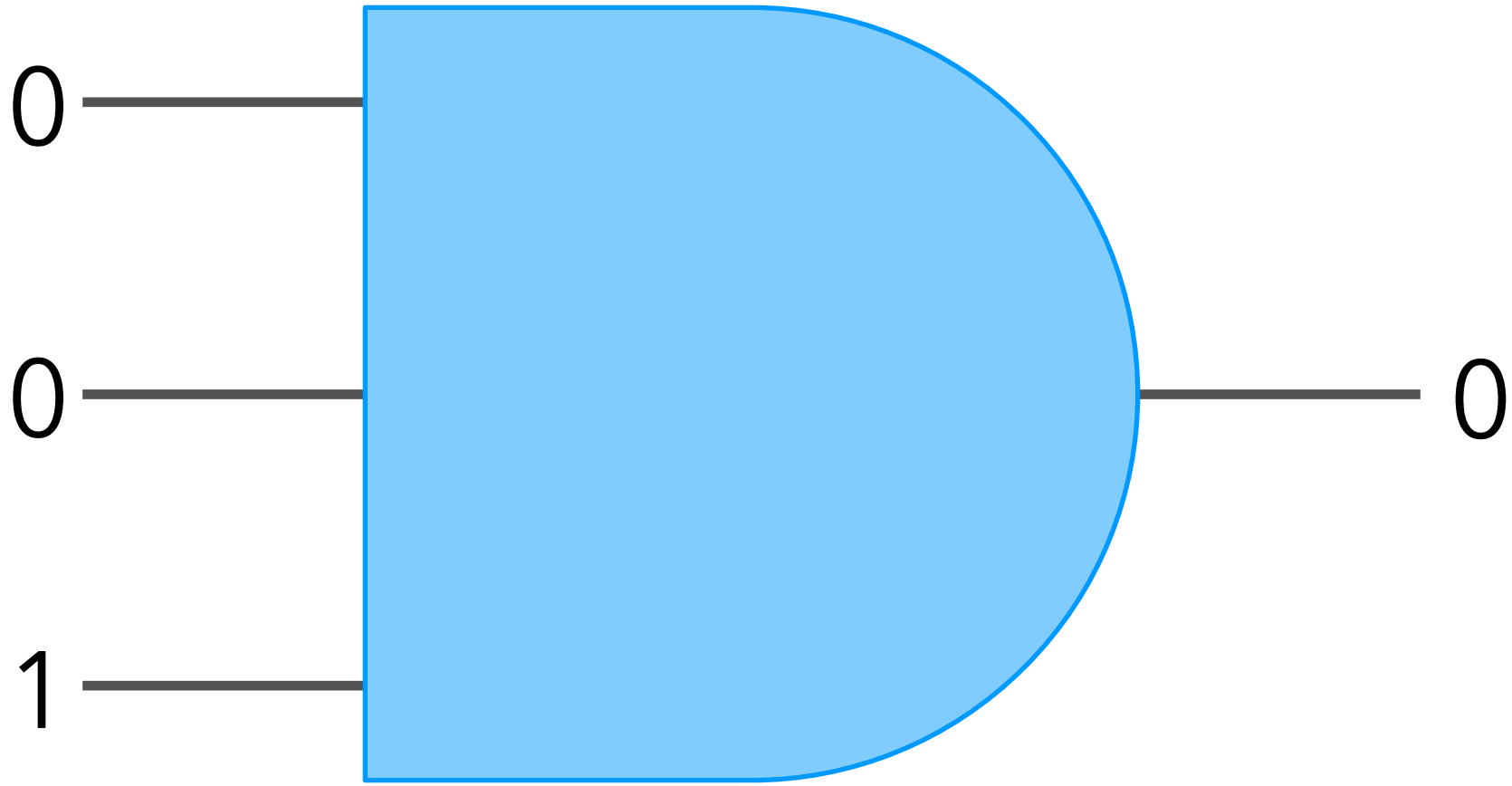
Neural Networks



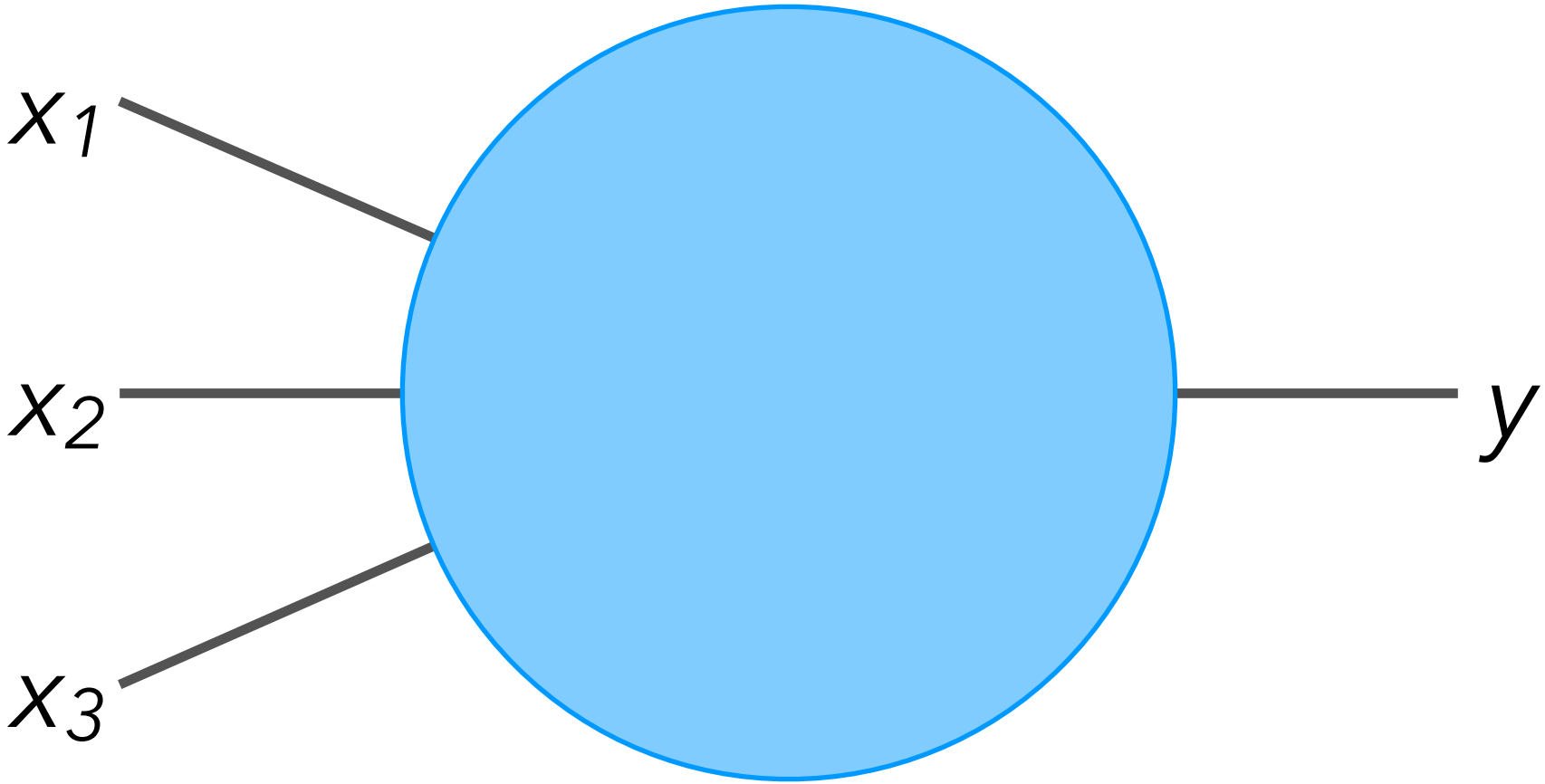
Logic Gates



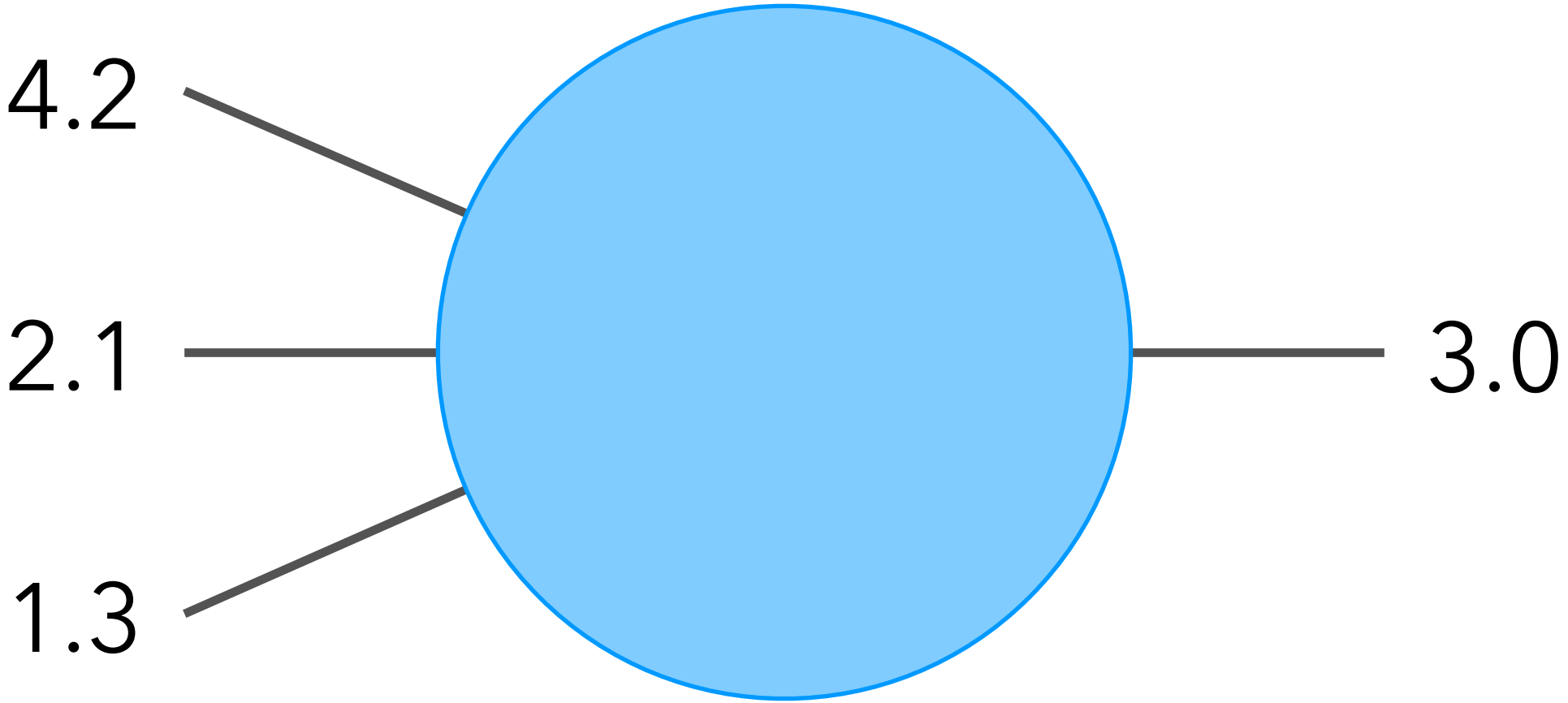
Logic Gates with Actual Numbers



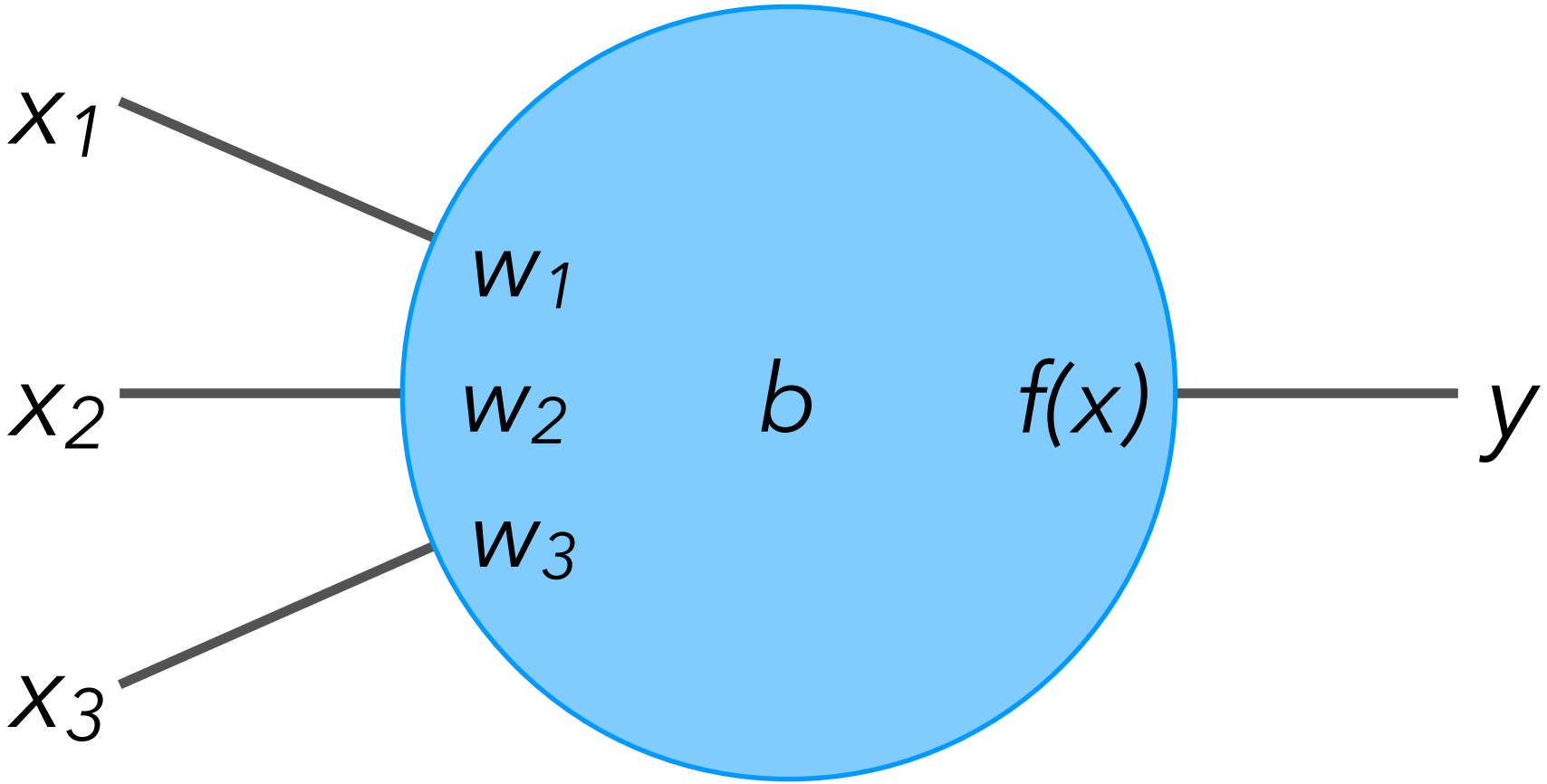
Neurons



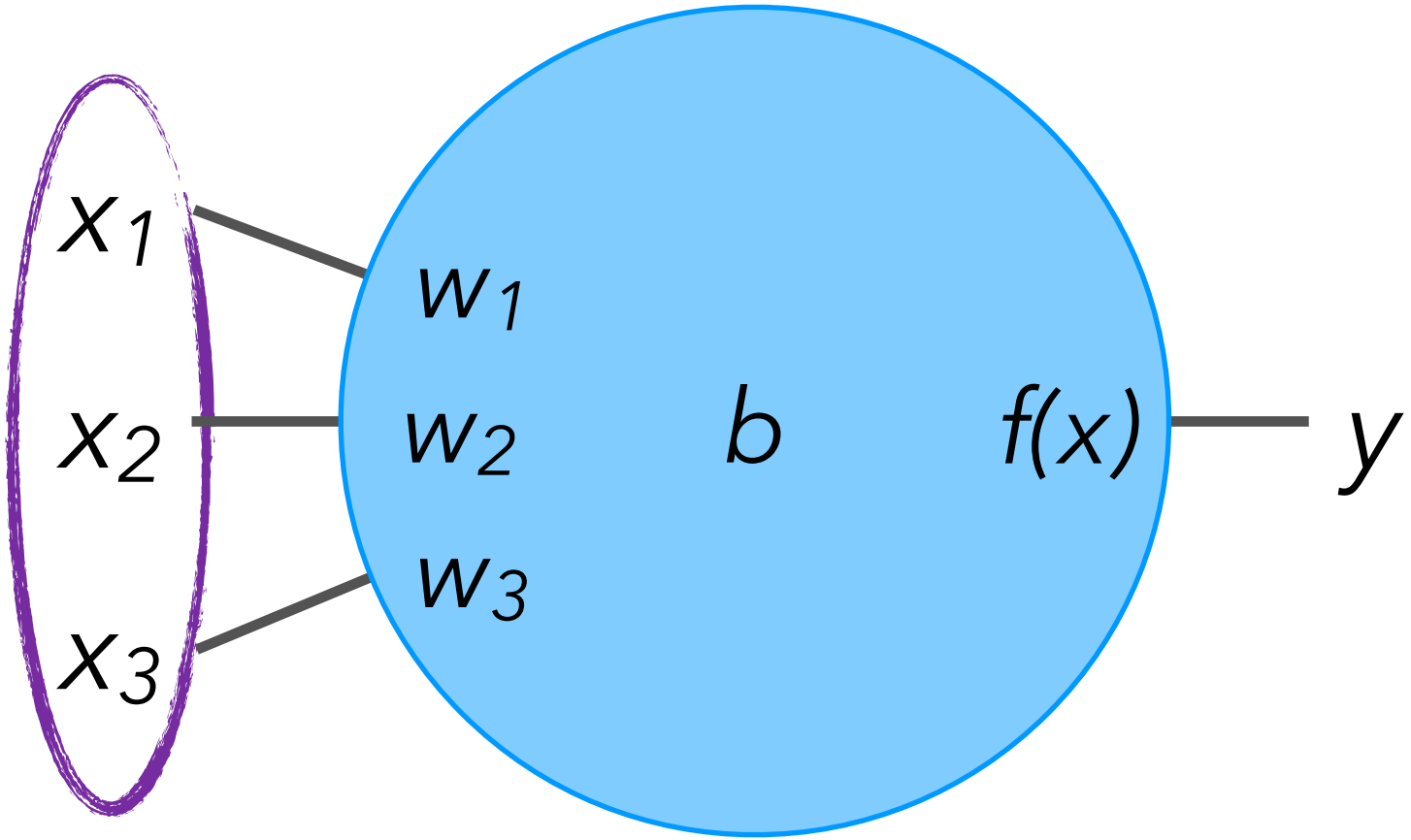
Neurons with Actual Numbers



Inside a Neuron

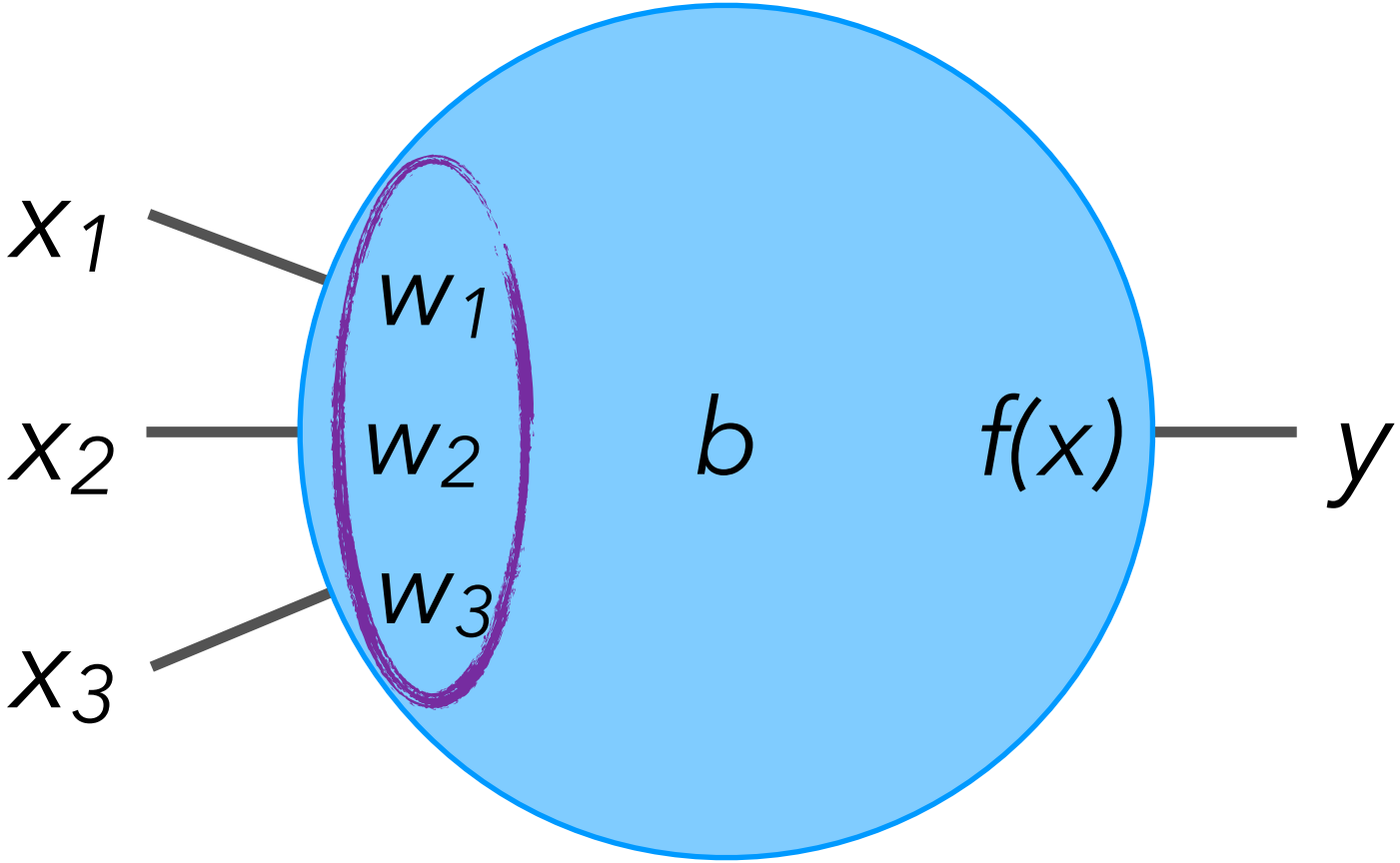


Inputs



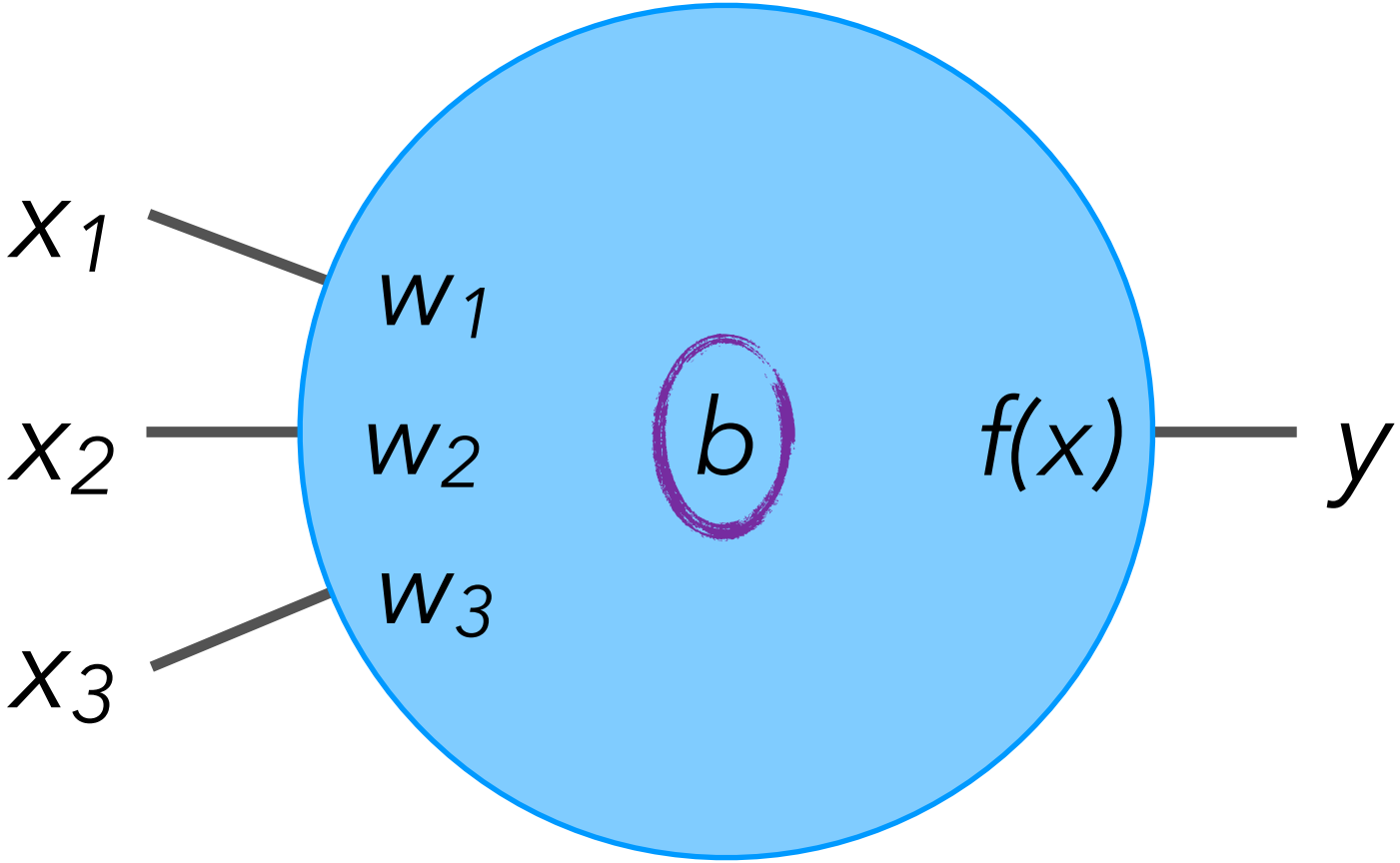
The values coming into the neuron.

Weights



Makes an input more or less important.

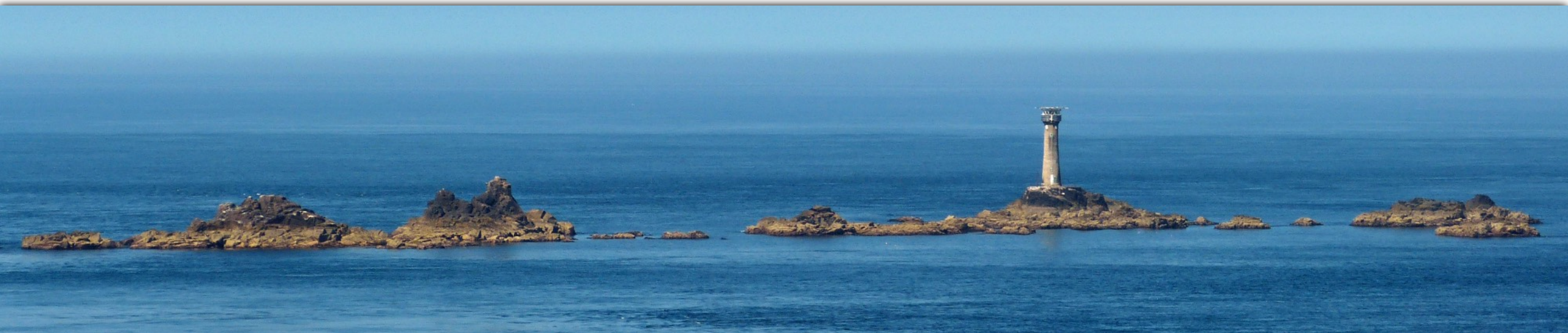
Bias



Makes the sum of the inputs more or less important.

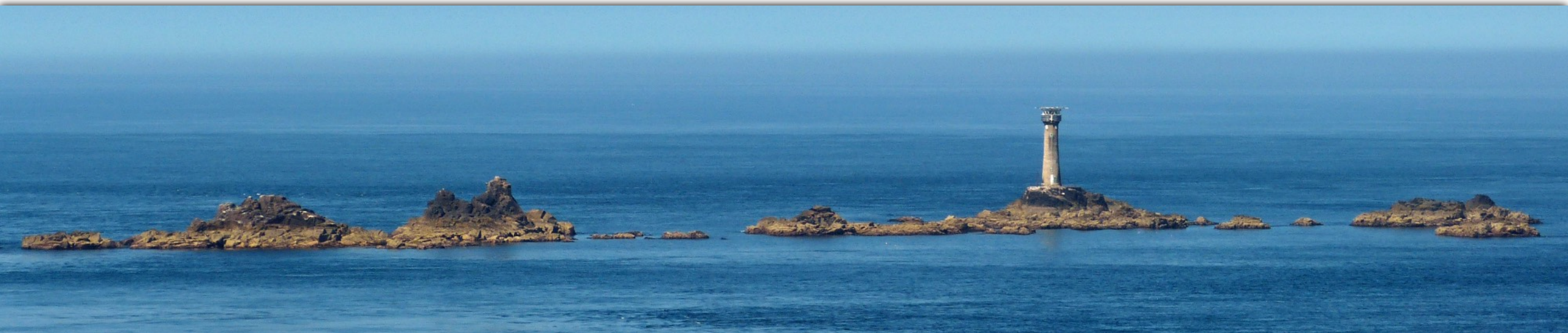
The Math So Far

$$x_1 w_1 + x_2 w_2 + x_3 w_3 + b$$

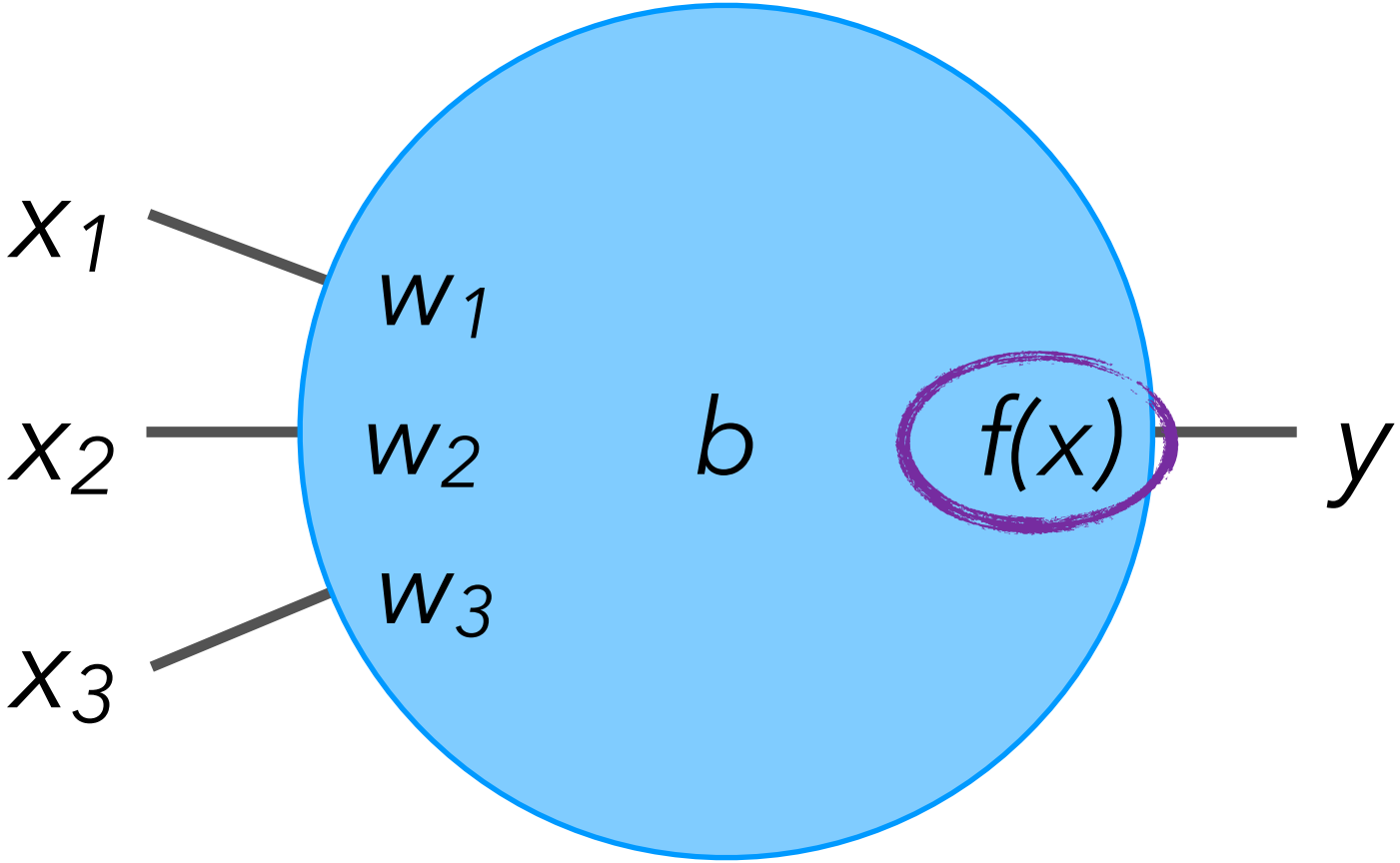


Even Mathier

$$\sum_i x_i w_i + b$$

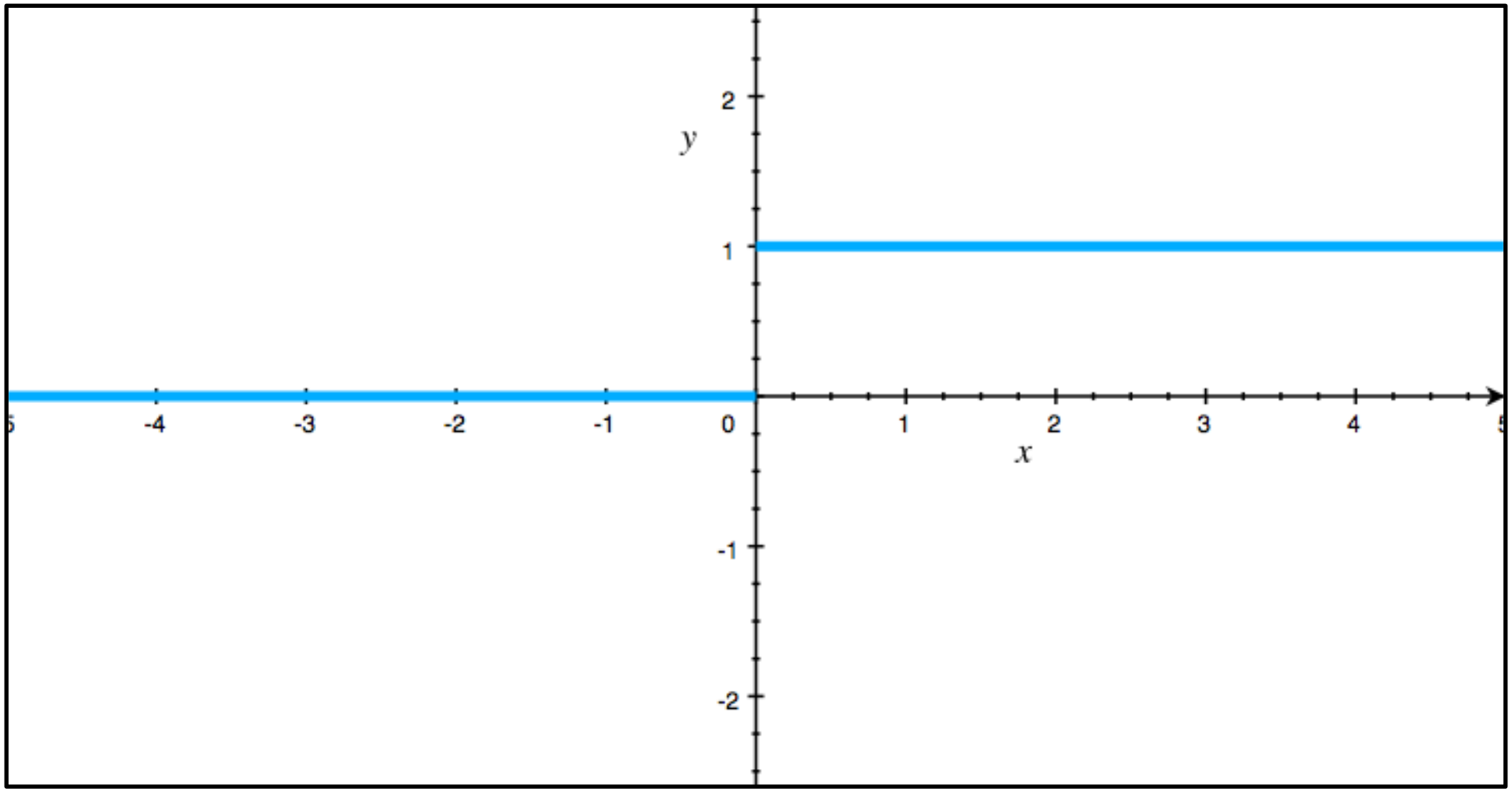


Activation Function

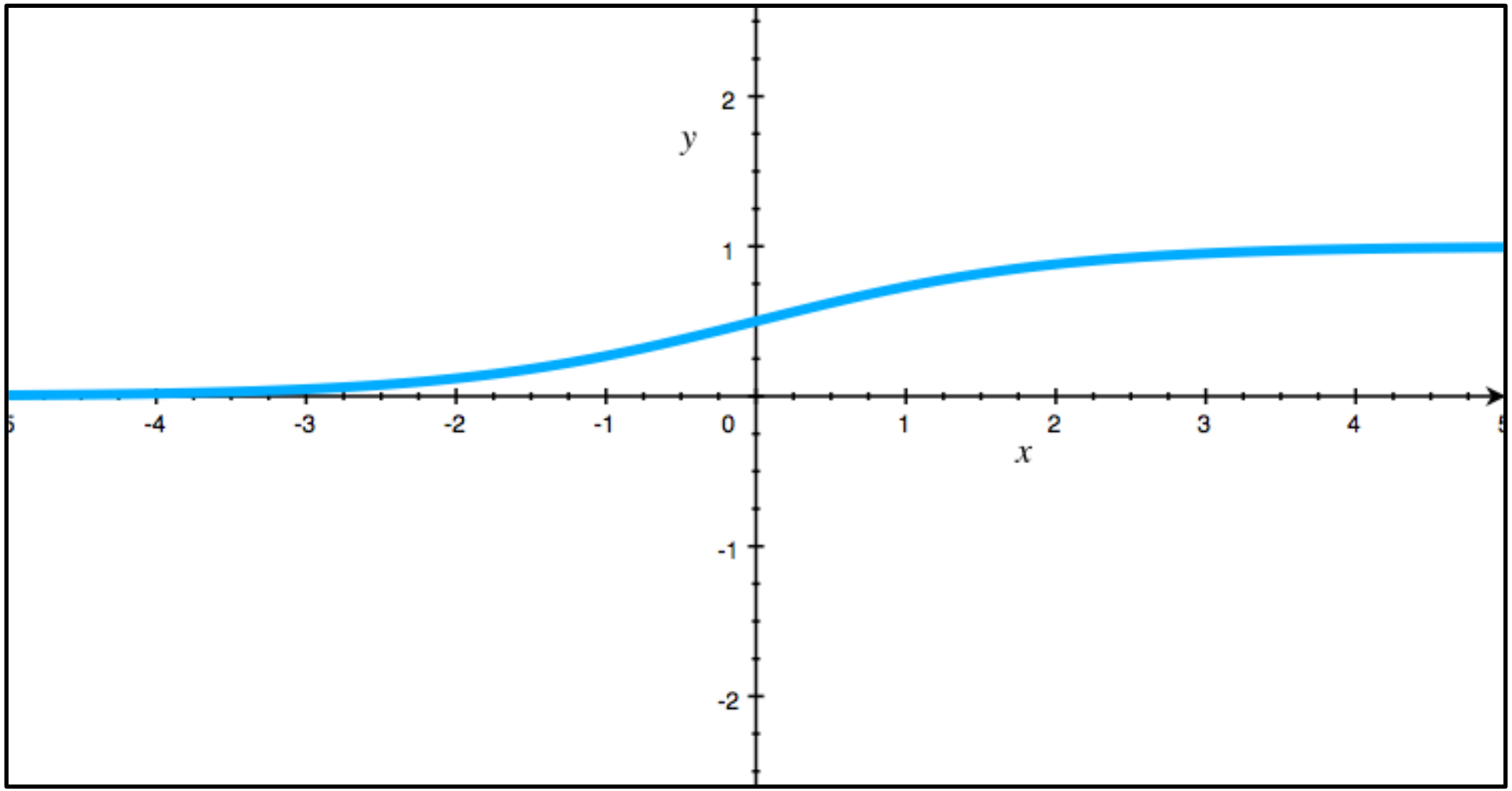


Adjusts the output of the neuron.

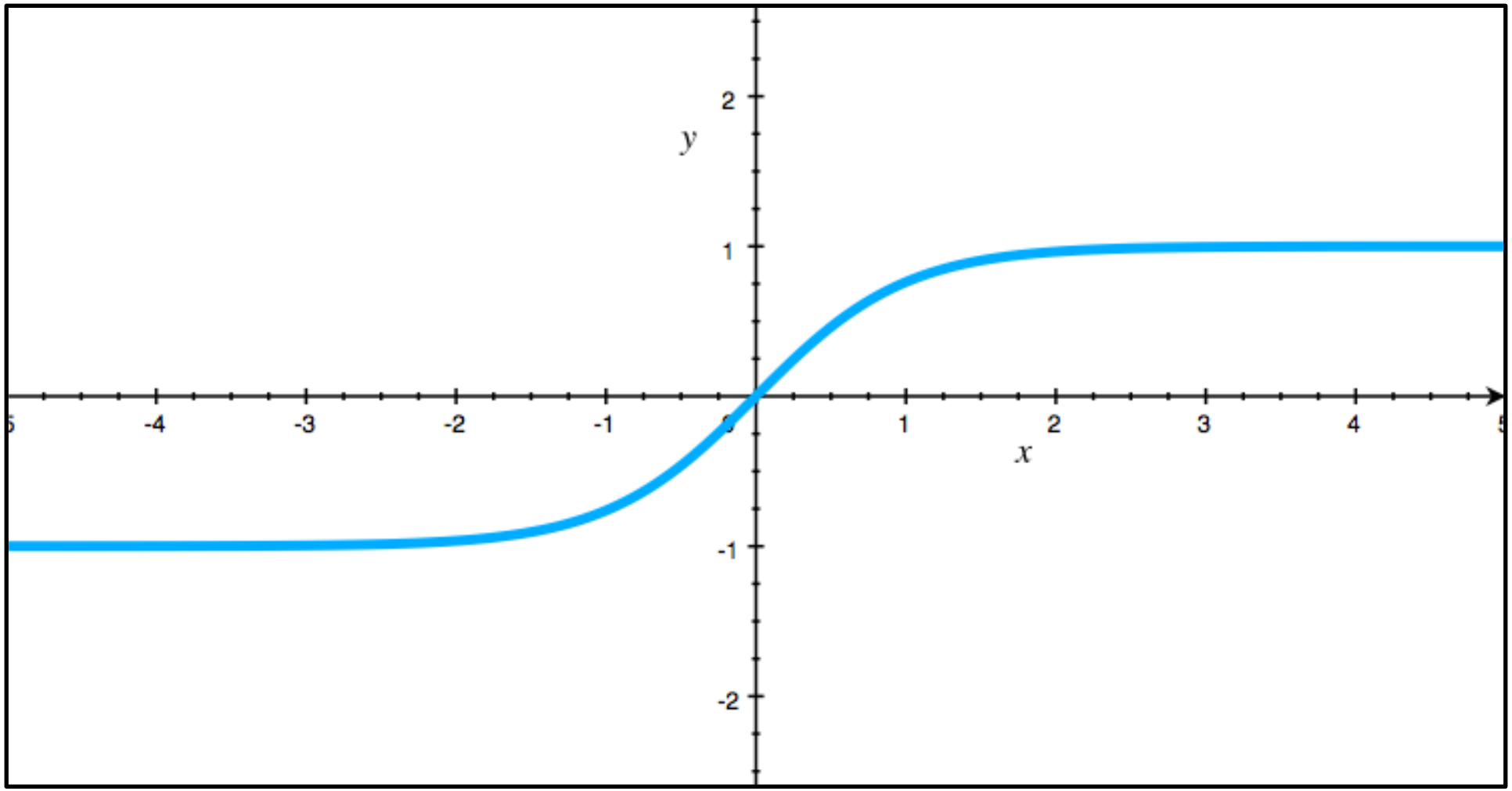
Step Function



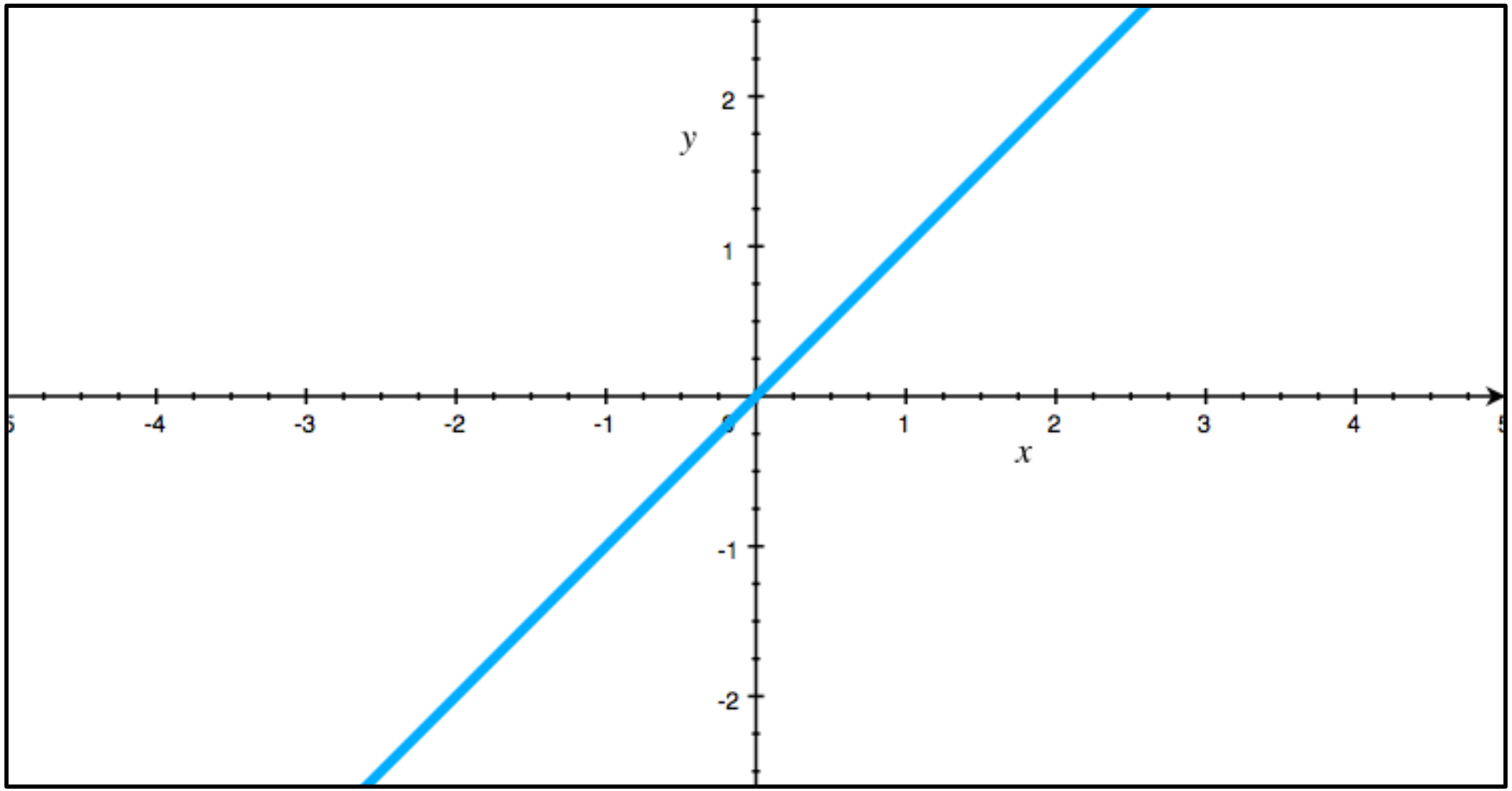
Sigmoid Function



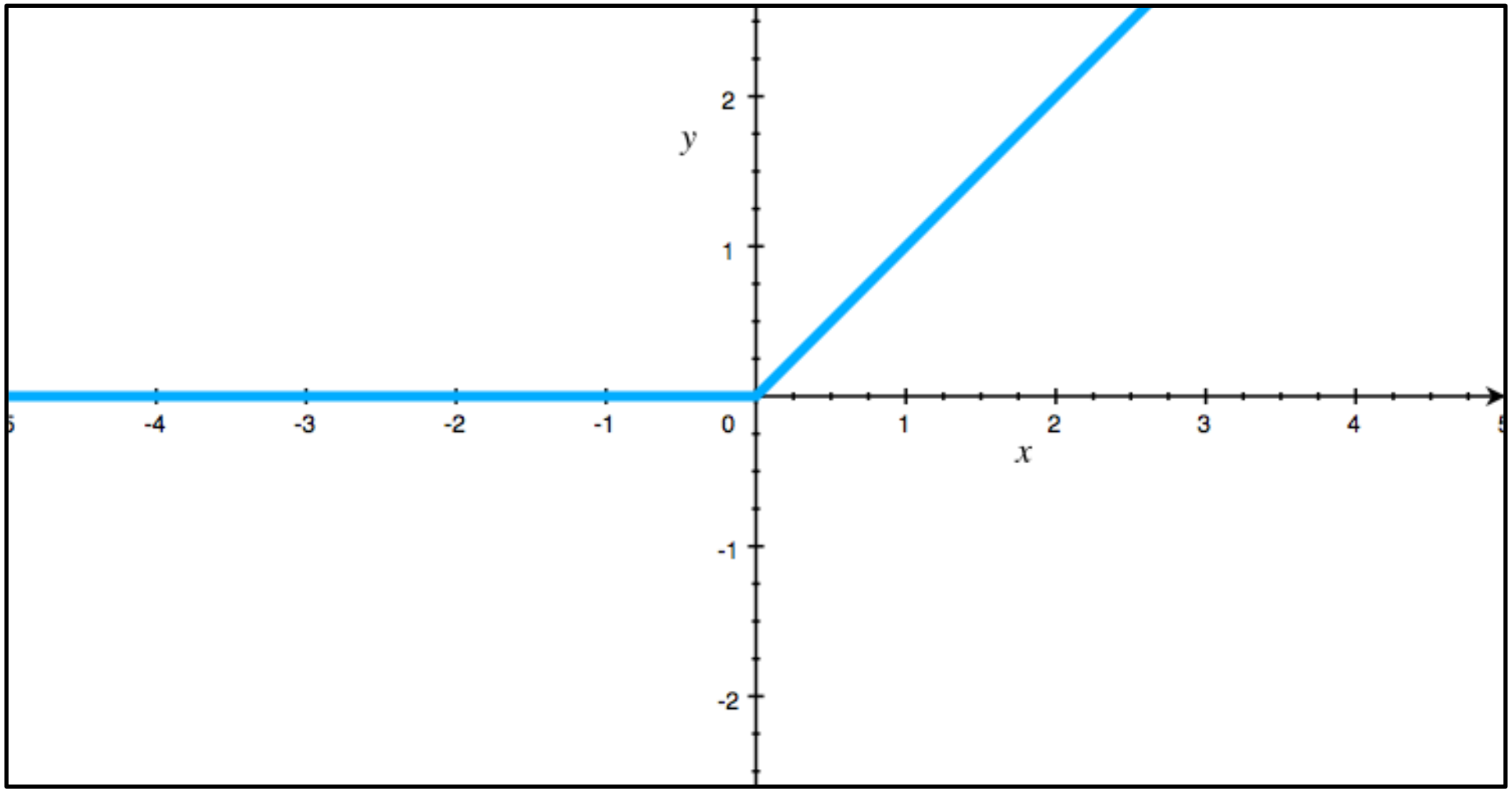
tanh Function



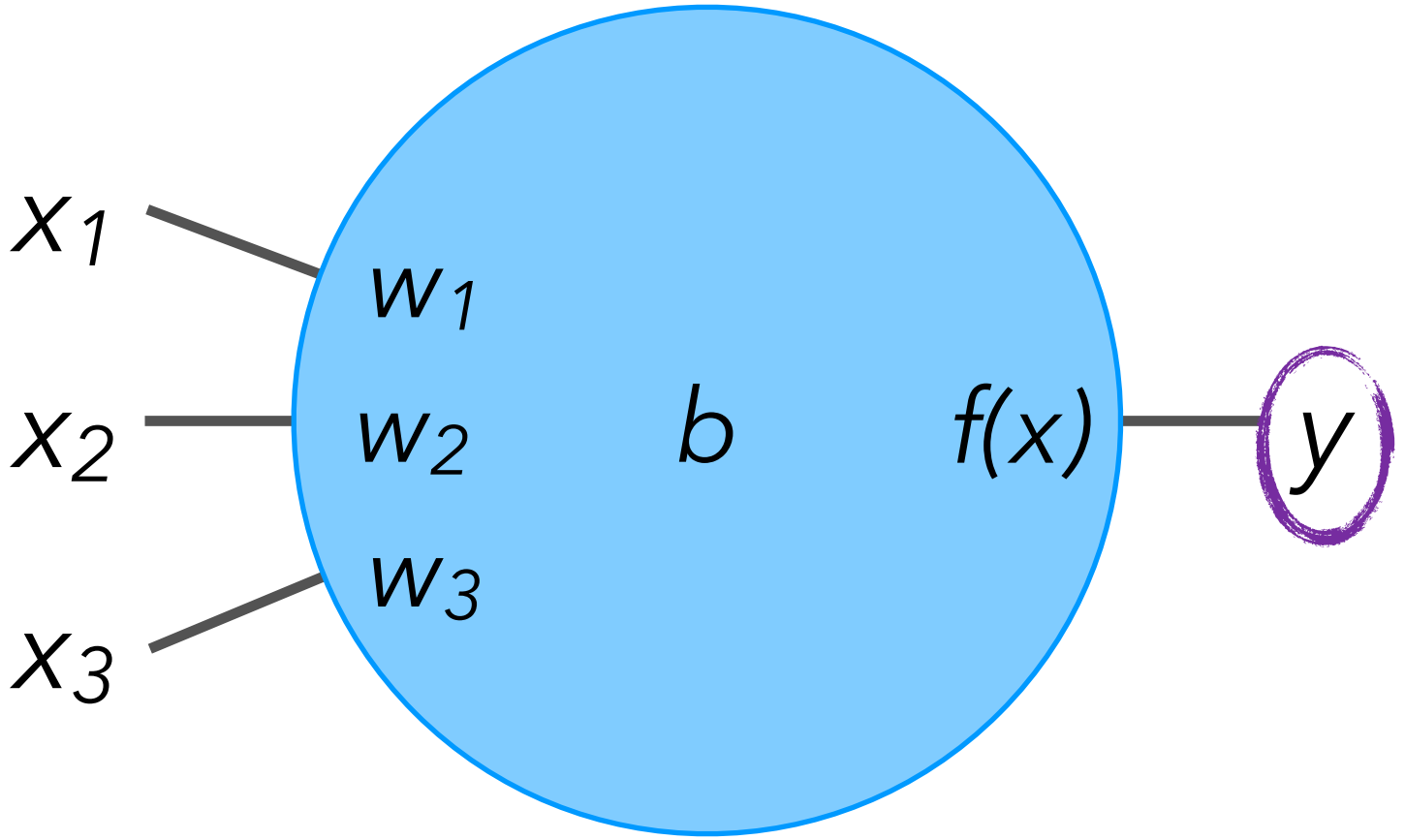
Linear Function



Rectified Linear Units (ReLU)

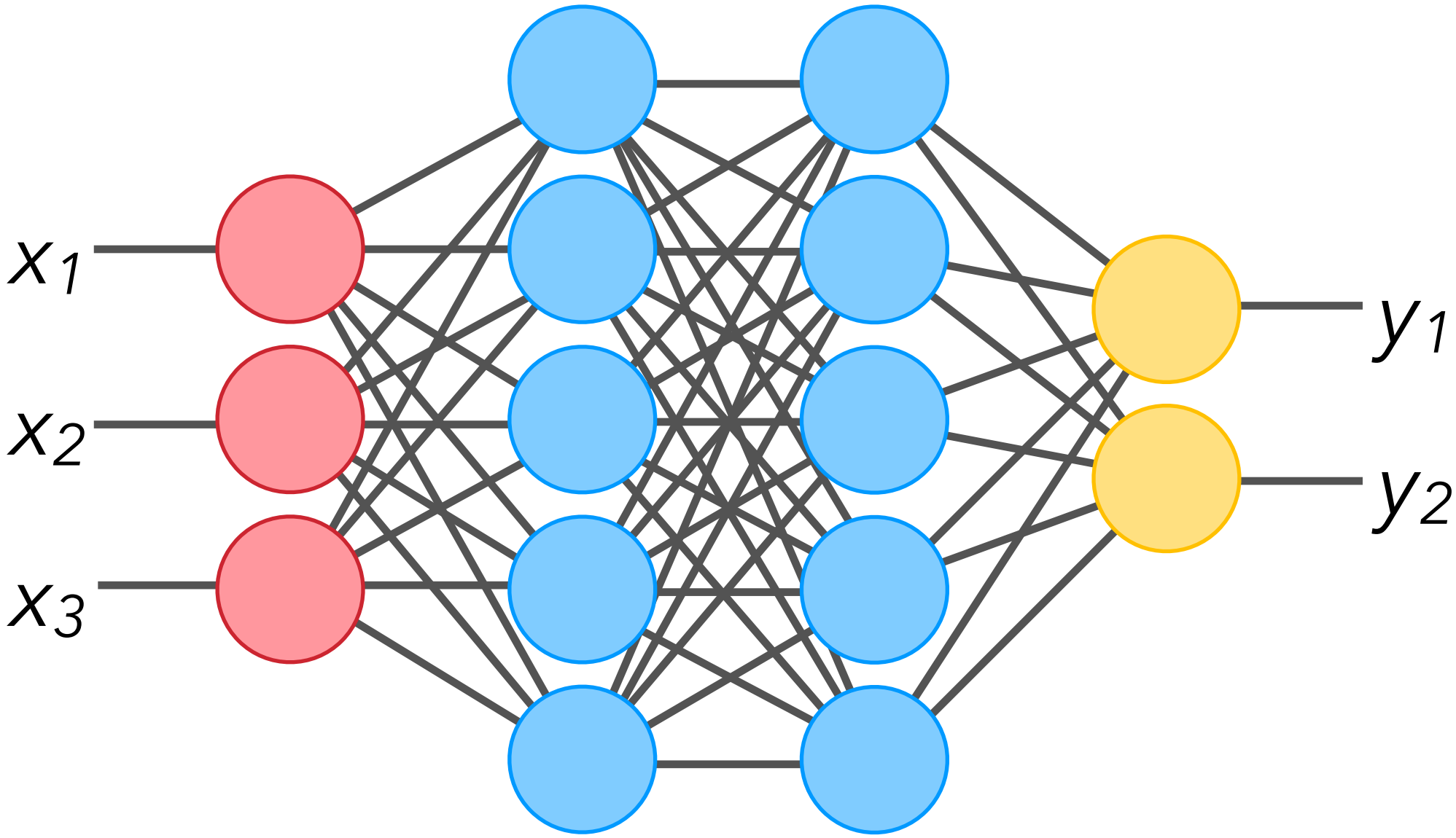


Output

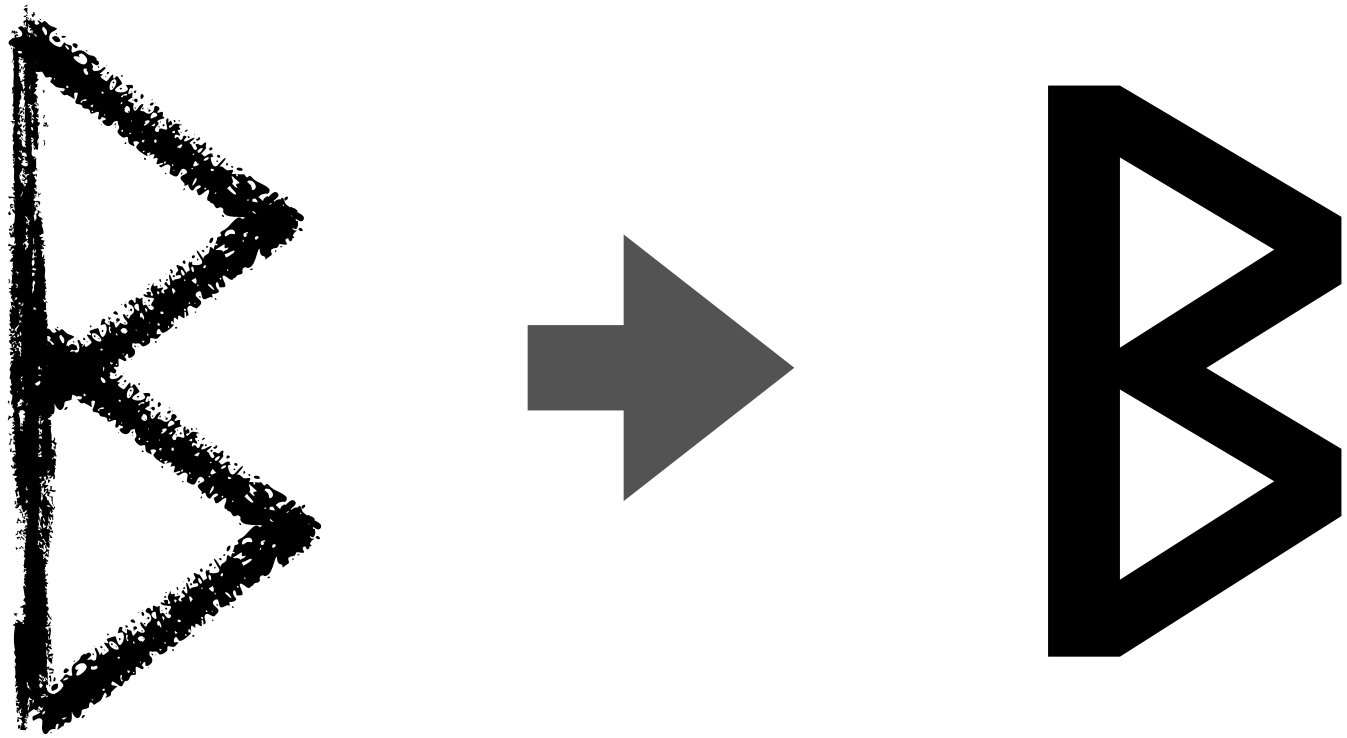


The value leaving the neuron.

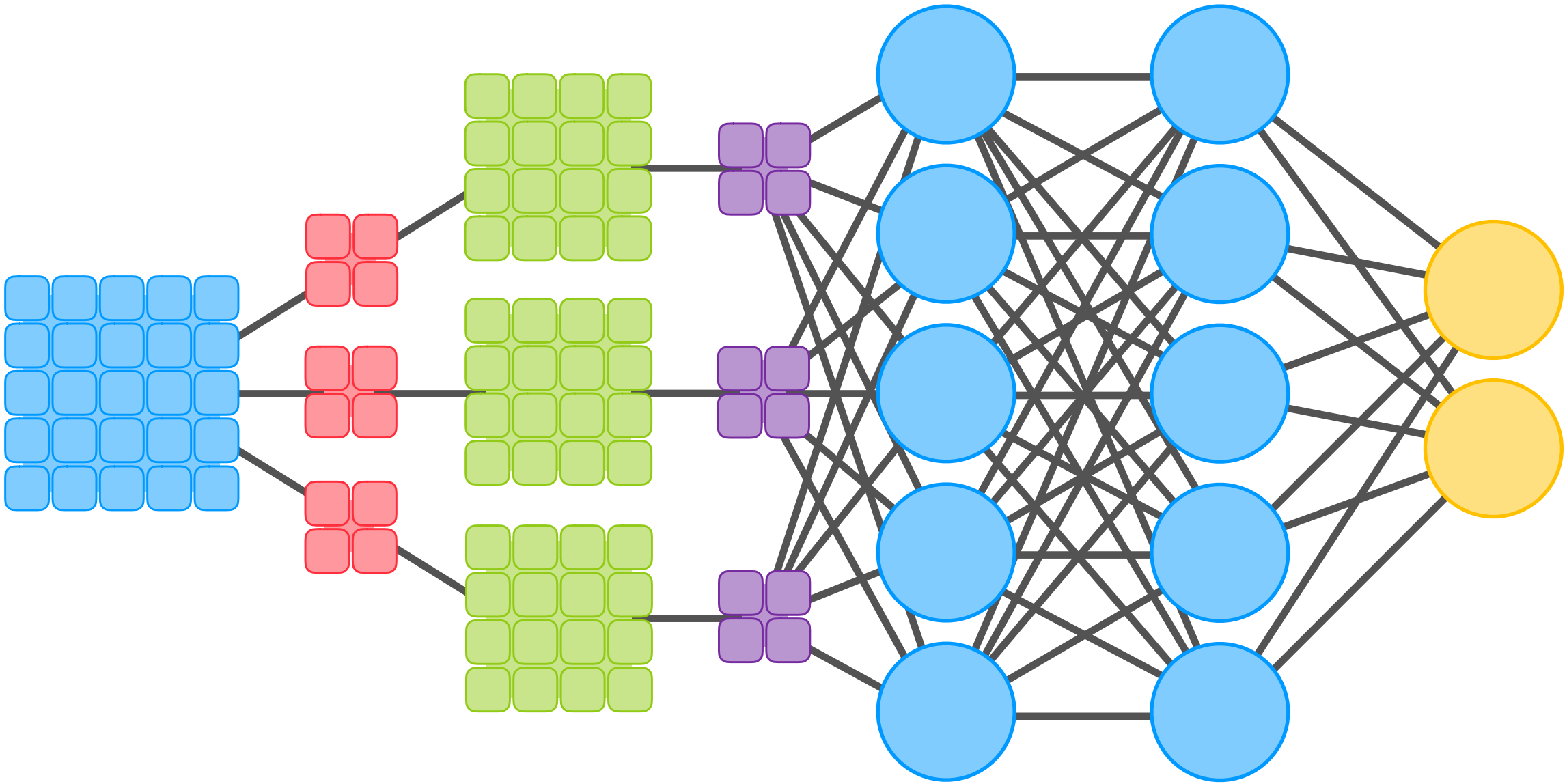
Neural Networks



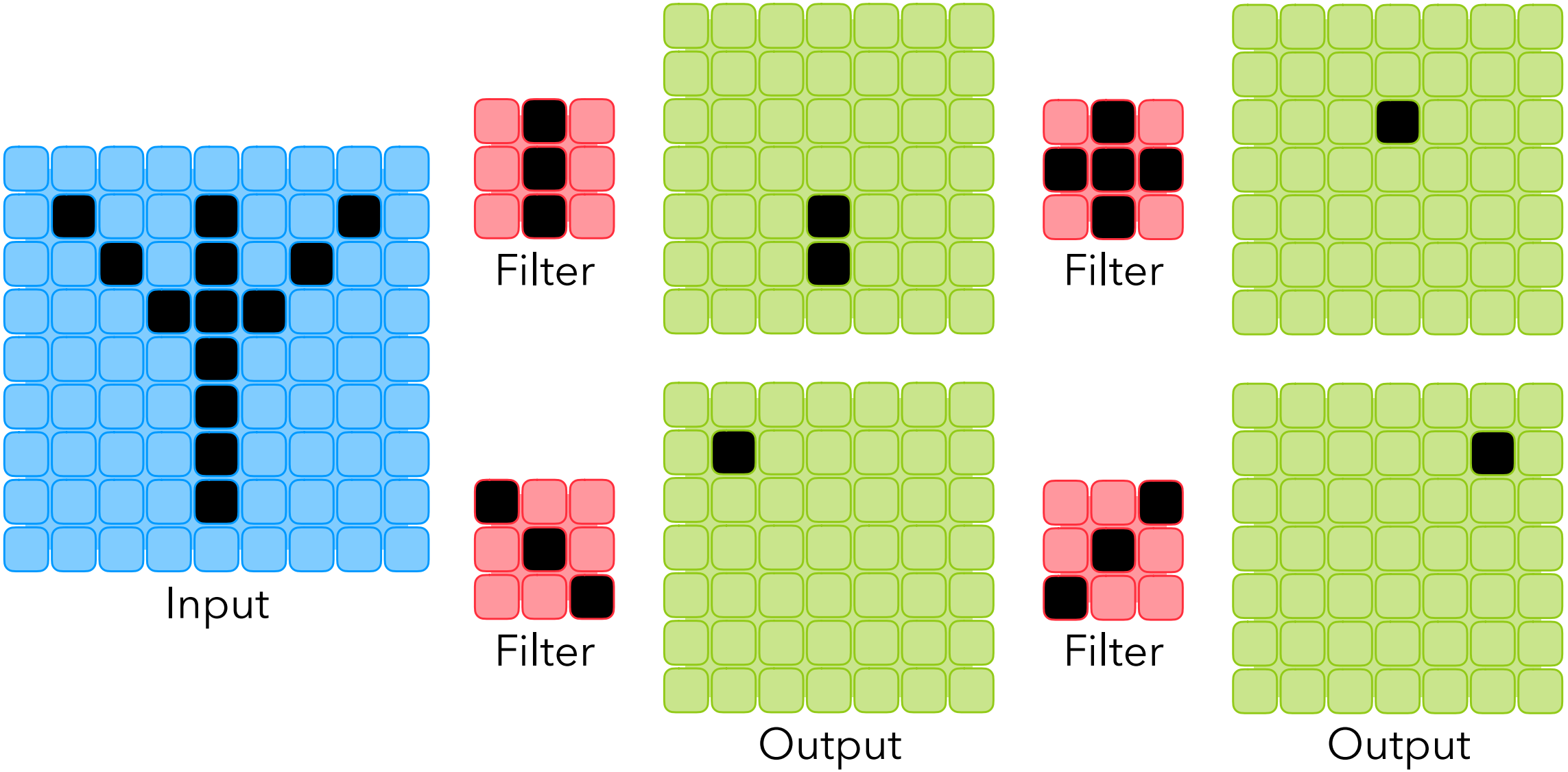
Bad at Recognizing Runes



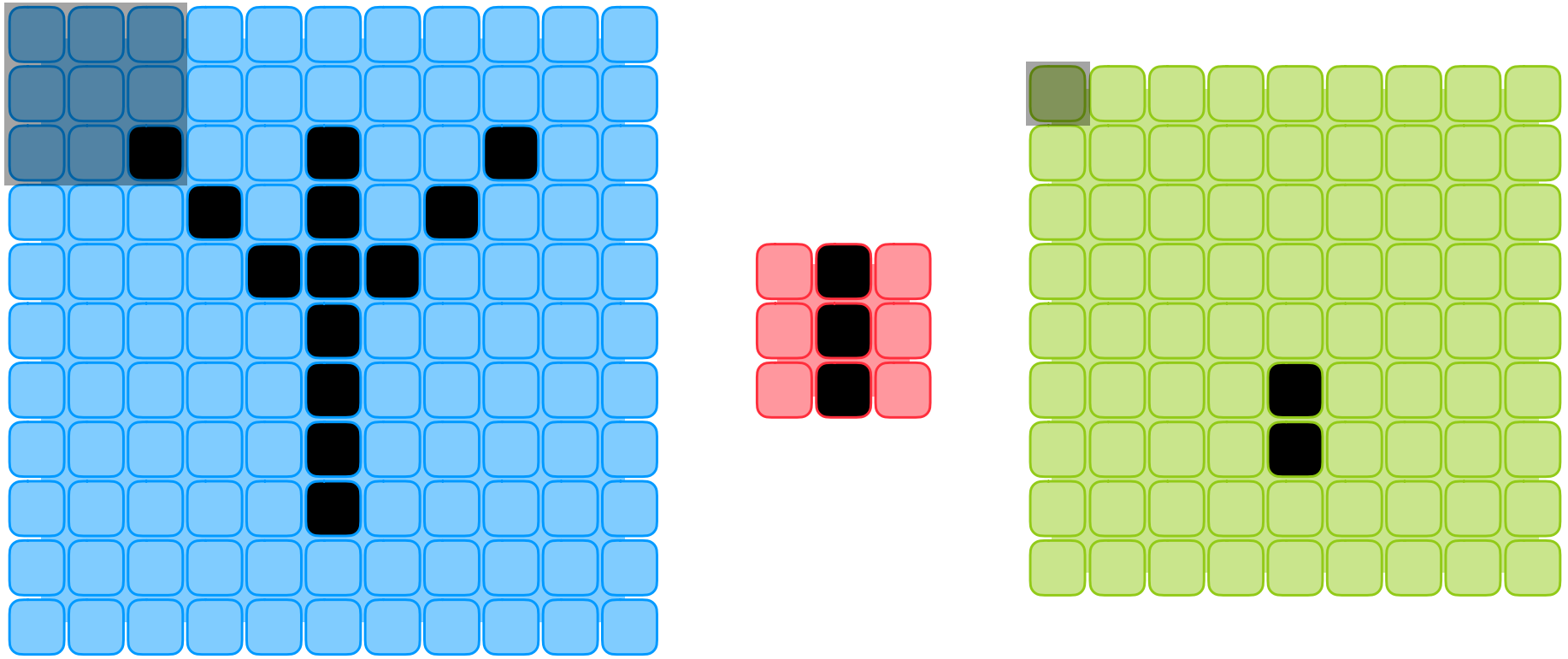
Convolutional Neural Networks



Convolutions

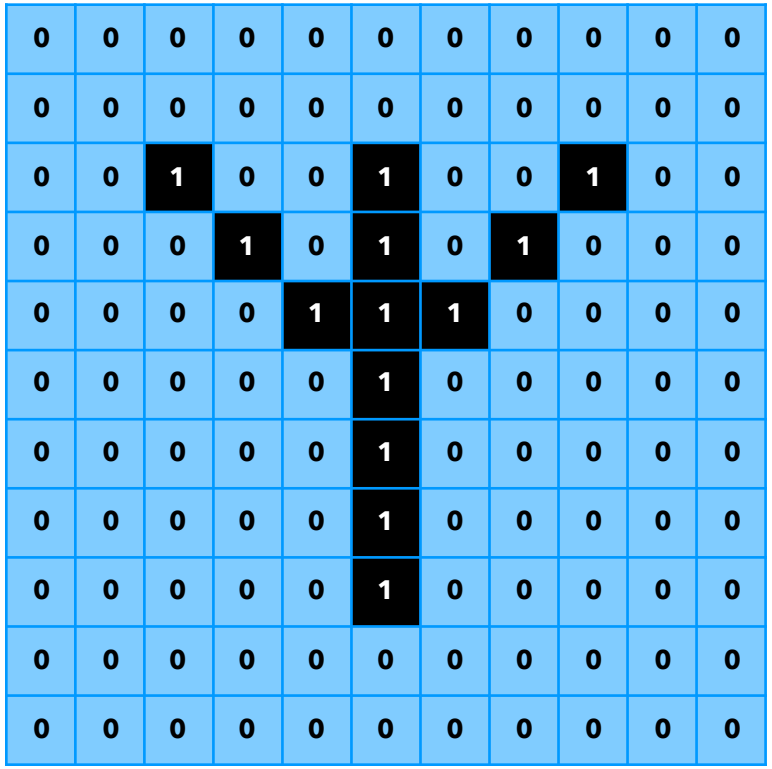


Convolutions with Fancy Animation

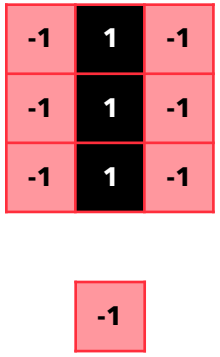


Input Filter Output

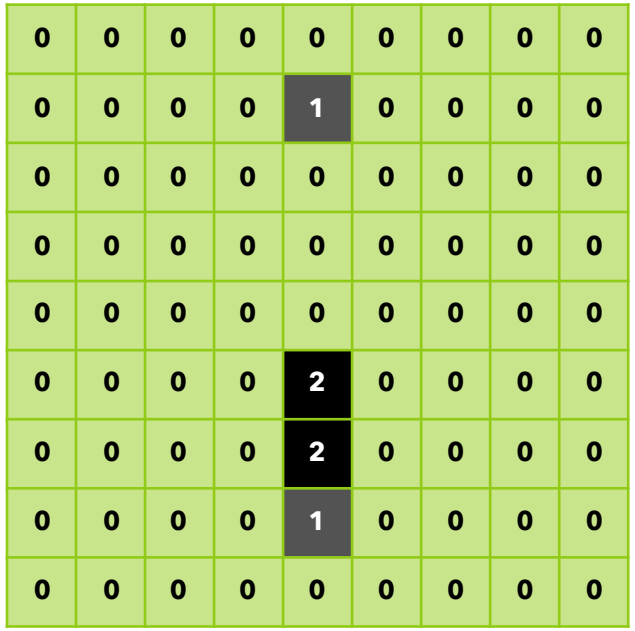
Convolutions with Numbers



Input



Filter



Output

Convolutions with Familiar Looking Numbers

x_i

0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	1	0	0	1	0	0	1	0	0
0	0	0	1	0	1	0	1	0	0	0
0	0	0	0	1	1	1	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0

w_i

-1	1	-1
-1	1	-1
-1	1	-1

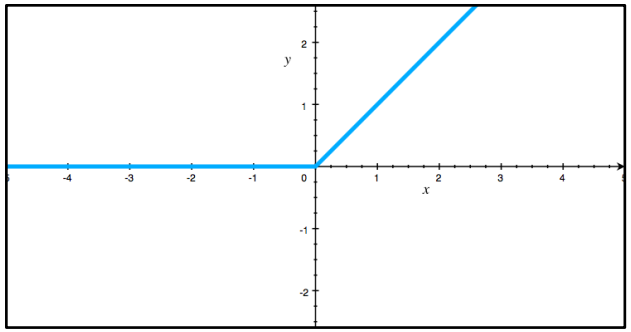
-1

b

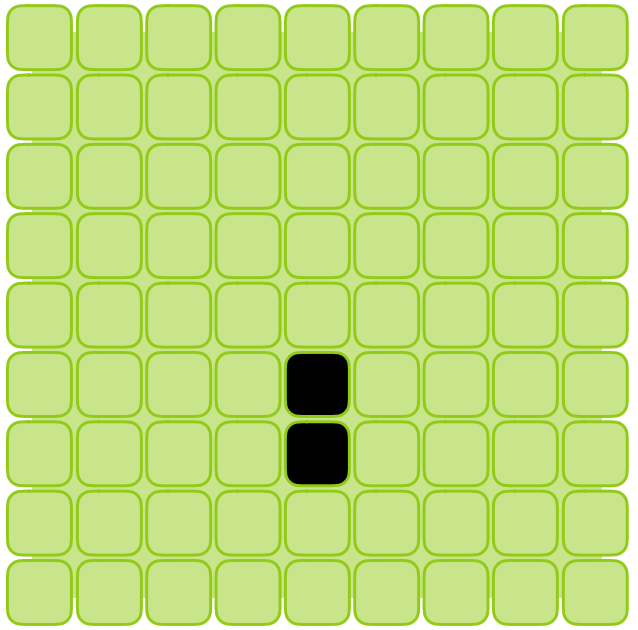
y_i

0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	2	0	0	0	0
0	0	0	0	2	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0

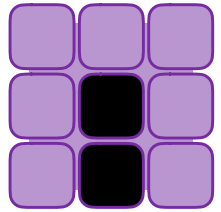
$$\Sigma_i \, x_i w_i + b$$



Pooling



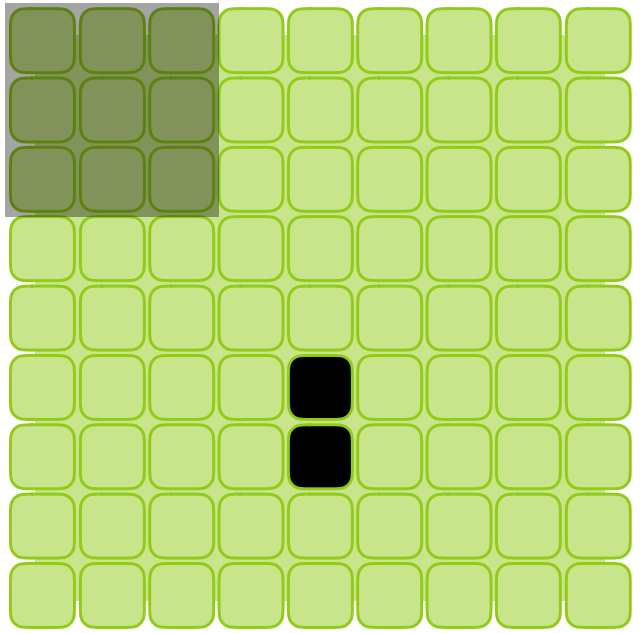
3 x 3



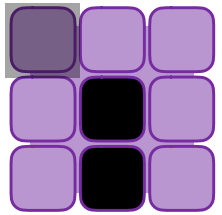
Output

Pooled

Pooling with Fancy Animation



3 x 3



Output

Pooled

Pooling with Numbers

0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	2	0	0	0	0
0	0	0	0	2	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0

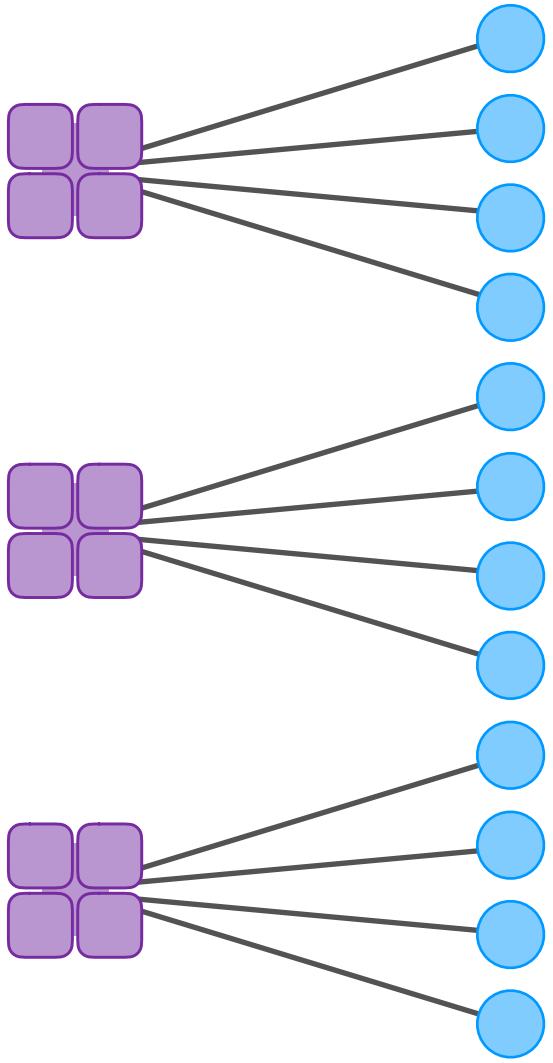
Output

3 x 3

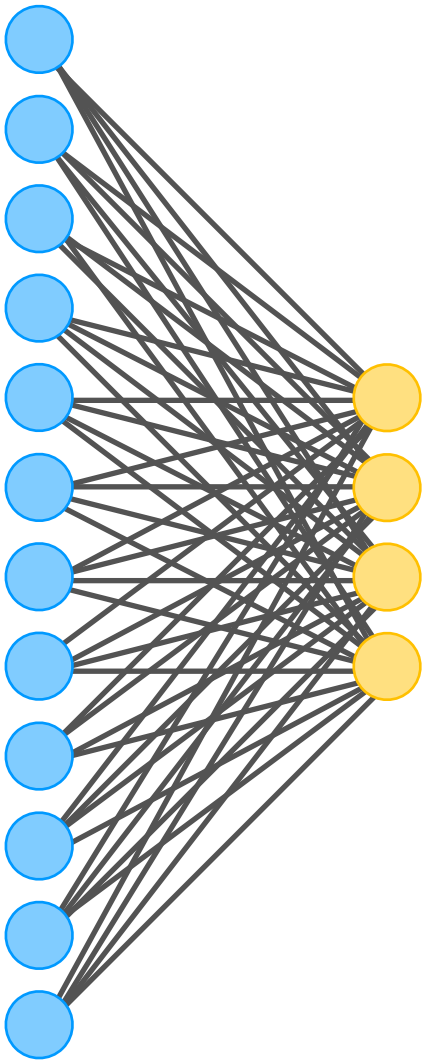
0	1	0
0	2	0
0	2	0

Pooled

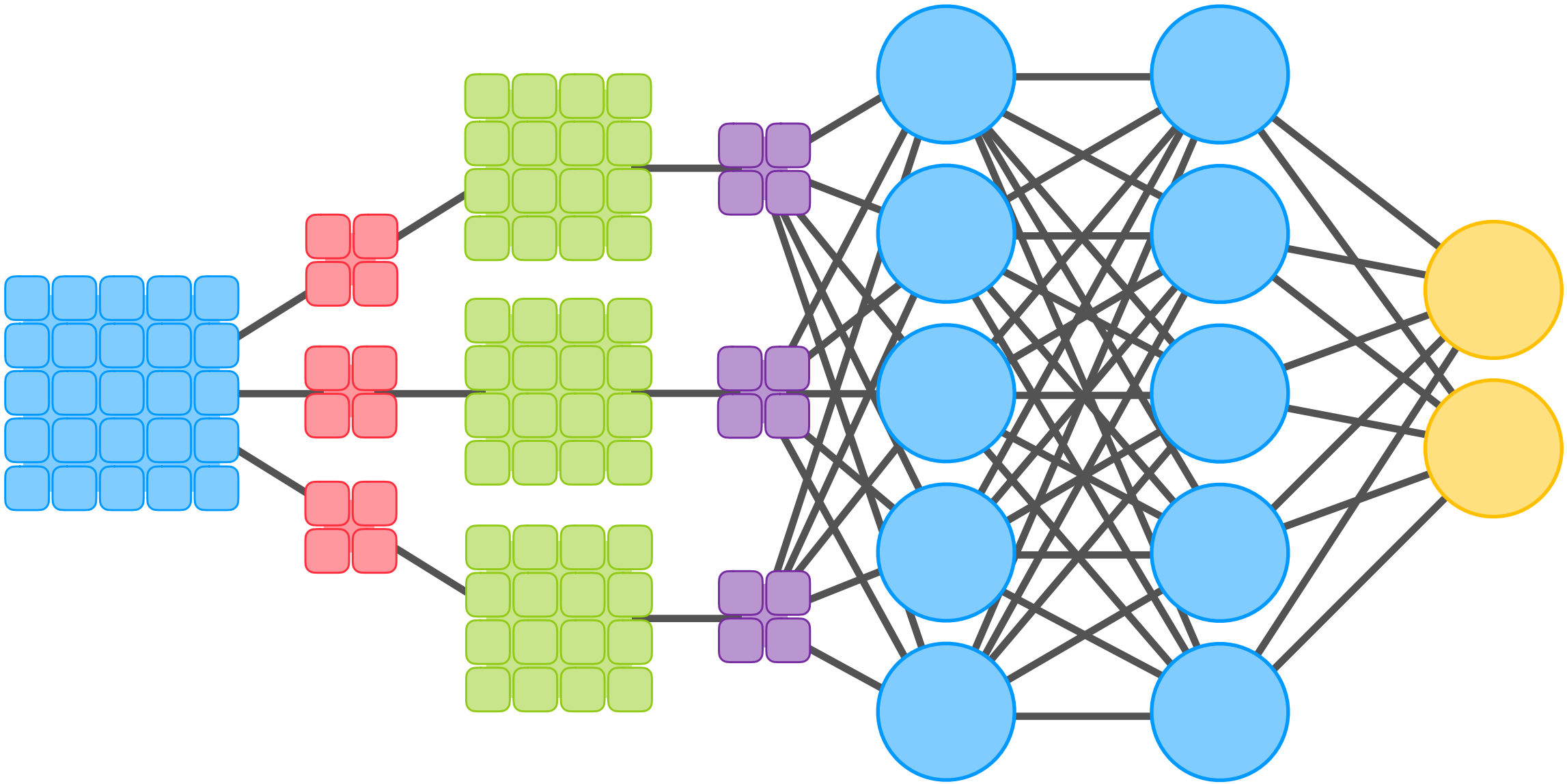
Flattening



Fully Connected



Convolutional Neural Networks



Keras

Keras

Microsoft Cognitive Toolkit

theano

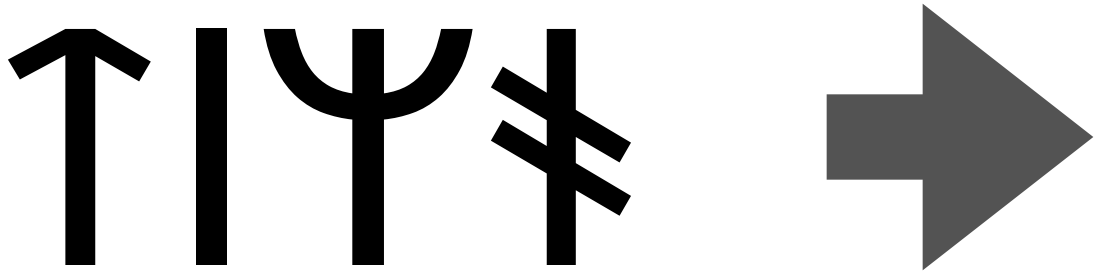
TensorFlow

```
model = Sequential()

model.add(Conv2D(48, (3,3), activation='relu', input_shape=(1,24,24)))
model.add(MaxPooling2D(pool_size=(2,2)))
model.add(Conv2D(24, (3,3), activation='relu'))
model.add(MaxPooling2D(pool_size=(2,2)))
model.add(Flatten())
model.add(Dense(128, activation='relu'))
model.add(Dense(16, activation='softmax'))

model.compile(loss='categorical_crossentropy', optimizer='adam', metrics=['accuracy'])

model.fit(X_train, Y_train, batch_size=32, epochs=20, verbose=1)
```



Demo

(Tima)

Resources

Keras

https://keras.io/

Microsoft CNTK

https://www.microsoft.com/en-us/cognitive-toolkit/

TensorFlow

https://www.tensorflow.org/

Theano

http://www.deeplearning.net/software/theano/

Flask

http://flask.pocoo.org/

VanillaJS

http://vanilla-js.com/

Younger Futhark

https://en.wikipedia.org/wiki/Younger_Futhark

Neural Network Zoo

http://www.asimovinstitute.org/neural-network-zoo/

A Beginner's Guide to to Neural Networks

https://towardsdatascience.com/a-beginners-guide-to-neural-networks-b6be0d442fa4

Hacker's Guide to Neural Networks

http://karpathy.github.io/neuralnets/

CS231n Convolutional Neural Networks for Visual Recognition

http://cs231n.github.io/convolutional-networks/

An Intuitive Guide to Convolutional Neural Networks

https://medium.freecodecamp.org/an-intuitive-guide-to-convolutional-neural-networks-260c2de0a050

https://github.com/guyroyse/deep-learning-like-a-viking

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