



# Classification

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# Image classification

Fashion MNIST dataset

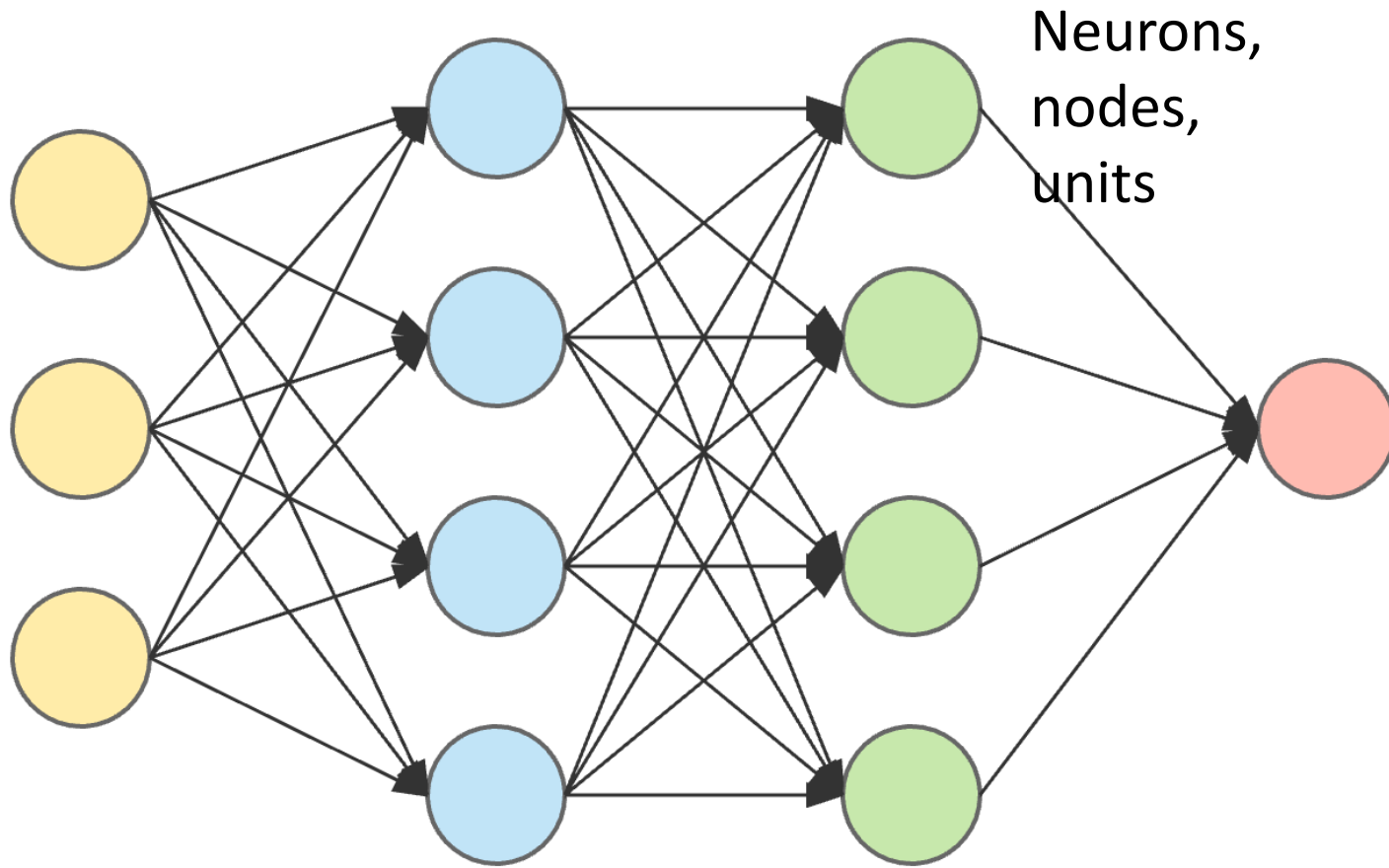


The background of the image is a dark blue field filled with a complex network of glowing blue lines and nodes, resembling a neural network or a star map. Several bright orange-yellow light flares are scattered throughout the scene, adding a sense of depth and energy. The overall aesthetic is futuristic and technological.

# Artificial Neural Networks (ANN)

# Deep learning

Fully connected ANN

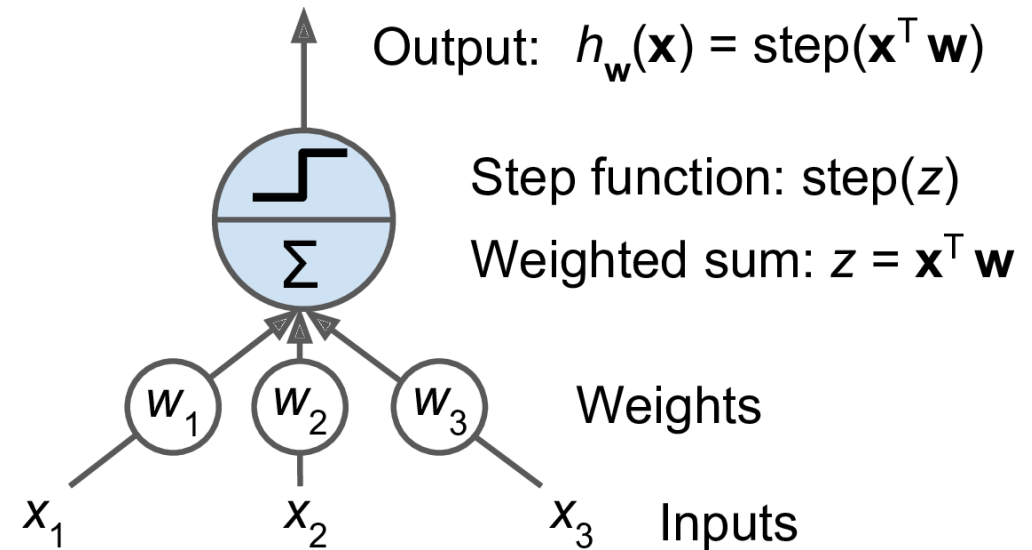


input layer

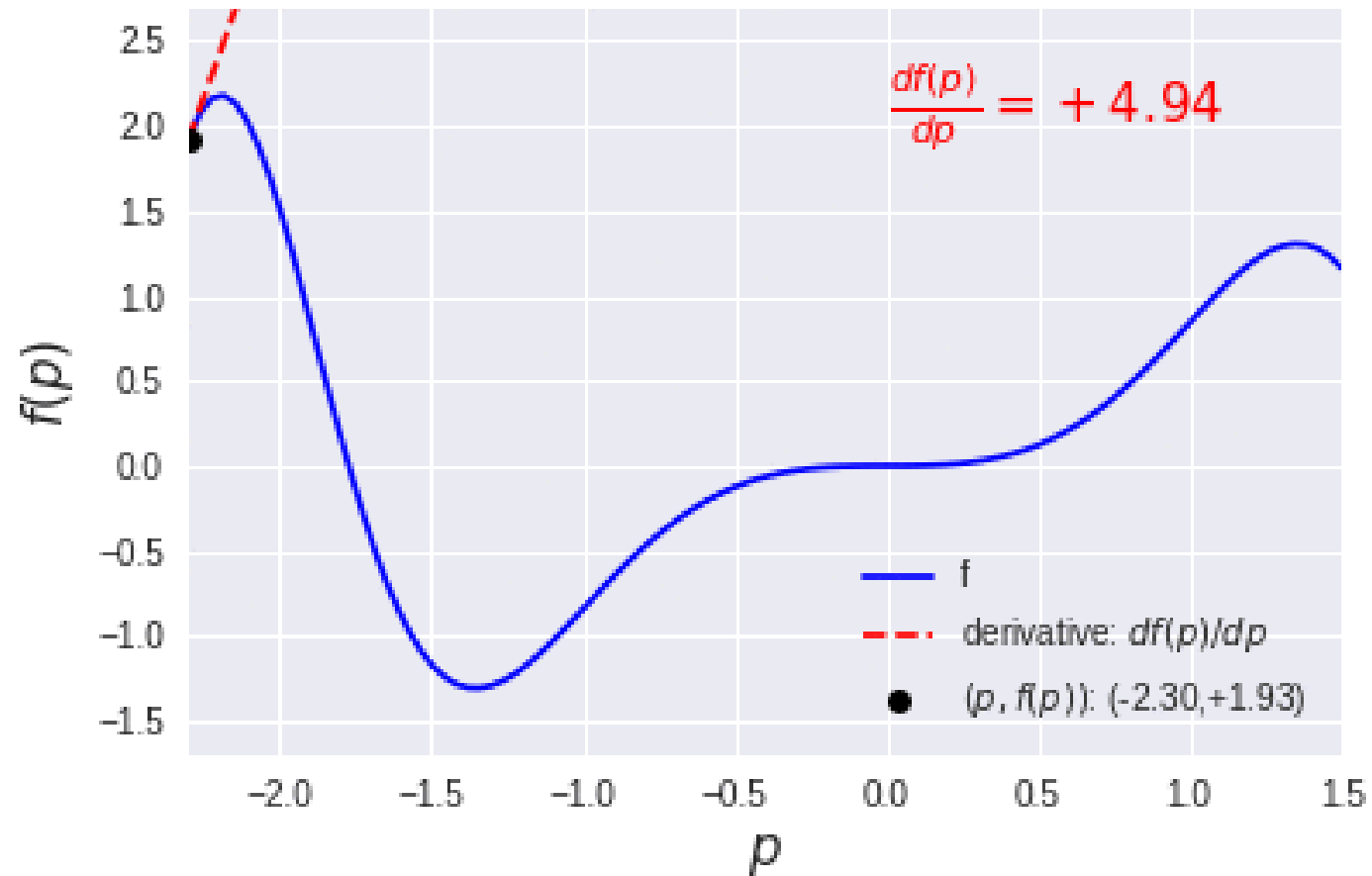
hidden layer 1

hidden layer 2

output layer

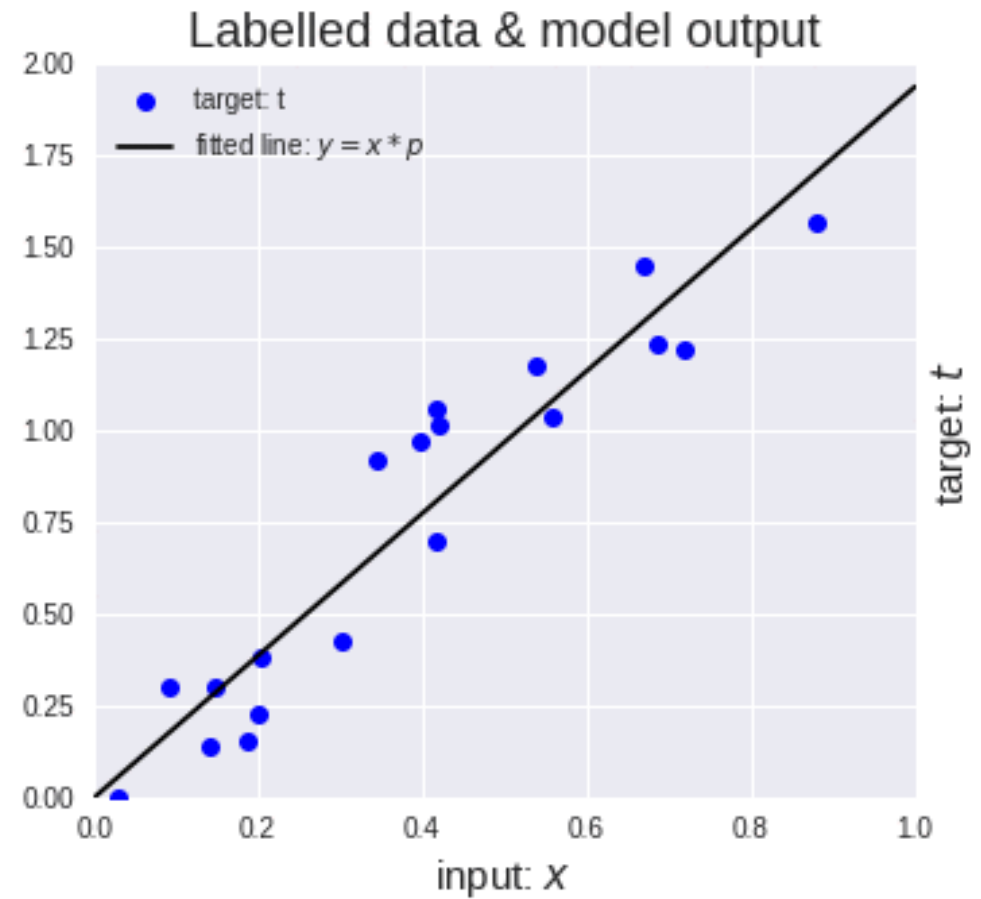
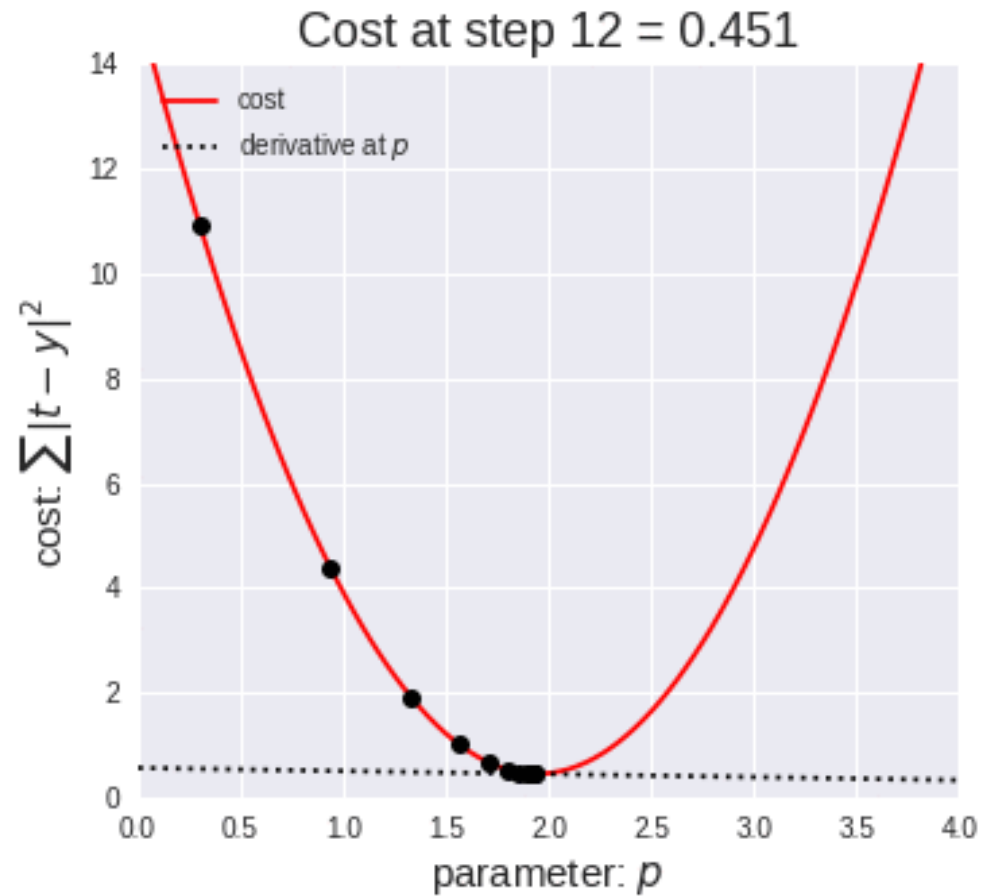


## Derivative over function $f$





Cost = Loss = Error =  $\varepsilon$



# Accuracy

- % of correctly classified

# Homework assignment

- `(x_train, y_train), (x_test, y_test) = tf.keras.datasets.mnist.load_data()`







Epoch  
000,000

Learning rate  
0.03

Activation  
Tanh

Regularization  
None

Regularization rate  
0

Problem type  
Classification

## DATA

Which dataset do you want to use?



Ratio of training to test data: 50%

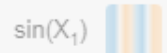
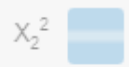
Noise: 0

Batch size: 10

REGENERATE

## FEATURES

Which properties do you want to feed in?



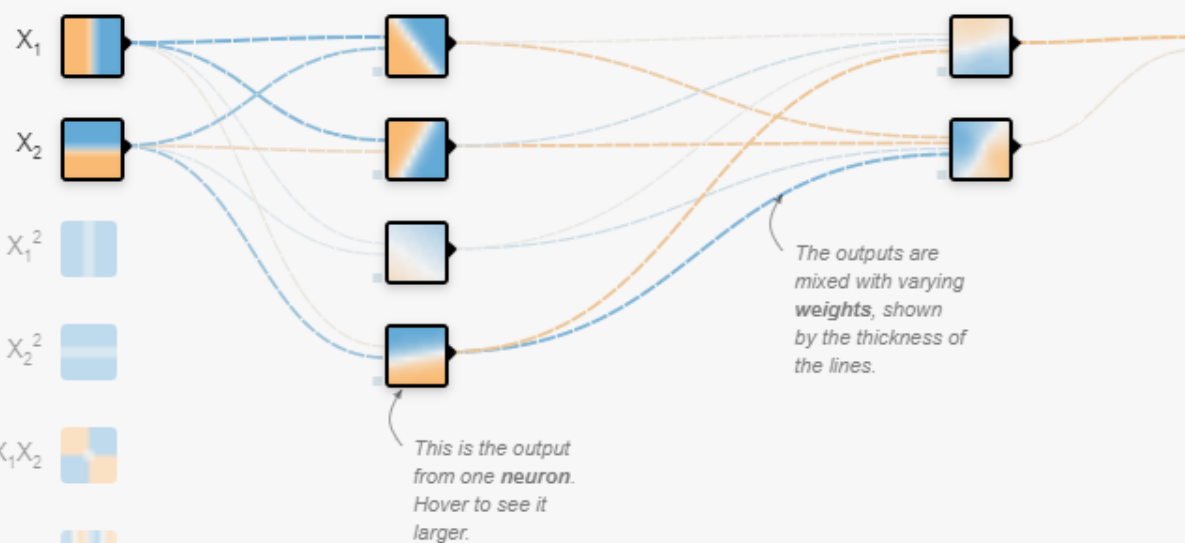
+ - 2 HIDDEN LAYERS

+ -

4 neurons

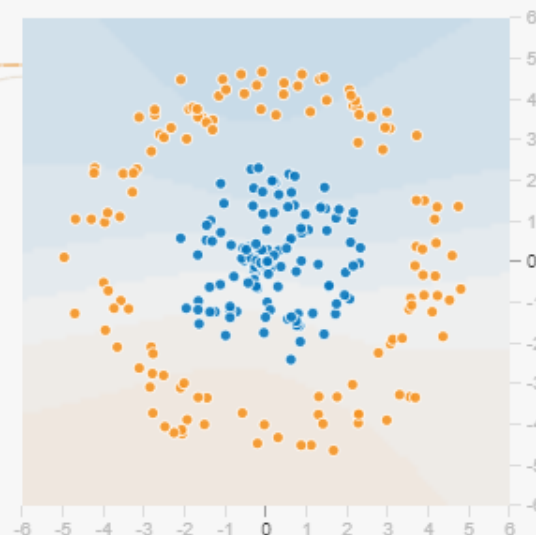
+ -

2 neurons



## OUTPUT

Test loss 0.512  
Training loss 0.513



Colors shows data, neuron and weight values.

☐ Show test data ☐ Discretize output

# Going further in computer vision

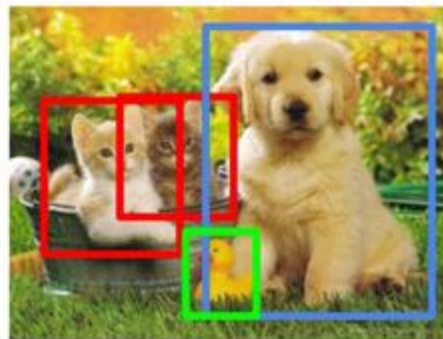
Classification  
Classification + Localization    Object detection



CAT



CAT



CAT, DOG, DUCK

Instance  
Segmentation

Color segmentation



DOG, DOG, CAT



DOG, DOG, CAT