**Neural Network**

Tutorial make a neural network yourself.

Deep learning – lots of layers of neurons.

Small arrow above x or y is vector.

Big sigma represents the sum.

**Neural network**

Is inspired by how our brain works. Neurons are changing potential difference over time.

Neural in brains fire. You can measure the spikes. In neural network this is represented by a single value. That’s the only difference.

**Math**

You start with inputs, then you have weights. You add everything up, if a certain threshold is reached, neurons start to fire (activation).

Sigmoid activation function is between 0 and 1. Sigmoid fuction is smooth (the curves).

ReLU

ReLu are more commonly used. Not smooth curve.

All neurons of first layer are connected to next layer. Only the weights can all be different.

Number of neurons on input layers will be equil to the neurons ..?

Number of hidden layers, you have to try it out to know what works best.

There is no solution for it.

Neural network is trained by supervised learning training set.

Cost function:

Cost function needs to be minimized. Cost function is the Mean Squared Error.

**Gradient descent**

For each step, take a step into the direction that goes down. You take one step at a time where the slope goes down the most. Too big steps, you’ll step over the minimum. Too small steps, takes too much time.

You want to find the minimum of the cost function. Local minimum could be the case. You can only get out If you go back up. You want to avoid that.

How to change those values?

Try compute the slope in different directions. Partial derivatives. Slope in x and y direction.

Find partial derivative in each way to find the smallest. Then you can take the next step.

Do not try to change the weights too much. Do not compute these difference for every single iitem in your dataset.

**Learning rate**

You set the learning rate before you hyperparameter.

Train the learning rate along the way. In the beginning you take larger steps, in the end you take smaller steps. (decays over time)

You want to go in the same direction. You’ll reach somewhere in the middle, not in the slope.