

1. API (NeuralNetwork)

It's in `NeuralNetwork.py`. In which you can find 5 methods, `__init__()`, `getLayer()`, `backward()`, `updateParams` and `forward()`.

In `__init__()`, the weights between different layers are initialized using `torch.distributions.normal()`, and the mean is 0, with standard deviation $1/\sqrt{\text{layer_size}}$. The input size is $2 \times n$, and output size is $1 \times n$.

`forward()` method accepts input values, and after a series calculations, output a single predict value.

`backward()` method accepts target value as input, and calculate the error between its output and the target. Then through backpropagation, the error is transferred backward, and the value how error gets affected by weights $dE_d\theta$ is calculated.

`updateParams()` method updates the weights between 2 adjacent layers of the network using the output of `backward()` method. It accepts eta as input to decide how aggressive the weights would be changed.

`getLayer()` gets the index of weight matrix as input and output the weight matrix.

2. API(logicGates)

It's in `logicGates.py`. There are four classes `AND`, `OR`, `NOT`, and `XOR`. Each of them has 2 public methods, `forward()` and `train()`.

`forward()` method decides the format of input. It only accepts 2 Booleans as input. It also converts Boolean to 1 or 0.

`Train()` method internally sets maximum iterations and loop `forward()`, `backward()` and `updateParams()` methods to train the network. So that desired outputs can be obtained.

3. Testing

The `test.py` contains testing code. The input values are ordered as 'True, True', 'True, False', 'False, True', 'False, False'.

4. Weights Comparison with manual values of homework 2

AND: 2 input neurons, 1 output neuron, no hidden neurons.

Train: One set of weights are [-6.5118, 4.3195, 4.3028]

Manual weights: [-3, 2, 2]

Or: 2 input neurons, 1 output neuron, no hidden neurons.

One set of weights are [-2.2661, 5.0383, 5.0126]

Manual weights: [-1, 2, 2]

Not: 2 input neurons, 1 output neuron, no hidden neurons.

One set of weights are [2.9673, -6.1551]

Manual weights: [1, -2]

Xor: 2 input neurons, 2 hidden neurons, 1 output neuron.

One set of weights are [2.6270, -6.5317, -6.5296; -8.6430, 5.5837, 5.5806] and [5.6108, -11.3671, -11.4133]

Manual weights: [-10, 20, 20; 30, -20, -20] and [-30, 20, 20]