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Direct and Inverse Distribution of Neural Networks.

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ABSTRACT

The most common training method of neural networks is to successively propagate the observation vectors and determine the weight coefficients in such a way that the output values are as close as possible to the required data. This is called tutoring.

Because for each vector observation we have the desired result. And we, accordingly, require the result from the network to be exactly close to the desired value.

It is possible to create an algorithm that finds the weighting coefficients in the best way (maximum speed, maximum value close to the required result).

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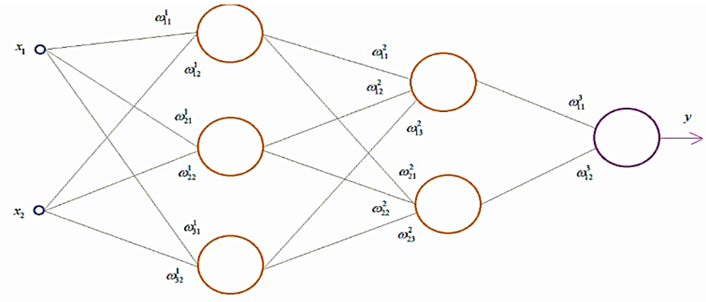
In forward distribution, the information passes through the network in one direction, which means that each neuron uses the input from the previous neuron to obtain the results. In this method, the data is read from the beginning of the network and the results reach the end of the network. For example, a direct network used for classification problems has an input layer, hidden layers, and an output layer. Each neuron depends on its previous wallets and updates chapters during training.

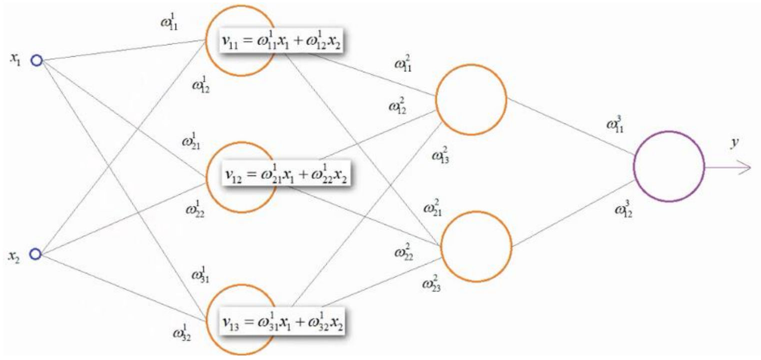
To understand a neural network, let's imagine that we have a neural network with a regular distribution of the following form:



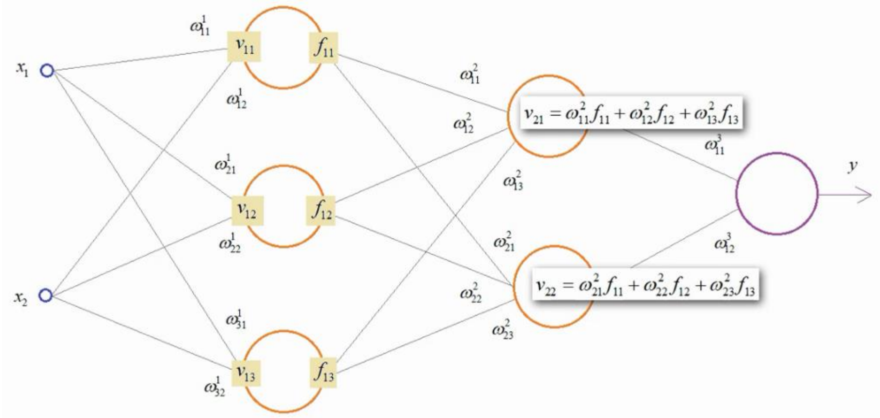
Has link weights: $\left[\omega_{11}^{1},\omega_{12}^{1},...,\omega_{21}^{2},\omega_{22}^{2},...,\omega_{11}^{3},\omega_{12}^{3}\right]\in\left[-0.5;0,5\right]$ We imagine that they are chosen arbitrarily in the interval -0.5 to 0.5.

Their superscripts indicate $\omega_{11}^{(1)}, \omega_{11}^{(2)}, \omega_{11}^{(3)}$ which layer each link belongs to.

In order to train this neural network, we have its structure, the initial weights of the connections. Furthermore, we assume that there is an observation declared at the input to the neural network, and each observation contains a desired output.



Each neuron outputs a specific value. Now we remember the output value (f11, f12, f13, f14...) for each neuron of our network.

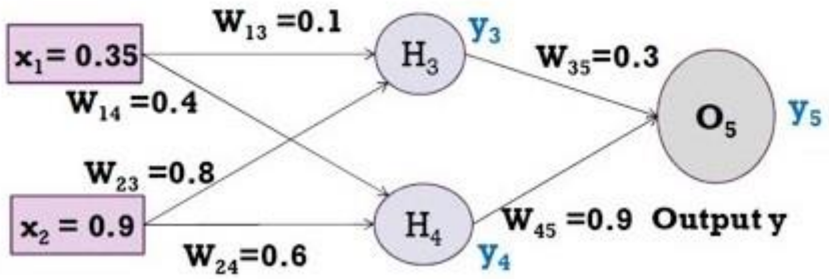


Now, knowing the value of the output d for the input vector x1 and x2, we can calculate the error made by this neural network:

$$e = y - d$$

We calculate this error by subtracting any value d from the network output - y.

Recurrent Neural Networks (RNNs) support variable information and allow one neuron to update itself by passing its information to subsequent processes. This network type is ideal for sequence data. For example, it is used to explain the connections between words, to translate, and to solve other problems related to sequence.



In our example below, we will consider the inverse distribution of neural networks.

In the given image, x1 and x2 are given as input data, and w-weights are also given, respectively. We use the following formula to define H3, H4 as hidden layers and to satisfy the values of y3 and y4.

$$a_j = \sum_j (w_{i,j} * x_i) \qquad yj = F(aj) = \frac{1}{1 + e^{-a_j}}$$

$a_1 = (W_{13} * x_1) + (W_{23} * x_2) = (0.1*0.35)+(0.8*0.9) = 0.75$

so the result of a1 was equal to 0.75. Taking the result, we can also calculate the result of y_3.

$y_3 = f(a1) = 1/(1+e^{-0.75}) = 0.68$

thus we can find y4 and y5 as well.

Subtract $y_{target}-y_5$ to find the minimum error. We take $y_{targe}=0.5$ in our example.

If we are not satisfied with the obtained result, we start the inverse distribution of neural networks by assigning new weights to w to find δ to reduce the minimum error.

We use the following formula:

$$\delta_j = o_j(1-o_j)(t_j - o_j)$$
$$\delta_j = o_j(1-o_j)\sum_k \delta_k w_{kj}$$

According to this formula, we get the result δ5= y5 (1- y5)(y target-y5).

We can also extract the results δ3= y3 (1- y3)(W35-y3), δ4= y4 (1- y4)(W45-y4).

Now the main problem for us is to find new weights for W.

$W_{ji} = \acute{\eta}\delta_i o_i$;

To determine the new W(nev), we find the old weight W(front) by subtracting the Wji found above. . $W_{(nev)} = W_{ji} - W_{(old)}$

After these operations, we have new weights W(nev). All we have to do is calculate the entries x1 and x2 in the new W(nev).

We can consider the output result by finding the minimum error above. You can continue this process until you get a texture that you are satisfied with.

It performs well for solving problems related to direct networks, such as image annotation, editing, classification, and other learning tasks. Inverse networks, on the other hand, are efficient for sequence information, such as explaining sequence lines, identifying associations between words, translation, and other reading tasks.

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