

# Deep Learning Lab

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## 1 Convolutional Neural Networks

Convolutional Neural Networks are mostly applied to the image classifications, image processing. Convolutional Neural Network has some different steps if we compare between the Neural Networks.

Firstly, assume that we have an input image and filter (kernel). Generally, the input image's pixels are between 0 and 255. Also filter pixel's has scalar values too. Filter scans the input image and he calculates the feature map. After creating the feature map, we will continue other steps using this feature map. This process is applied in convolutional layer. Network can has more than one convolutional layers.

Other layer is max pooling layer. In this layer network has also a filter for max pooling using this filter the feature map shrinks and as a result of this feature map will be easy to handle. As an advantage of this layer is, when we try to find some specific thing in the image, we should not check the position of this thing. So, our filter will find it if it is right side of the image or left side of the image. As convolutional layer, network can has more than one max pooling layers.

At the end of the network fully connected layer is discovered. In this layer, the all feature maps connected and using activation function as softmax, the network can classify easily.

## 2 Dropout and Overfitting

Sometimes when our network train too much, after some point our efficiency and accuracy will getting lower because of it tries the find the best classification but it overfits. That's why we have to have a pretending method for overfitting and one of them these method is dropout.

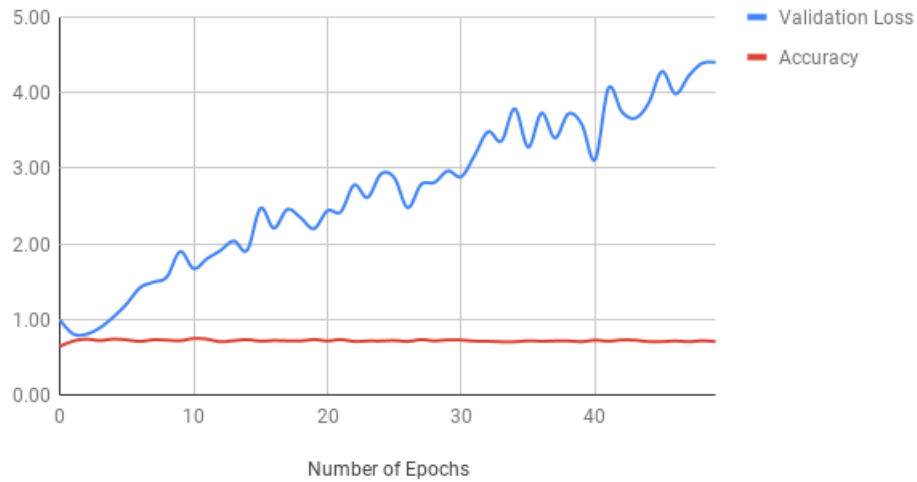
Dropping out can be seen as temporarily deactivating or ignoring neurons of the network.

## 3 Graphs

Below, you can find the my neural network's efficiency, validation loss and number of epoch's with the graphs.

First graph is the my network's result when I did not use the dropout function. As you can see below, the validation loss increases and we do not want to this.

### Validation Loss and Accuracy without DropOut

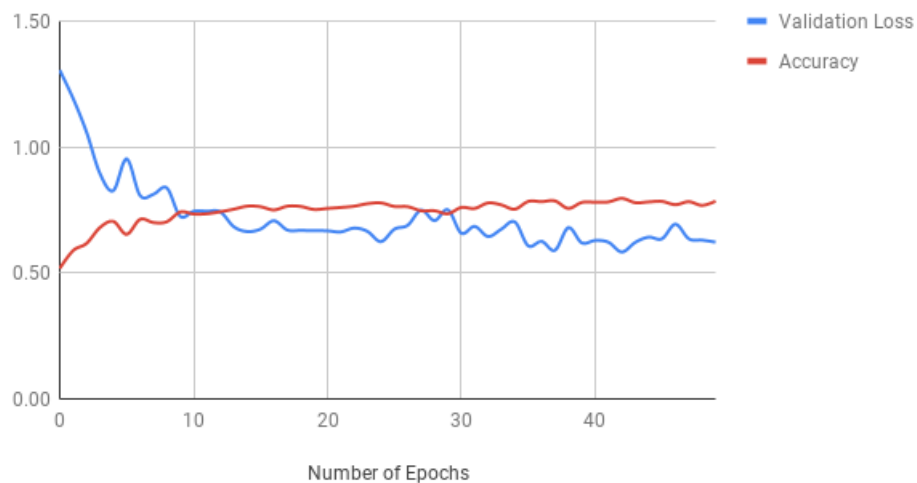


Epoch Number	Learning Rate	Batch Size	Validation Loss	Accuracy
1	0,001	32	0,99	0,64
10	0,001	32	1,90	0,72
25	0,001	32	2,78	0,71
50	0,001	32	4,40	0,70

Best Epoch Number	Best Accuracy	Lowest Validation Loss
11	1,67	0,75

Second graph is from same network with the first graph but the only difference between first and second graph is dropout function. You can easily see that when we use the dropout function our network is getting more efficient and our validation loss is smaller now.

### Validation Loss and Accuracy with DropOut

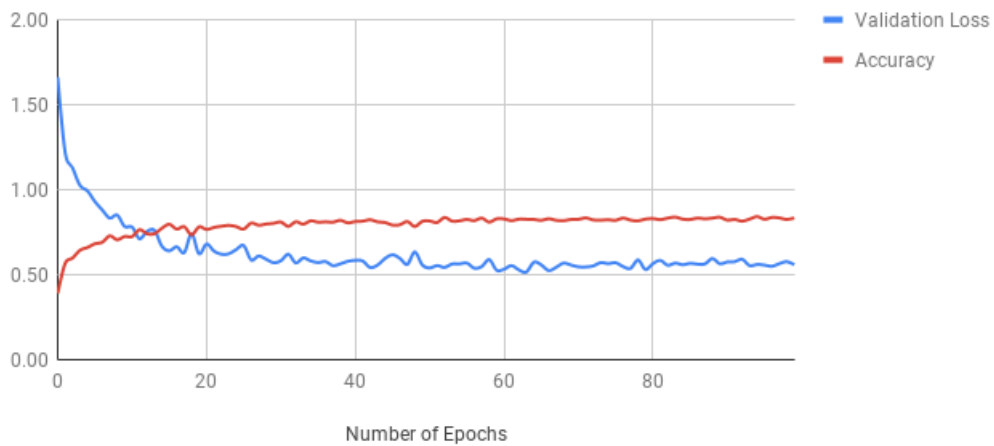


Epoch Number	Learning Rate	Batch Size	Validation Loss	Accuracy
1	0,001	32	1,30	0,52
10	0,001	32	0,81	0,70
25	0,001	32	0,68	0,76
50	0,001	32	0,62	0,79

Best Epoch Number	Best Accuracy	Lowest Validation Loss
42	0,80	0,58

For receiving third graph I changed some hyperparameters of my network. Before the learning rate was 0.001 and now it is 0.005 and also, epoch number was 50 but now it is 100. As you can see in the graphs, we have much better result than previous networks.

Validation Loss and Accuracy with DropOut (learning rate changed to the 0.0005 and number of epoch changed to the 100)

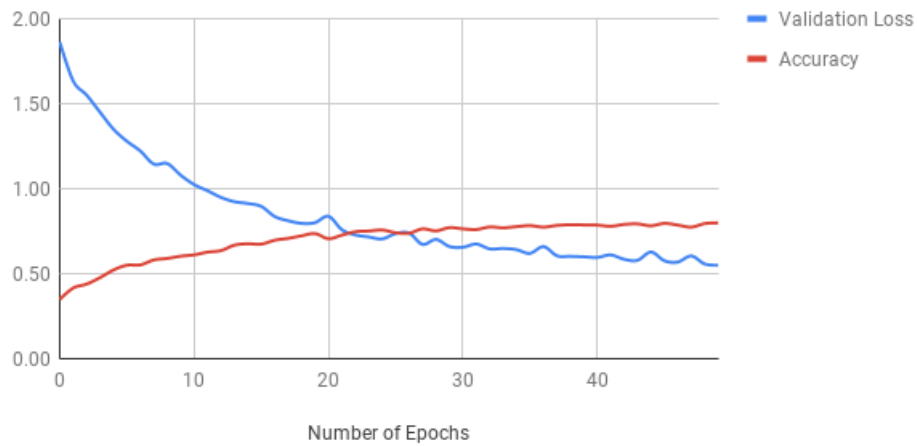


Epoch Number	Learning Rate	Batch Size	Epoch Number	Validation Loss	Accuracy
1	0.0005	32	100	1,66	0,38
25	0.0005	32	100	0,64	0,78
50	0.0005	32	100	0,55	0,81
100	0.0005	32	100	0,55	0,83

Best Epoch Number	Best Accuracy	Lowest Validation Loss
63	0,82	0,51

For receiving third graph I changed some hyperparameters of my network. Before the learning rate was 0.005 and now it is 0.0001. As you can see the result of our network is also good but it was better than previous. So, according to my try, I can see that third image has the best efficiency and lowest validation loss.

Validation Loss and Accuracy with DropOut (learning rate changed to the 0.0001)



Epoch Number	Learning Rate	Batch Size	Validation Loss	Accuracy
1	0.0001	32	1,86	0,34
10	0.0001	32	1,07	0,60
25	0.0001	32	0,70	0,75
50	0.0001	32	0,55	0,79

Best Epoch Number	Best Accuracy	Lowest Validation Loss
50	0,79	0,55