Deep Learning (MNIST Fashion Classification)

Python packages/libraries used: Numpy, Pandas, Tensorflow, Time, Matplotlib .

Note: Use of user defined functions is not done.

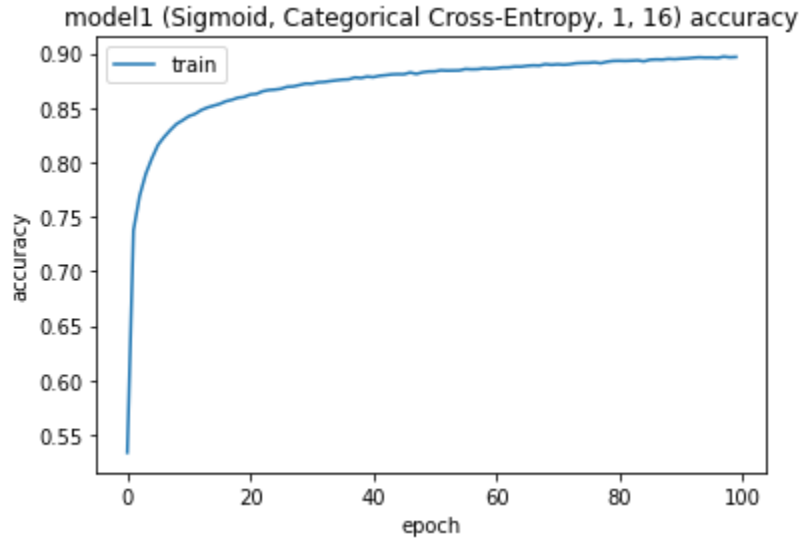
Data Set Link: https://www.kaggle.com/zalando-research/fashionmnist

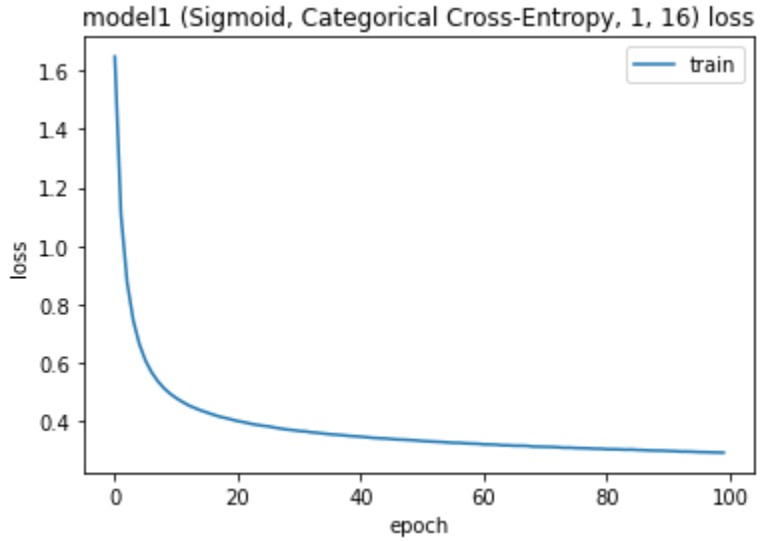
Model 1:

1. Activation Function: Sigmoid
2. Loss Function: Categorical Cross-Entropy
3. Number of Hidden Layers: 1
4. Number of Nodes in Hidden Layer: 16

Activation Function for output layer: Softmax

Number of Epochs: 100





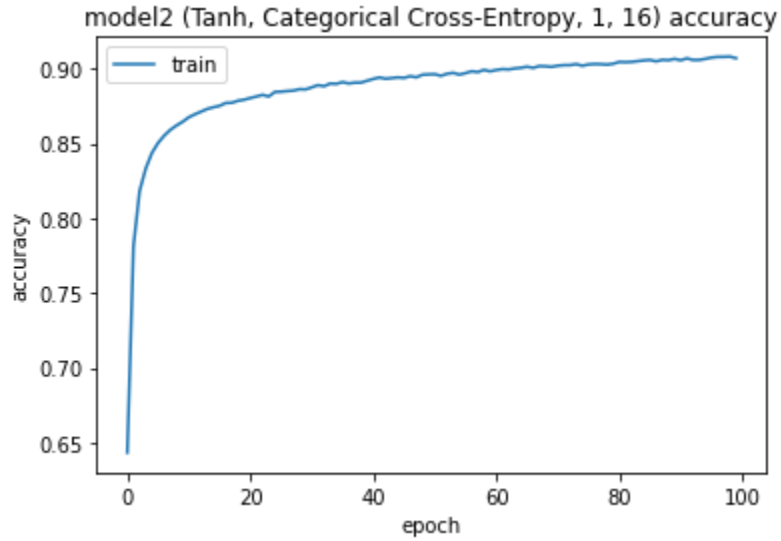
Accuracy : Medium
Loss: Superior

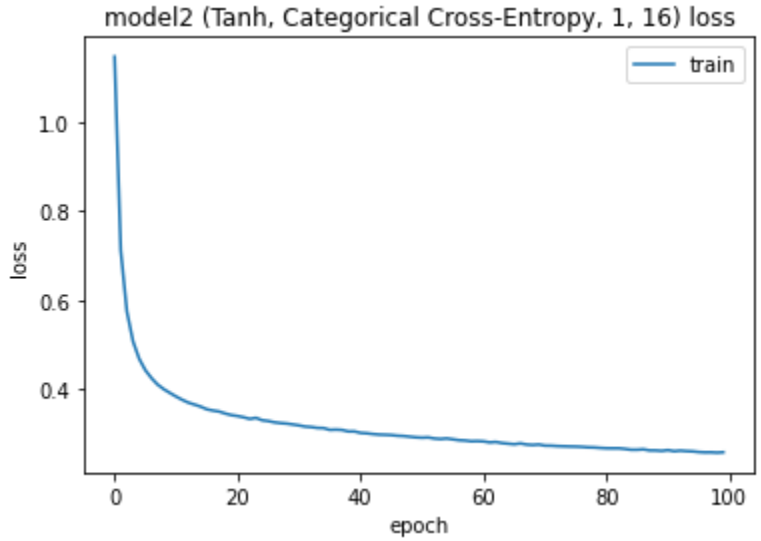
Model 2:

1. Activation Function: Tanh
2. Loss Function: Categorical Cross-Entropy
3. Number of Hidden Layers: 1
4. Number of Nodes in Hidden Layer: 16

Activation Function for output layer: Softmax

Number of Epochs: 100





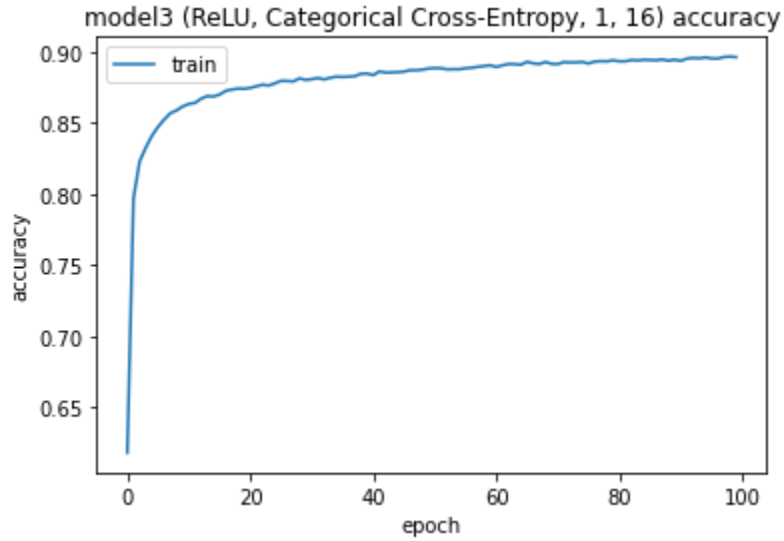
Accuracy : Medium
Loss: Superior

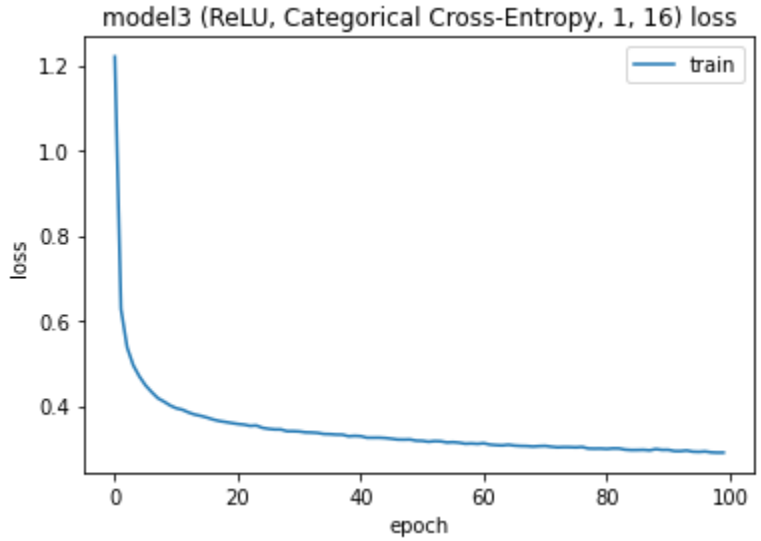
Model 3:

1. Activation Function: ReLU
2. Loss Function: Categorical Cross-Entropy
3. Number of Hidden Layers: 1
4. Number of Nodes in Hidden Layer: 16

Activation Function for output layer: Softmax

Number of Epochs: 100





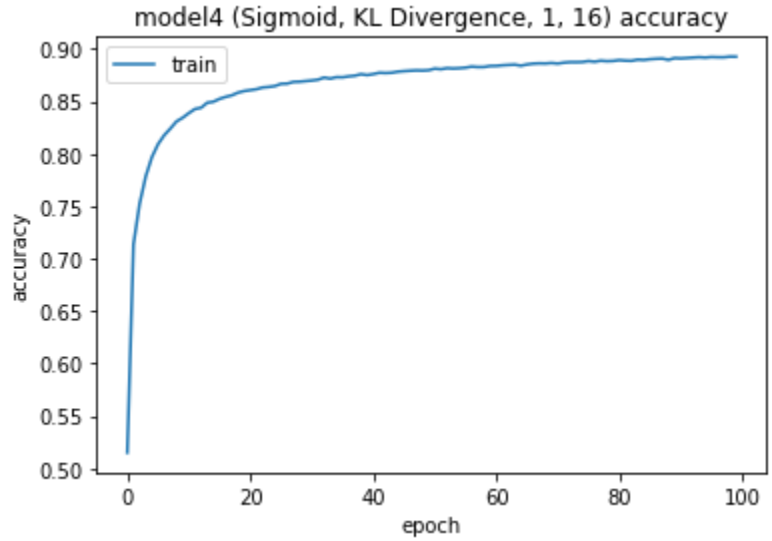
Accuracy : Medium
Loss: Superior

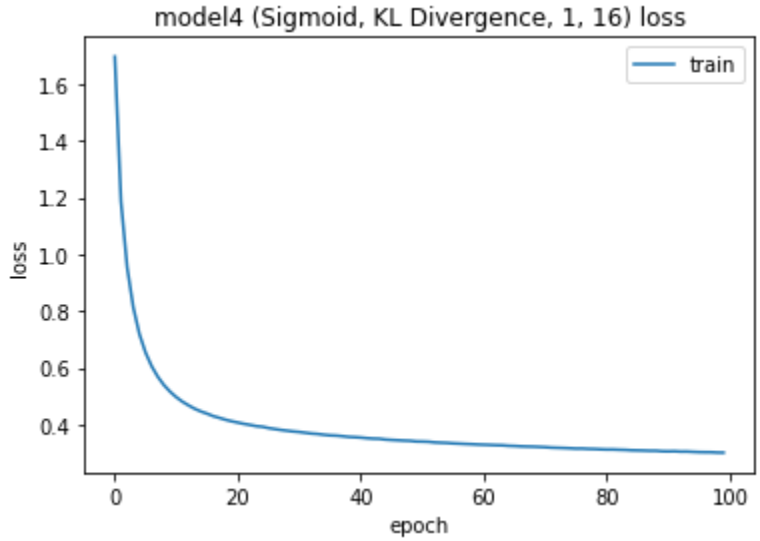
Model 4:

1. Activation Function: Sigmoid
2. Loss Function: KL Divergence
3. Number of Hidden Layers: 1
4. Number of Nodes in Hidden Layer: 16

Activation Function for output layer: Softmax

Number of Epochs: 100





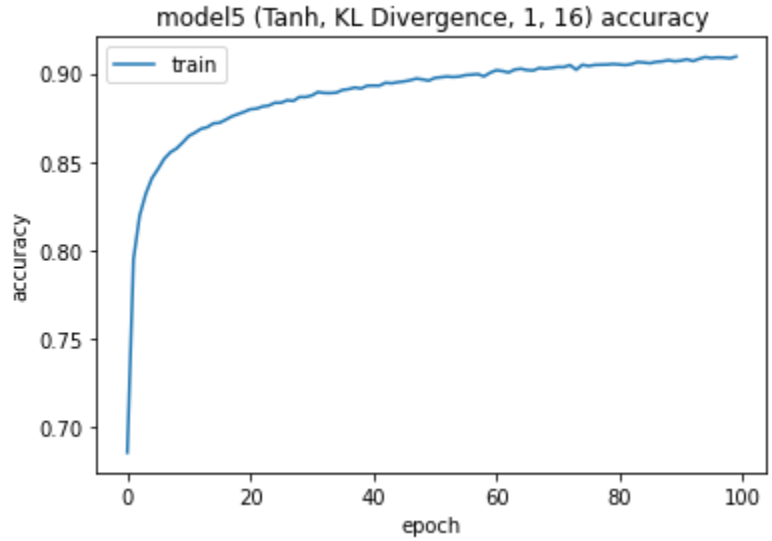
Accuracy : Medium
Loss: Superior

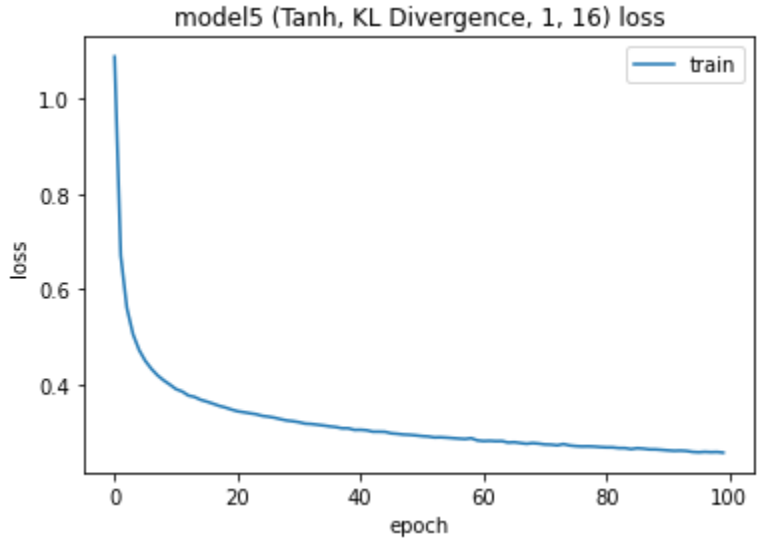
Model 5:

1. Activation Function: Tanh
2. Loss Function: KL Divergence
3. Number of Hidden Layers: 1
4. Number of Nodes in Hidden Layer: 16

Activation Function for output layer: Softmax

Number of Epochs: 100





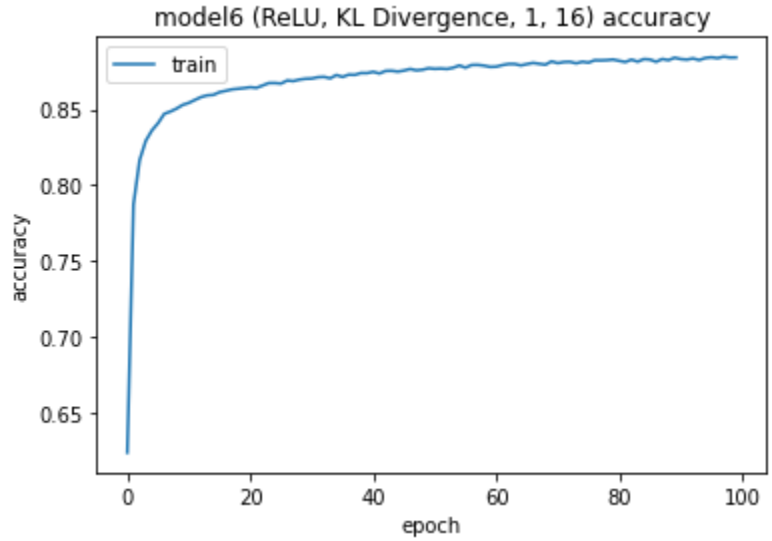
Accuracy : Medium
Loss: Superior

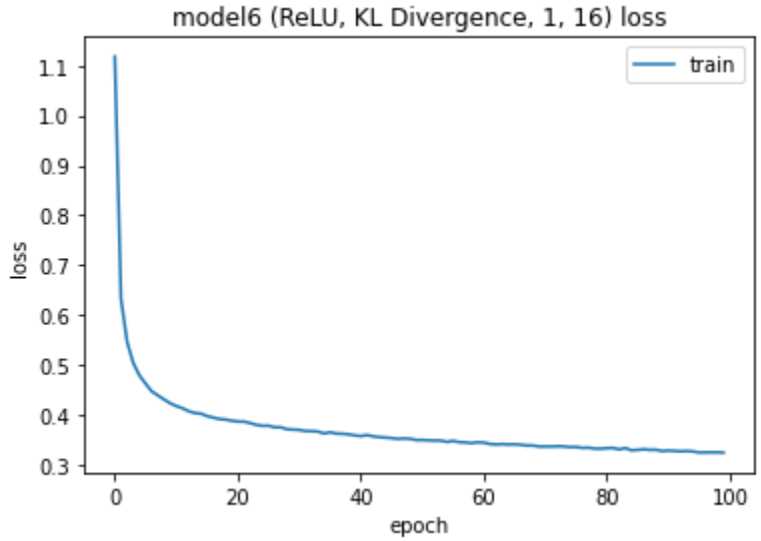
Model 6:

1. Activation Function: ReLU
2. Loss Function: KL Divergence
3. Number of Hidden Layers: 1
4. Number of Nodes in Hidden Layer: 16

Activation Function for output layer: Softmax

Number of Epochs: 100





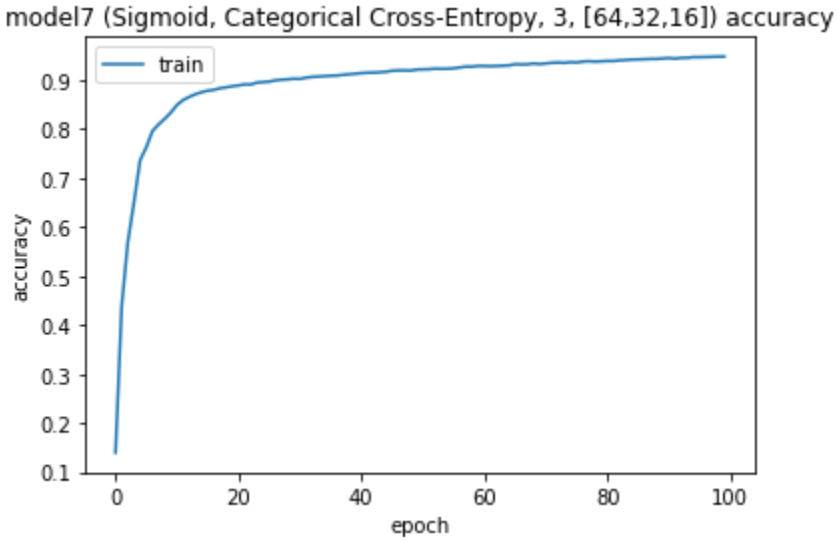
Accuracy : Medium
Loss: Superior

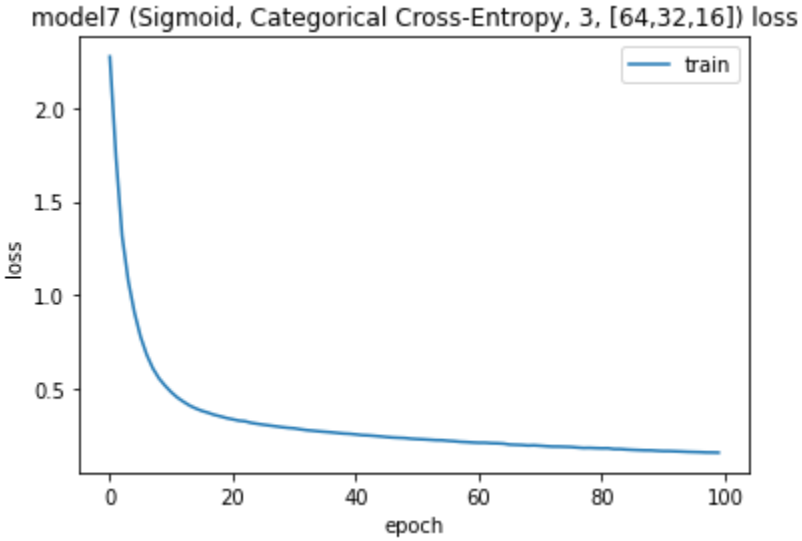
Model 7:

1. Activation Function: Sigmoid
2. Loss Function: Categorical Cross-Entropy
3. Number of Hidden Layers: 3
4. Number of Nodes in Hidden Layer: 64,32,16

Activation Function for output layer: Softmax

Number of Epochs: 100





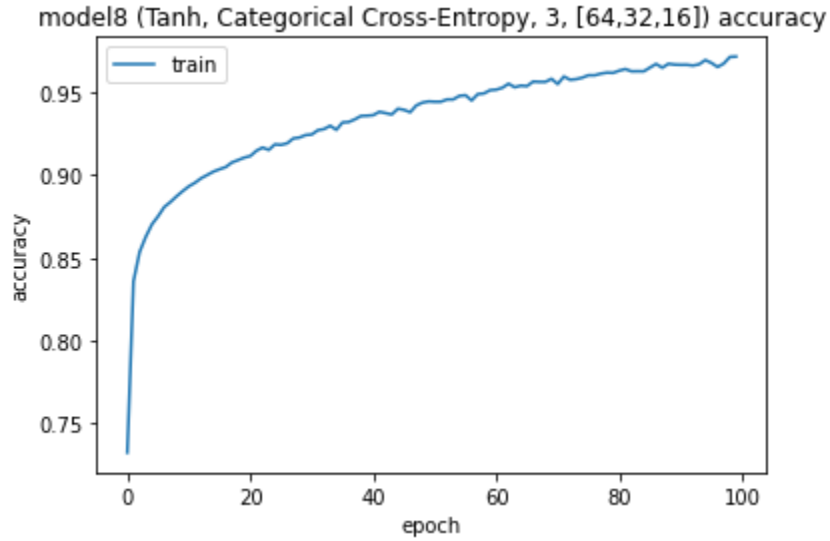
Accuracy : Medium
Loss: Superior

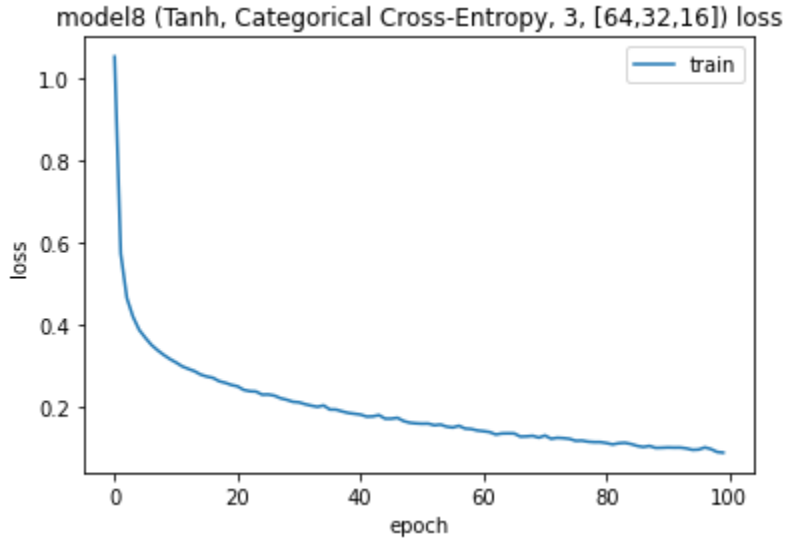
Model 8:

1. Activation Function: Tanh
2. Loss Function: Categorical Cross-Entropy
3. Number of Hidden Layers: 3
4. Number of Nodes in Hidden Layer: 64,32,16

Activation Function for output layer: Softmax

Number of Epochs: 100





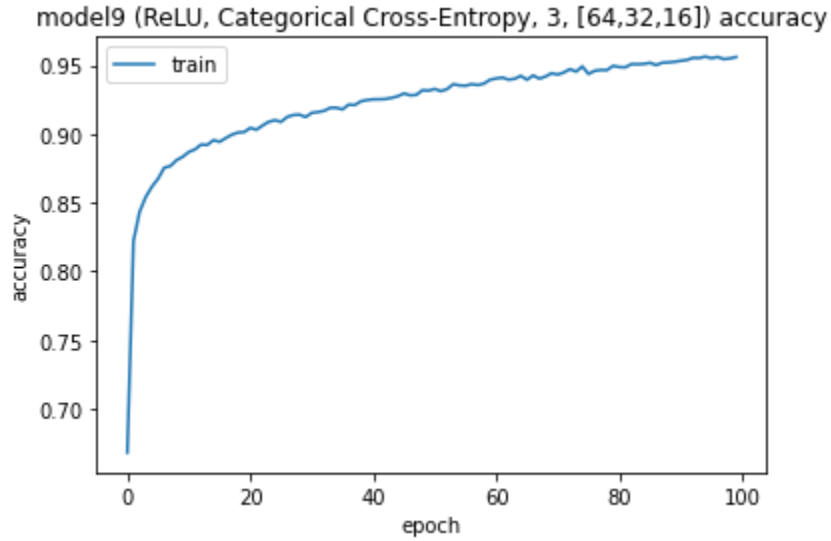
Accuracy : Medium
Loss: Medium

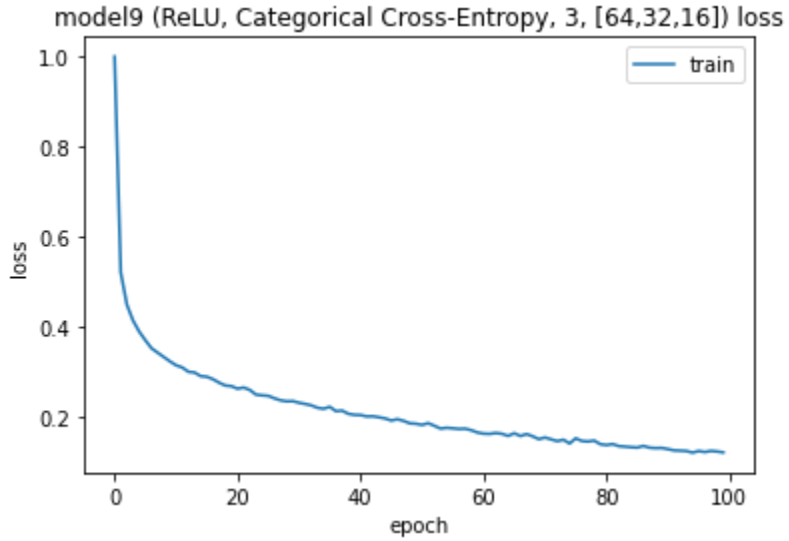
Model 9:

1. Activation Function: ReLU
2. Loss Function: Categorical Cross-Entropy
3. Number of Hidden Layers: 3
4. Number of Nodes in Hidden Layer: 64,32,16

Activation Function for output layer: Softmax

Number of Epochs: 100





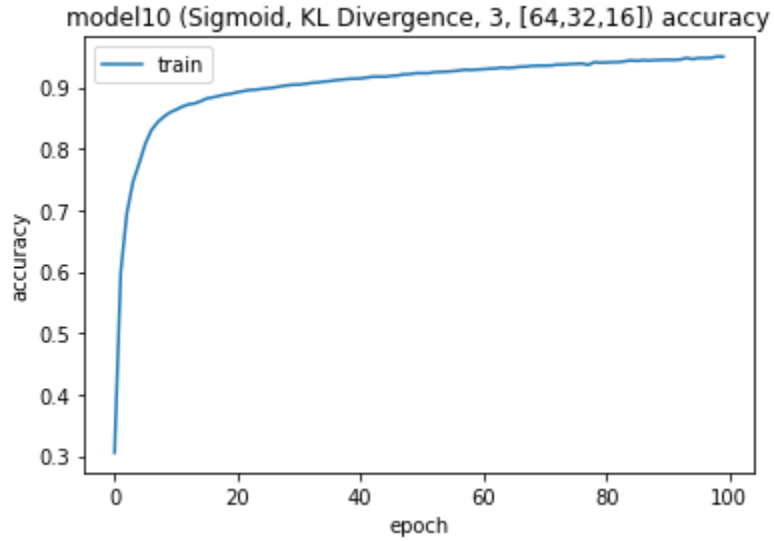
Accuracy : Medium
Loss: Medium

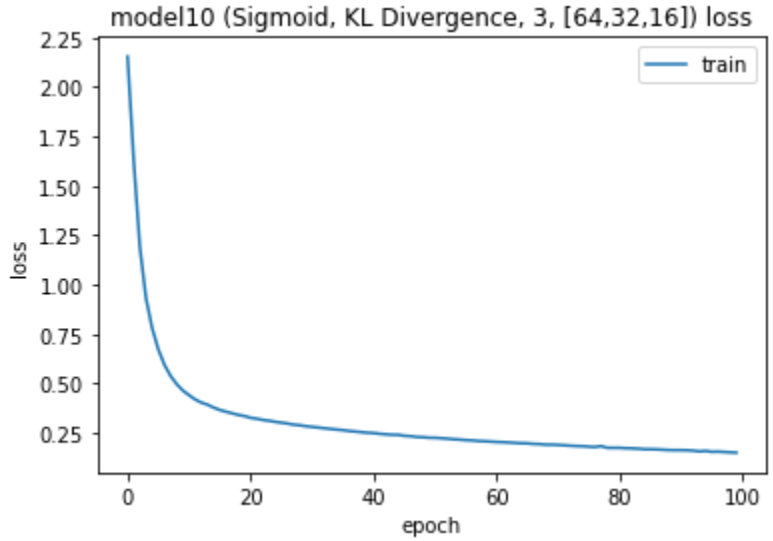
Model 10:

1. Activation Function: Sigmoid
2. Loss Function: KL Divergence
3. Number of Hidden Layers: 3
4. Number of Nodes in Hidden Layer: 64,32,16

Activation Function for output layer: Softmax

Number of Epochs: 100





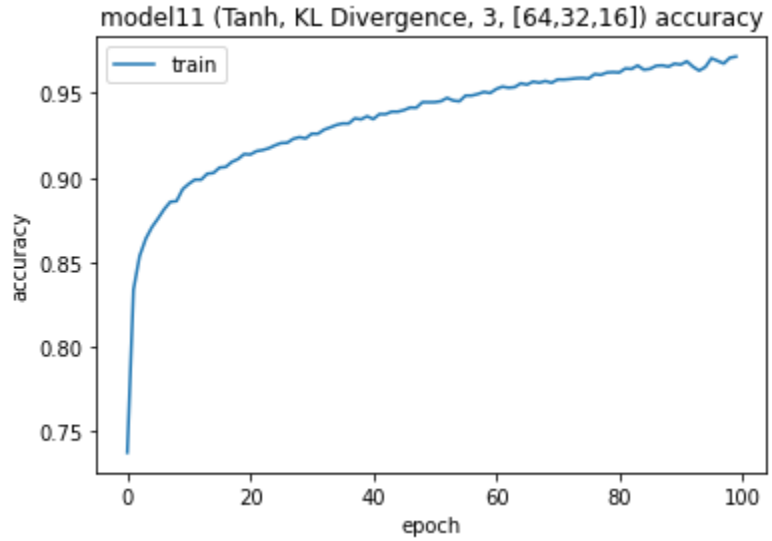
Accuracy : Medium
Loss: Superior

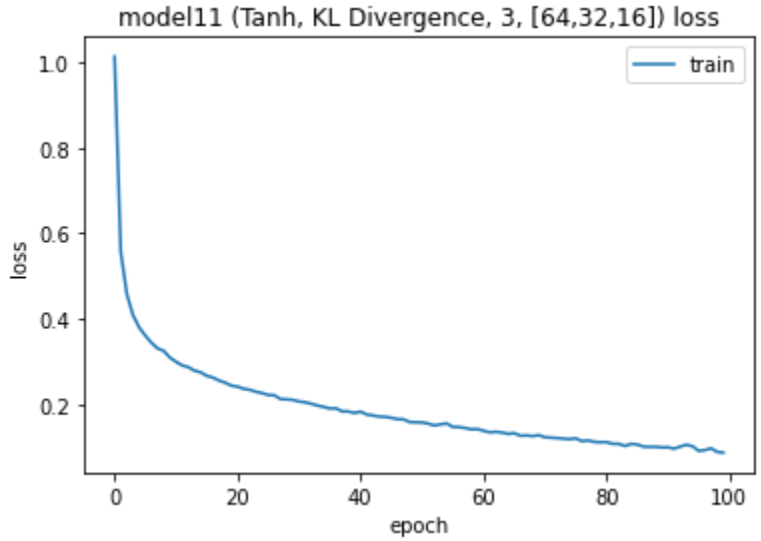
Model 11:

1. Activation Function: Tanh
2. Loss Function: KL Divergence
3. Number of Hidden Layers: 3
4. Number of Nodes in Hidden Layer: 64,32,16

Activation Function for output layer: Softmax

Number of Epochs: 100





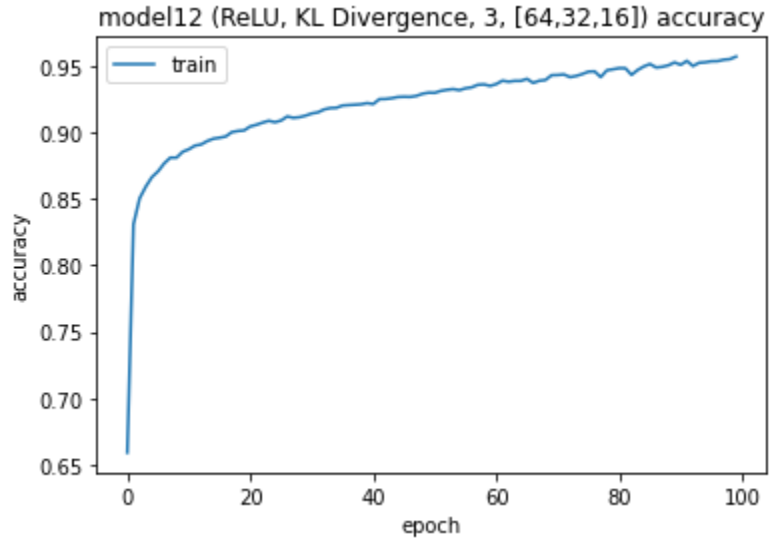
Accuracy : Medium
Loss: Medium

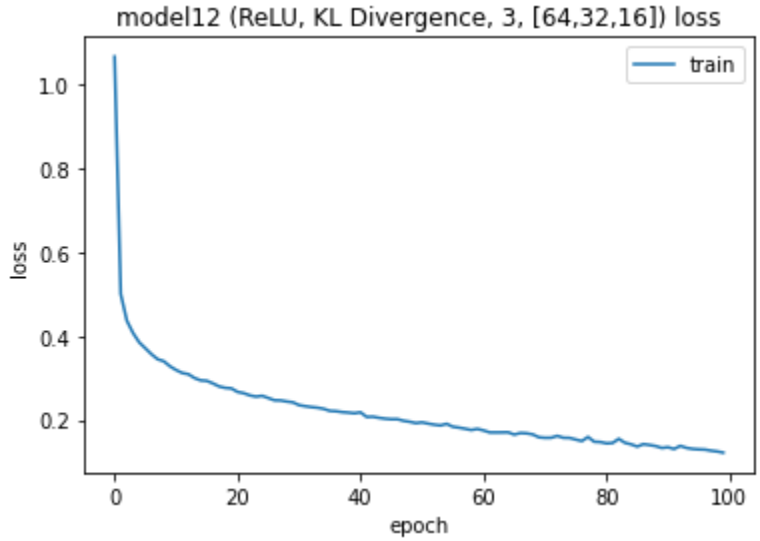
Model 12:

1. Activation Function: ReLU
2. Loss Function: KL Divergence
3. Number of Hidden Layers: 3
4. Number of Nodes in Hidden Layer: 64,32,16

Activation Function for output layer: Softmax

Number of Epochs: 100





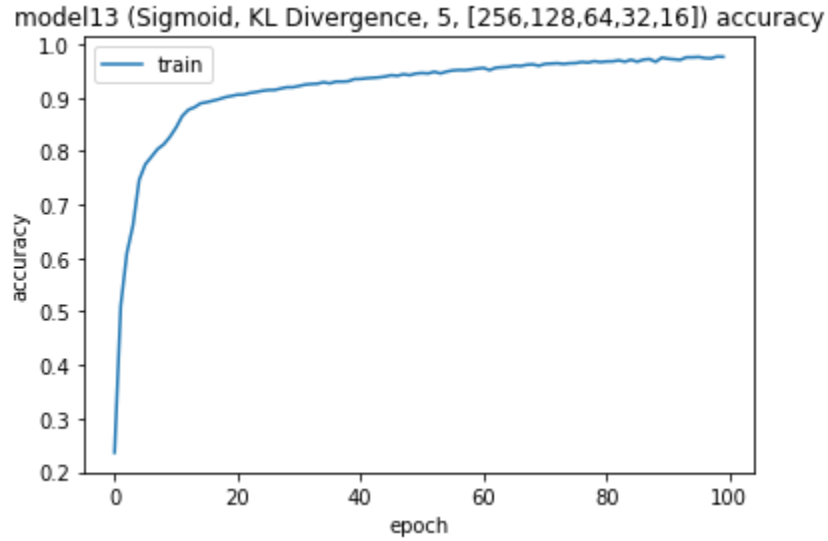
Accuracy : Medium
Loss: Medium

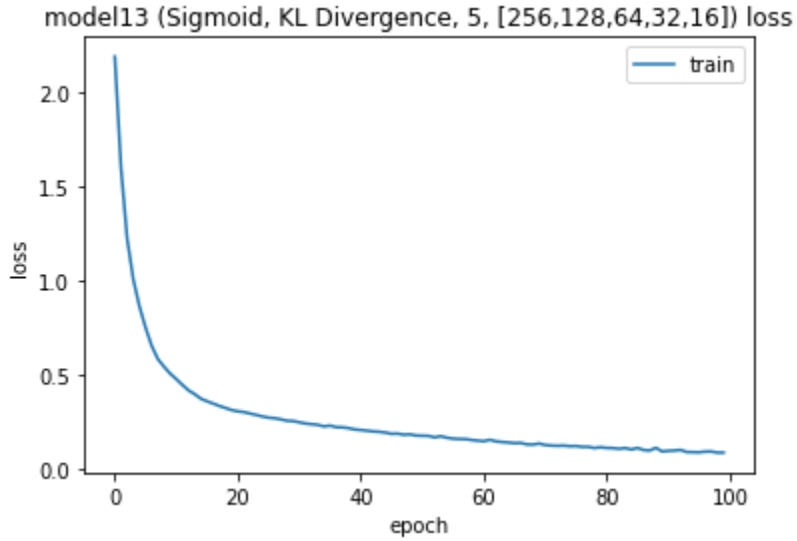
Model 13:

1. Activation Function: Sigmoid
2. Loss Function: KL Divergence
3. Number of Hidden Layers: 5
4. Number of Nodes in Hidden Layer: 256,128,64,32,16

Activation Function for output layer: Softmax

Number of Epochs: 100





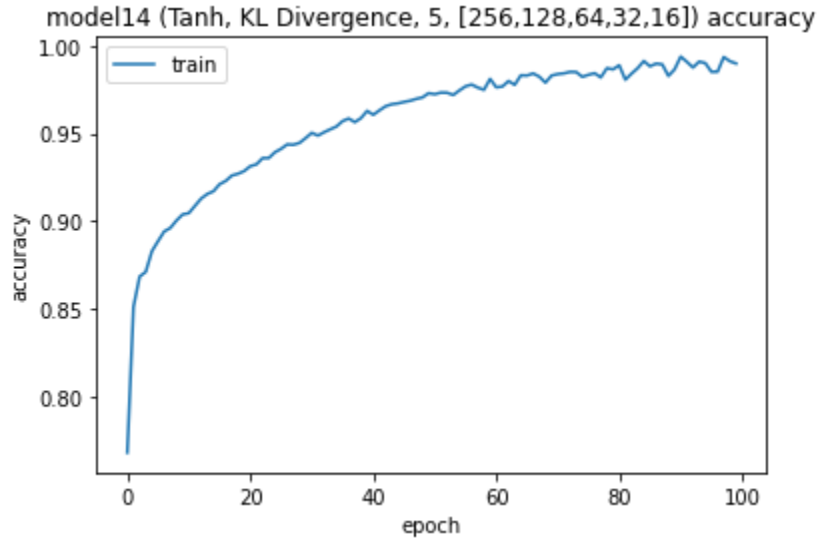
Accuracy : Medium
Loss: Medium

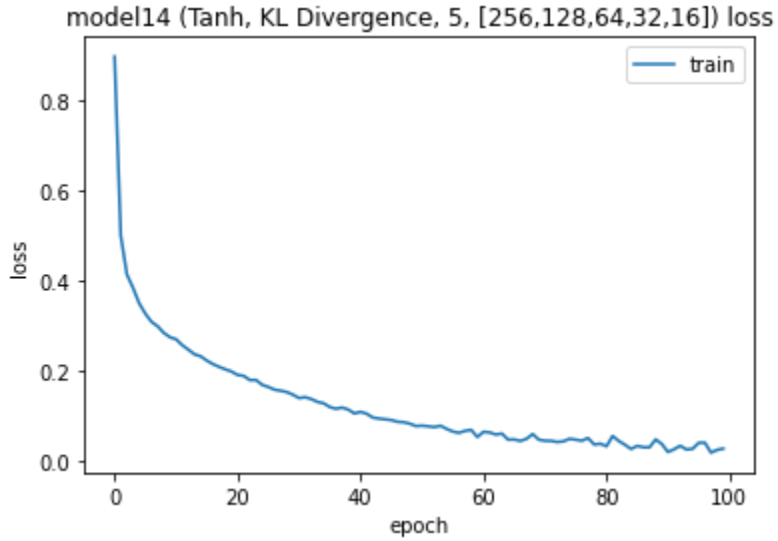
Model 14:

1. Activation Function: Tanh
2. Loss Function: KL Divergence
3. Number of Hidden Layers: 5
4. Number of Nodes in Hidden Layer: 256,128,64,32,16

Activation Function for output layer: Softmax

Number of Epochs: 100





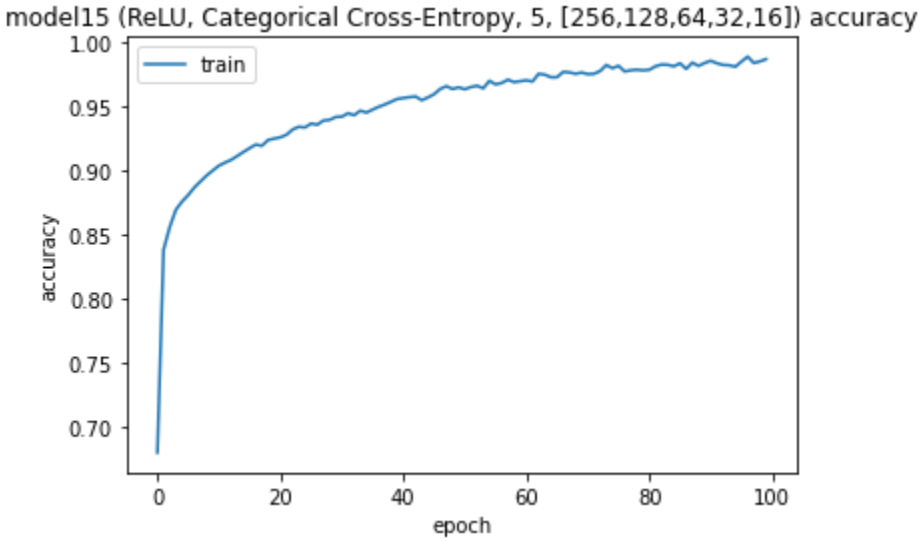
Accuracy : Medium
Loss: Inferior

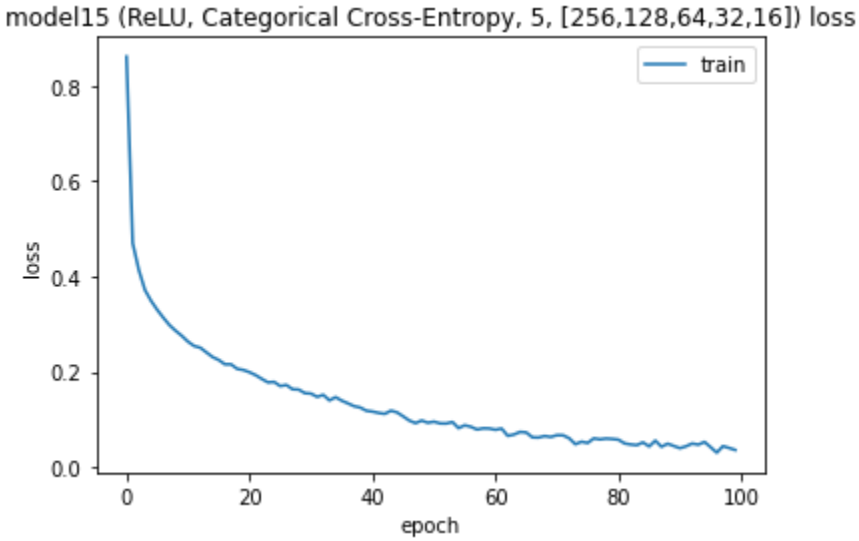
Model 15:

1. Activation Function: ReLU
2. Loss Function: Categorical Cross-Entropy
3. Number of Hidden Layers: 5
4. Number of Nodes in Hidden Layer: 256,128,64,32,16

Activation Function for output layer: Softmax

Number of Epochs: 100





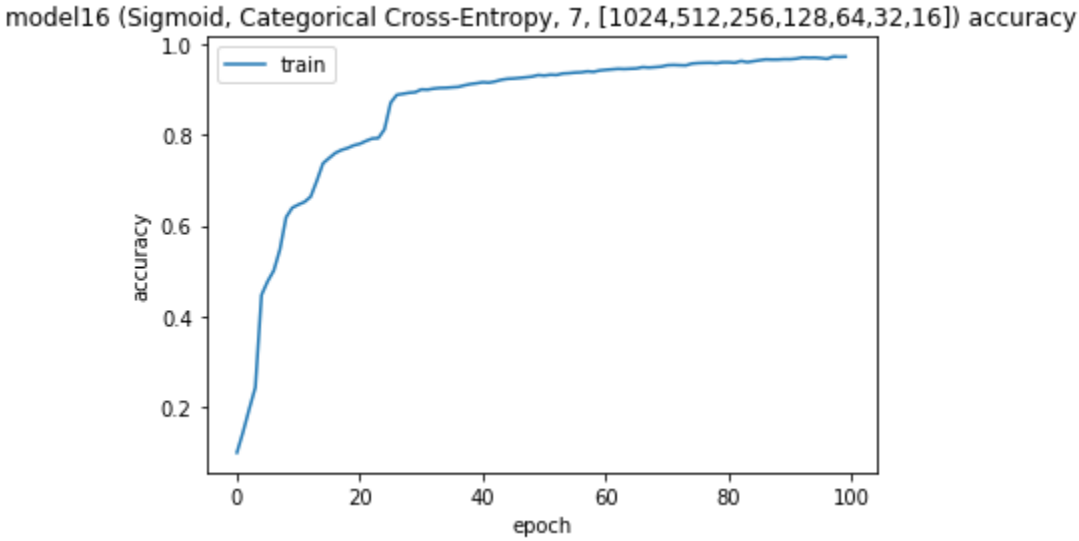
Accuracy : Medium
Loss: Inferior

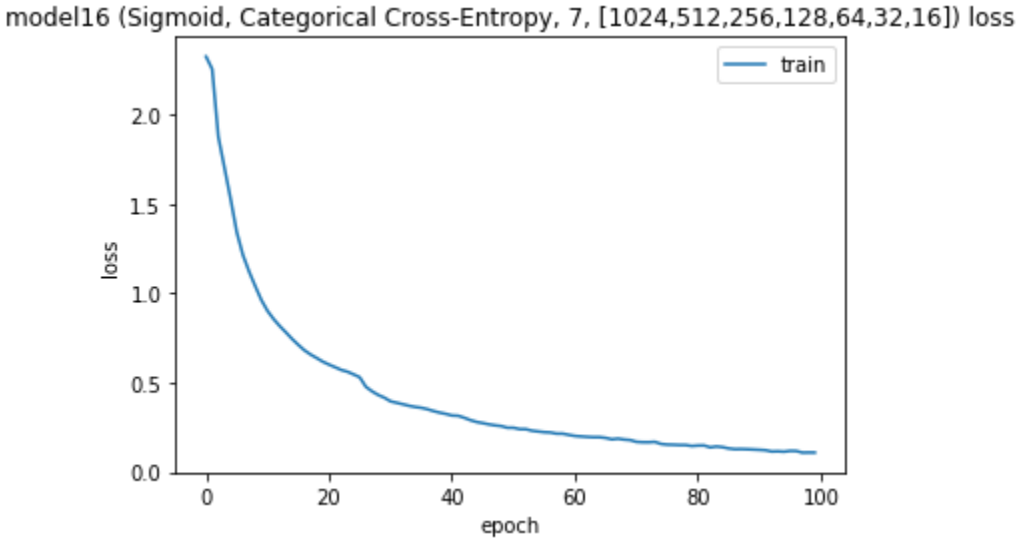
Model 16:

1. Activation Function: Sigmoid
2. Loss Function: Categorical Cross-Entropy
3. Number of Hidden Layers: 7
4. Number of Nodes in Hidden Layer: 1024,512,256,128,64,32,16

Activation Function for output layer: Softmax

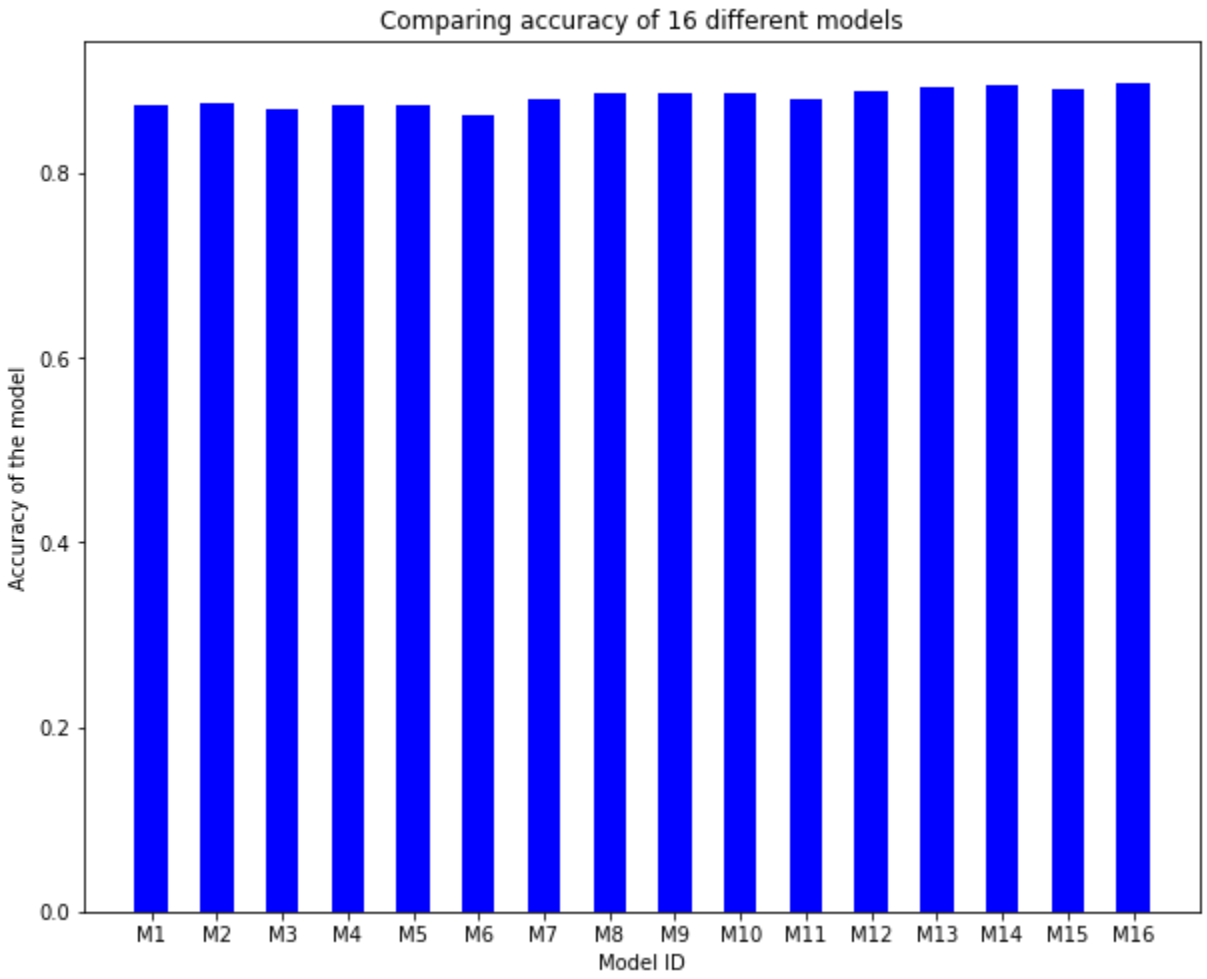
Number of Epochs: 100



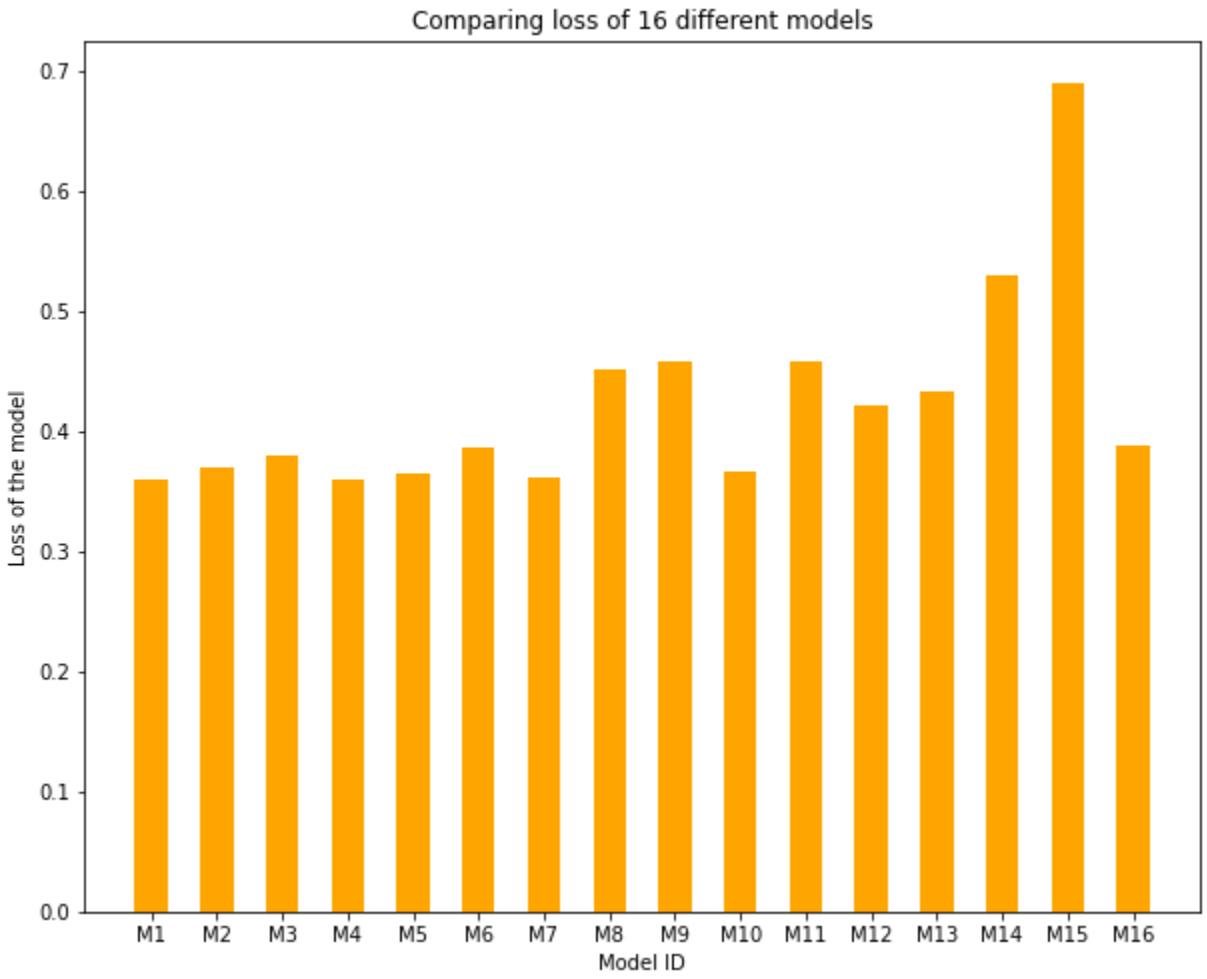


Accuracy : Medium
Loss: Superior

Accuracy:


Comparing accuracy of 16 different models
Accuracy of the model
0.0
0.2
0.4
0.6
0.8
M1
M2
M3
M4
M5
M6
M7
M8
M9
M10
M11
M12
M13
M14
M15
M16
Model ID

Loss:


Comparing loss of 16 different models
Loss of the model
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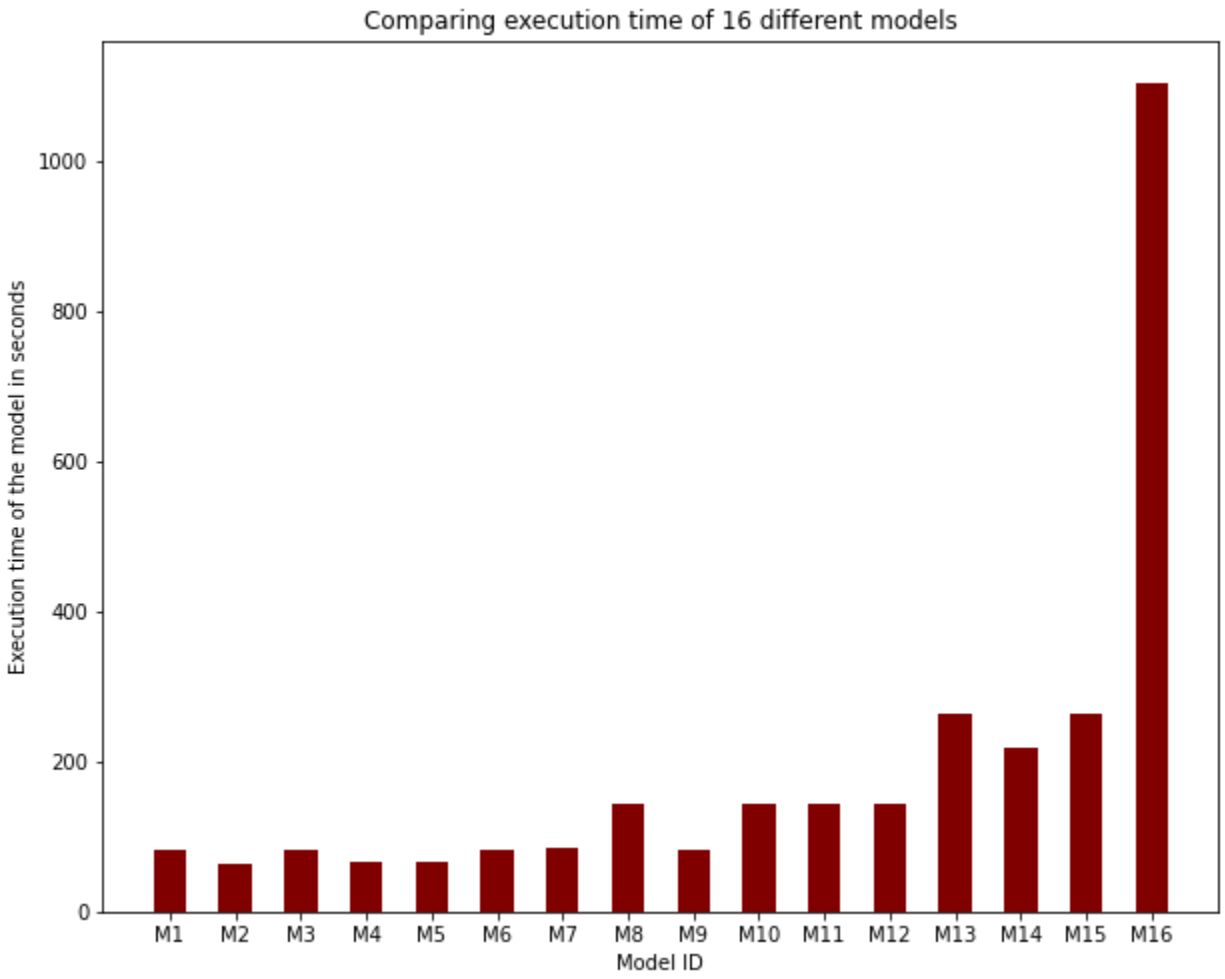
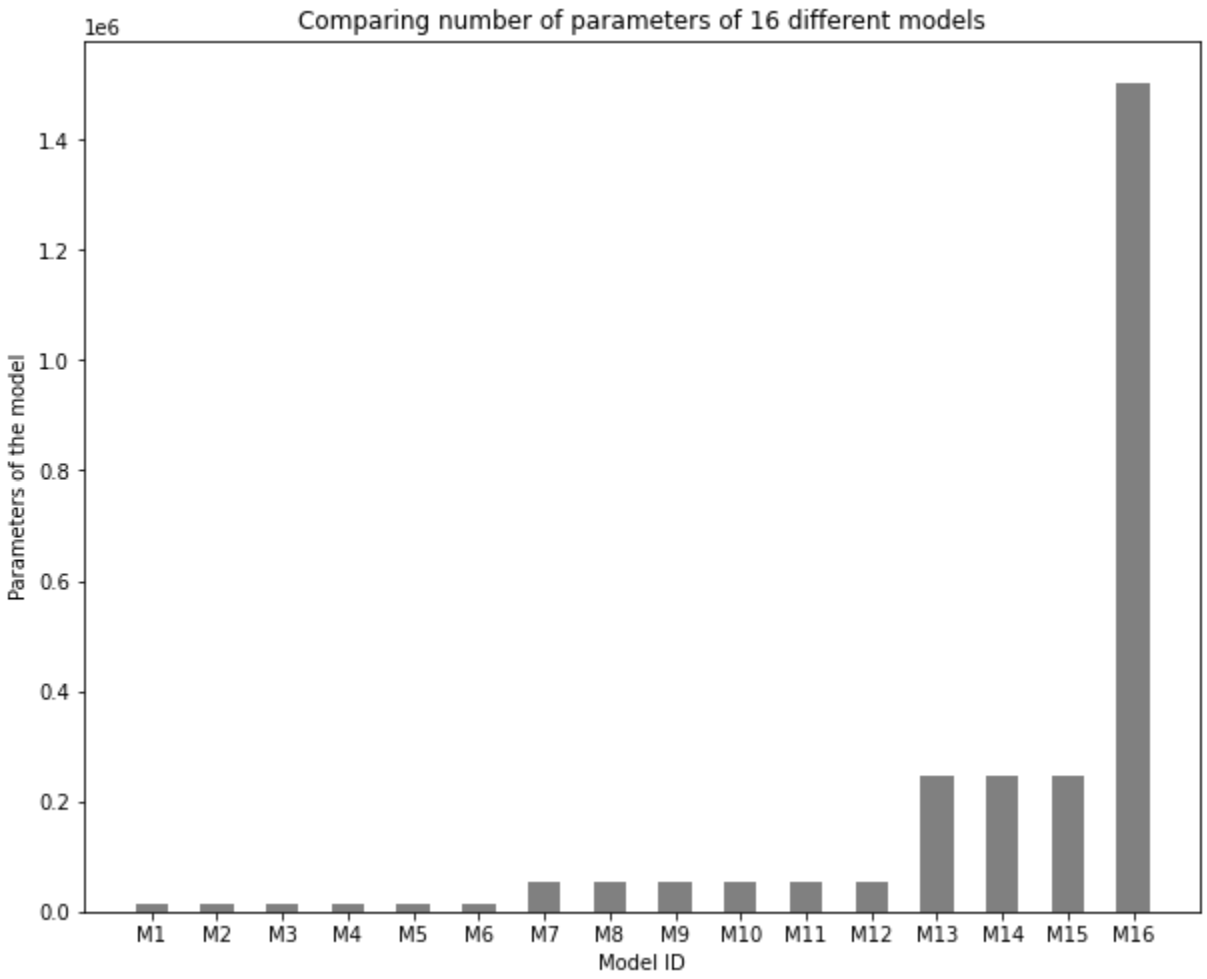
0.1
0.2
0.3
0.4
0.5
0.6
0.7
M1
M2
M3
M4
M5
M6
M7
M8
M9
M10
M11
M12
M13
M14
M15
M16
Model ID

Execution Time:



Parameters:


Comparing number of parameters of 16 different models
1e6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Parameters of the model
M1
M2
M3
M4
M5
M6
M7
M8
M9
M10
M11
M12
M13
M14
M15
M16
Model ID