

Experiments on Using Neural Networks to Fit Function

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To simplify networks' structure, I choose to use two-layer fully-connected feedforward neural networks to fit a cosine function $\cos(x)$ $x \in (-\frac{\pi}{2}, \frac{\pi}{2})$. What I am interested is the width of network, choice of loss function and different initialization of weighted parameters, so I set different levels and doing experiments each for four repetition. I experiment on 10, 50, 100 three different widths; MSE ($\sum_{i=1}^n (f_{\theta}(x_i) - y_i)^2$) and MAE ($\sum_{i=1}^n |f_{\theta}(x_i) - y_i|$); three different standard variations 0.01, 0.1, 1.

As for other settings, I keep them all invariant: use adam optimizer with learning rate 0.001, 0 mean normal distribution for initialization, $\text{relu} \max(0, x)$ as activation function, training 3000 epoches, 1000 training size, 1000 testing size and full batch size.

In each case, I will show the learning curve and the fitting process every 500 epoches.

1 Width = 10

1.1 Mean Square Error

1.1.1 Standard Error = 0.01

1.1.2 Standard Error = 0.1

1.1.3 Standard Error = 1

1.2 Mean Absolute Error

1.2.1 Standard Error = 0.01

1.2.2 Standard Error = 0.1

1.2.3 Standard Error = 1

2 Width = 50

2.1 Mean Square Error

2.1.1 Standard Error = 0.01

2.1.2 Standard Error = 0.1

2.1.3 Standard Error = 1

2.2 Mean Absolute Error

2.2.1 Standard Error = 0.01

2.2.2 Standard Error = 0.1

2.2.3 Standard Error = 1

3 Width = 100

3.1 Mean Square Error

3.1.1 Standard Error = 0.01

3.1.2 Standard Error = 0.1

3.1.3 Standard Error = 1

3.2 Mean Absolute Error

3.2.1 Standard Error = 0.01

3.2.2 Standard Error = 0.1

3.2.3 Standard Error = 1