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EE 456 **Homework - 17** November 8, 2020

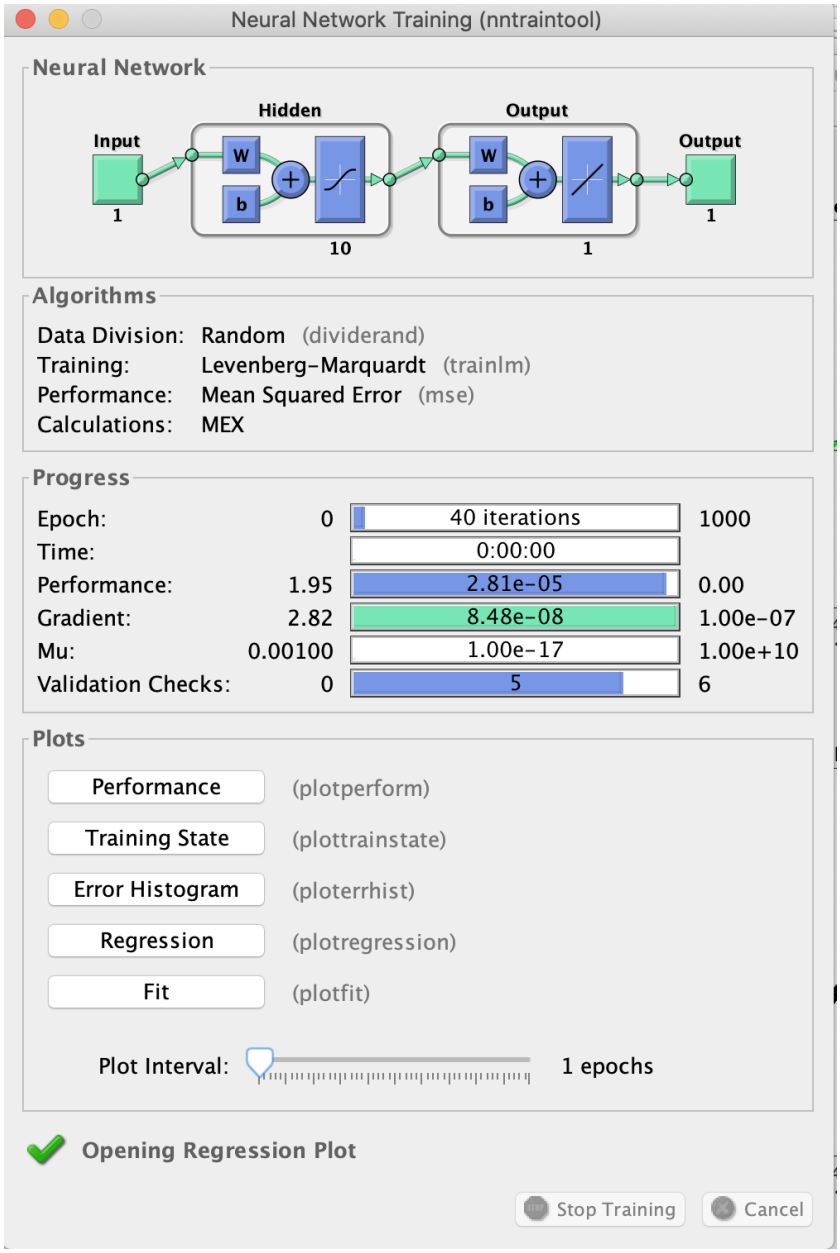
Question: Use the curve fitting facility in the MATLAB NN Tool Box to approximate the graph of where $Y = sin^n(t)$ where n is the 4th digit of your student ID number.

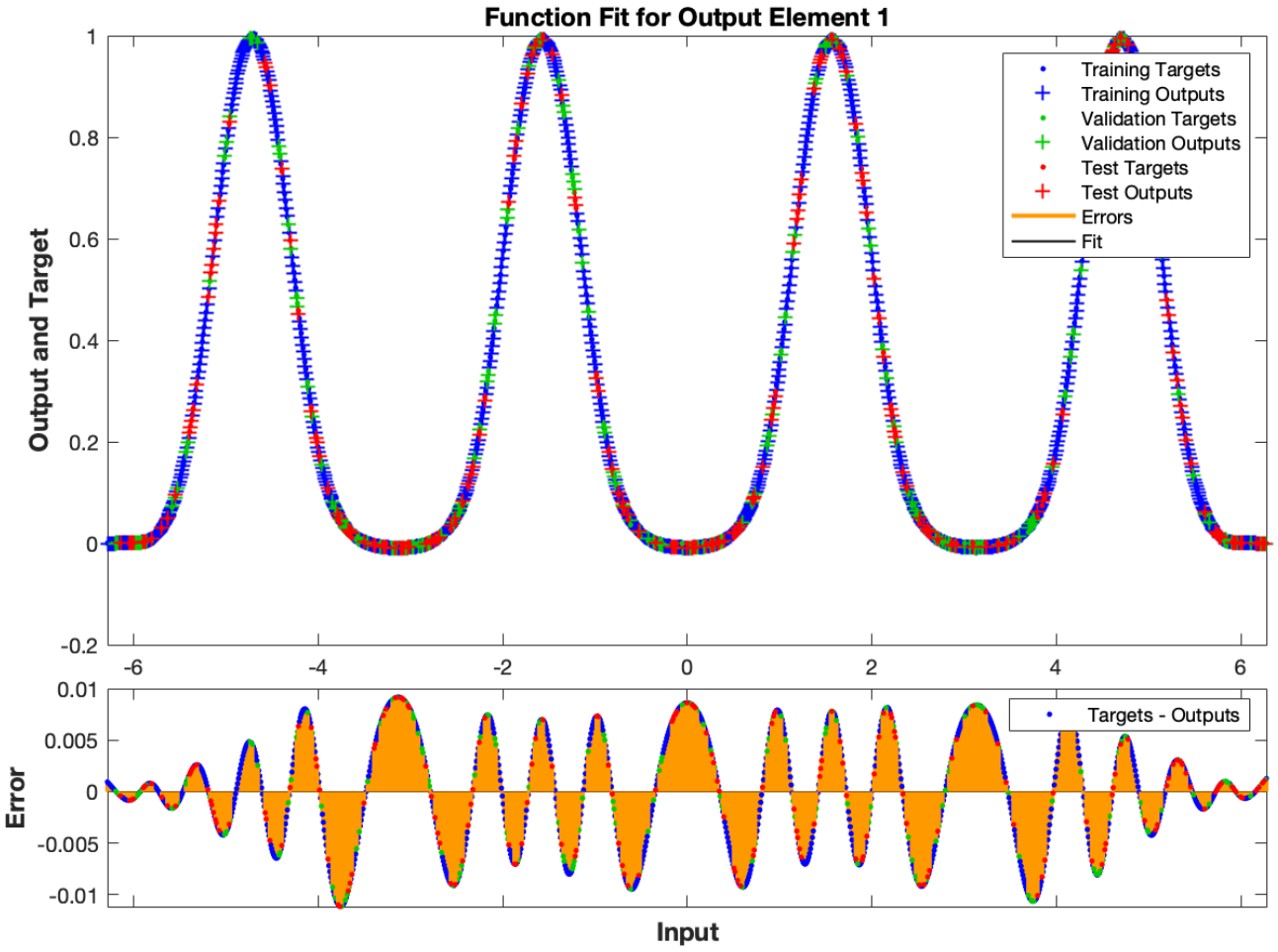
Solution:

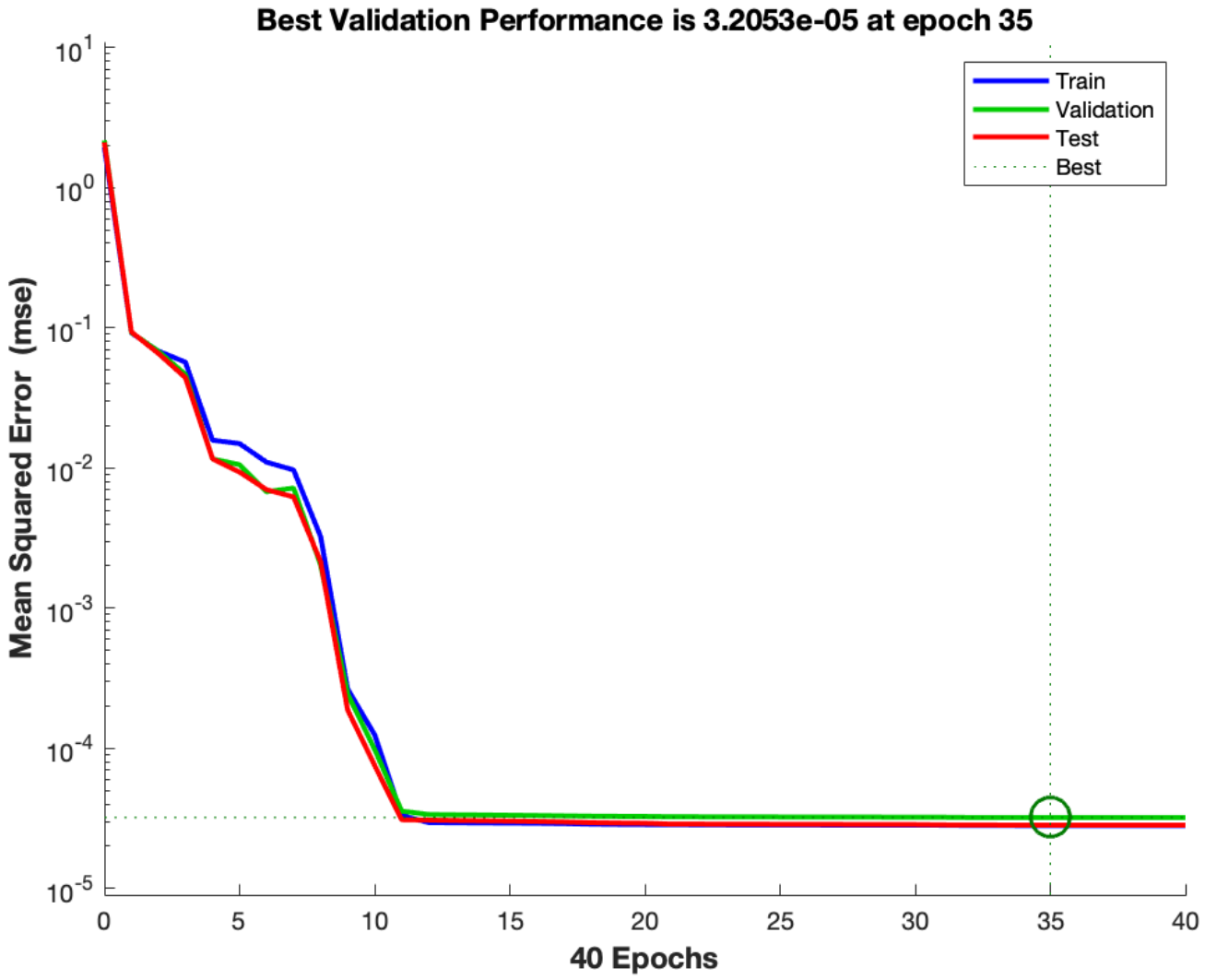
- Student ID: 930616252, fourth digit = 6.
- Train the network for $Y = sin^6(t)$.
- Since it is even power, $Y \geq 0$.
- Following is the code:

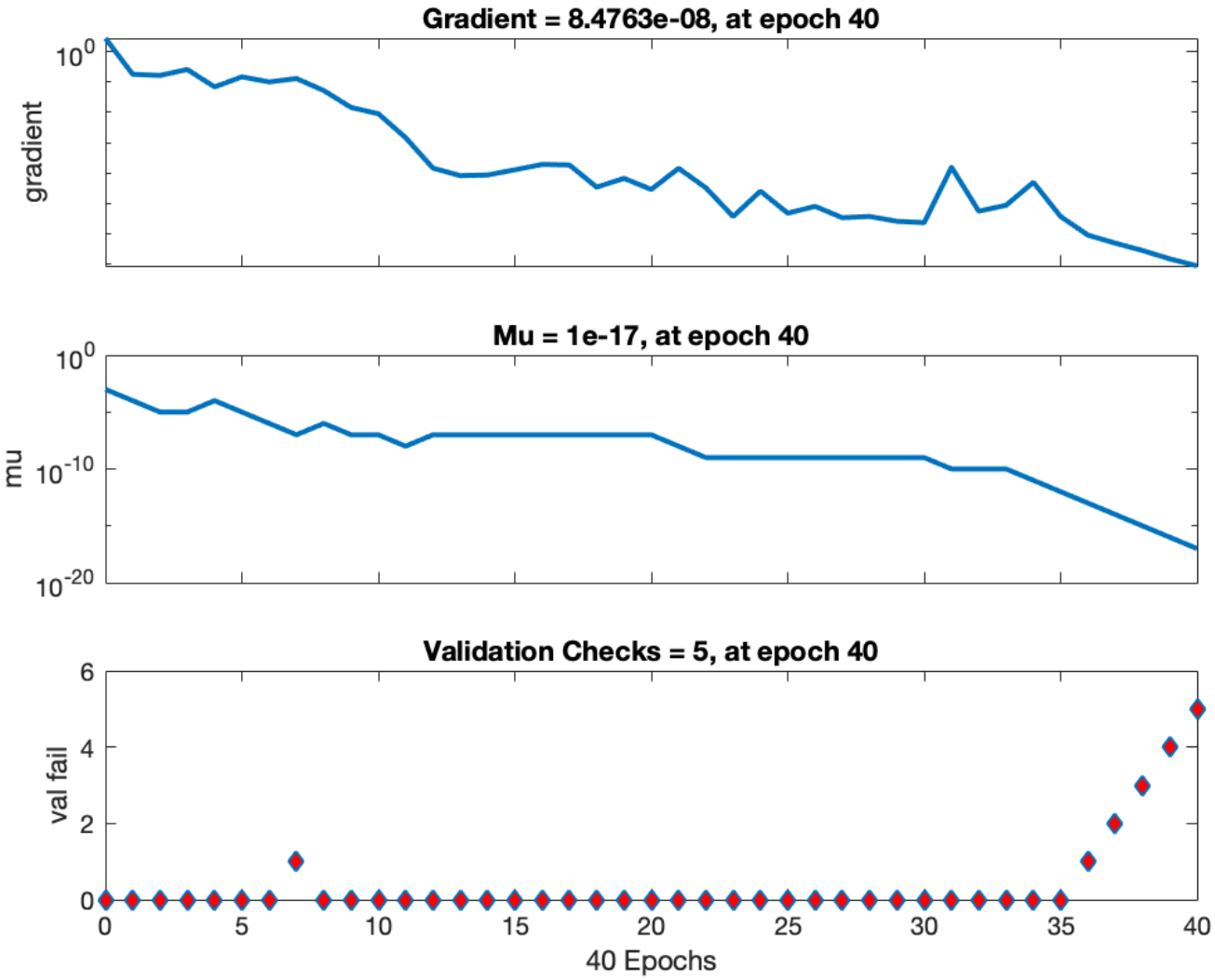
```
% Solve an Input-Output Fitting problem with a Neural Network
% Script generated by NFTOOL
%
% This script assumes these variables are defined:
%
%   houseInputs - input data.
%   houseTargets - target data.

inputs = -2*pi:0.01:2*pi;
targets = sin(inputs).^6;

% Create a Fitting Network
hiddenLayerSize = 10;
net = fitnet(hiddenLayerSize);

% Set up Division of Data for Training, Validation, Testing
net.divideParam.trainRatio = 70/100;
net.divideParam.valRatio = 15/100;
net.divideParam.testRatio = 15/100;

% Train the Network
[net,tr] = train(net,inputs,targets);

% Test the Network
outputs = net(inputs);
errors = gsubtract(outputs,targets);
performance = perform(net,targets,outputs);

% View the Network
view(net)

% Plots
% Uncomment these lines to enable various plots.
```

```
figure, plotperform(tr)
% figure, plottrainstate(tr)
% figure, plotfit(targets,outputs)
% figure, plotregression(targets,outputs)
% figure, ploterrhist(errors)
```




Function Fit for Output Element 1
Training Targets
Training Outputs
Validation Targets
Validation Outputs
Test Targets
Test Outputs
Errors
Fit
Output and Target
1
0.8
0.6
0.4
0.2
0
-0.2
-6
-4
-2
0
2
4
6
Targets - Outputs
Error
0.01
0.005
0
-0.005
-0.01
Input


Best Validation Performance is 3.2053e-05 at epoch 35
Train
Validation
Test
Best
Mean Squared Error (mse)
40 Epochs
10^1
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
0
5
10
15
20
25
30
35
40


Gradient = 8.4763e-08, at epoch 40
gradient
10^0
Mu = 1e-17, at epoch 40
mu
10^0
10^{-10}
10^{-20}
Validation Checks = 5, at epoch 40
val fail
0
2
4
6
0
5
10
15
20
25
30
35
40
40 Epochs