

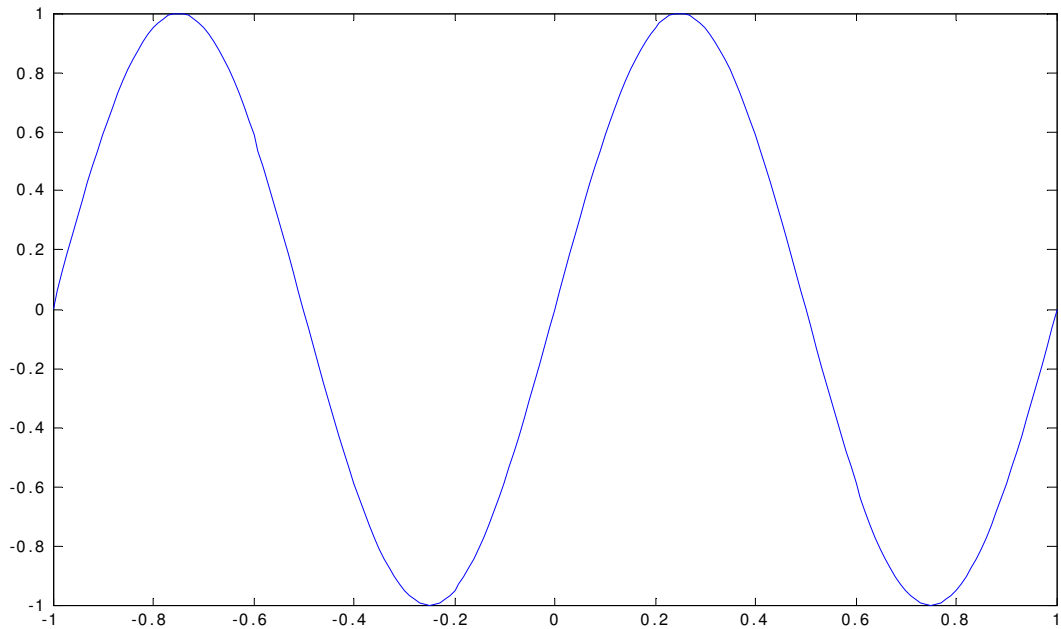
CEN457 - Tutorial

Example of Using Neural Network Toolbox in identification of nonlinear function.

```
P= -1:0.01:1; % input vector
```

```
T=sin(2*pi*T); % target
```

```
Plot(T,P)
```



```
Net=newff([-1 1],[5 10 1],{'logsig','logsig','purelin'},'traingd');
```

```
Net.trainParam.show=50;
```

```
Net.trainParam.lr=0.1;
```

```
Net.trainParam.epochs=1000;
```

```
Net.trainParam.goal=1e-2;
```

```
>> Net=newff([-1 1],[5 10 1],{'logsig','logsig','purelin'},'traingd');
```

```
>> Net2=train(Net,P,T);
```

```
TRAINGD, Epoch 0/100, MSE 7.91252/0, Gradient 14.3324/1e-010
```

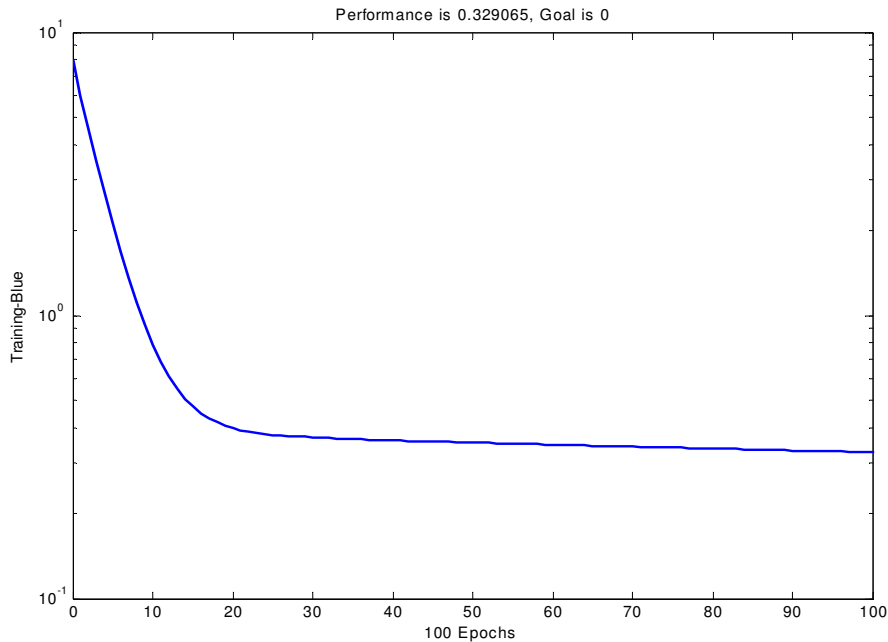
```
TRAINGD, Epoch 25/100, MSE 0.378383/0, Gradient 0.465364/1e-010
```

```
TRAINGD, Epoch 50/100, MSE 0.35558/0, Gradient 0.252343/1e-010
```

```
TRAINGD, Epoch 75/100, MSE 0.341115/0, Gradient 0.229007/1e-010
```

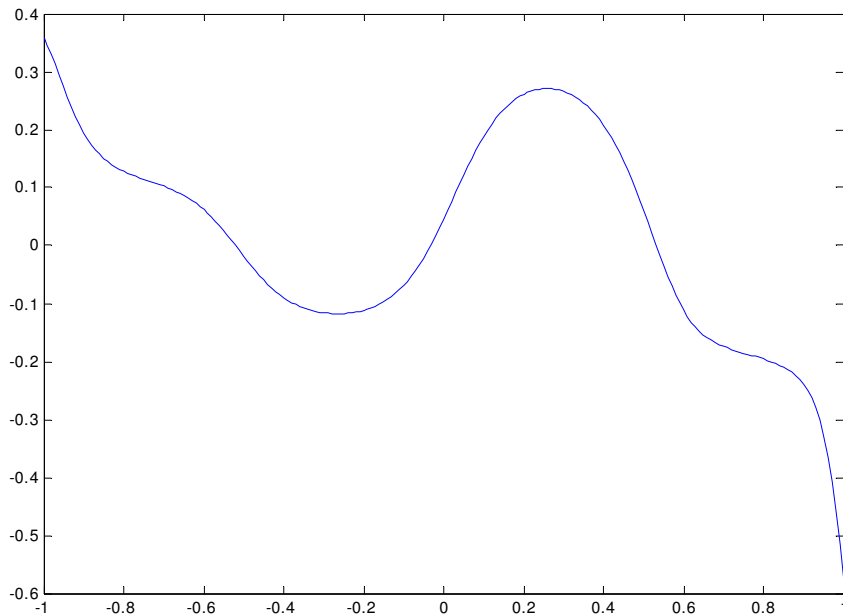
```
TRAINGD, Epoch 100/100, MSE 0.329065/0, Gradient 0.210247/1e-010
```

```
TRAINGD, Maximum epoch reached, performance goal was not met.
```



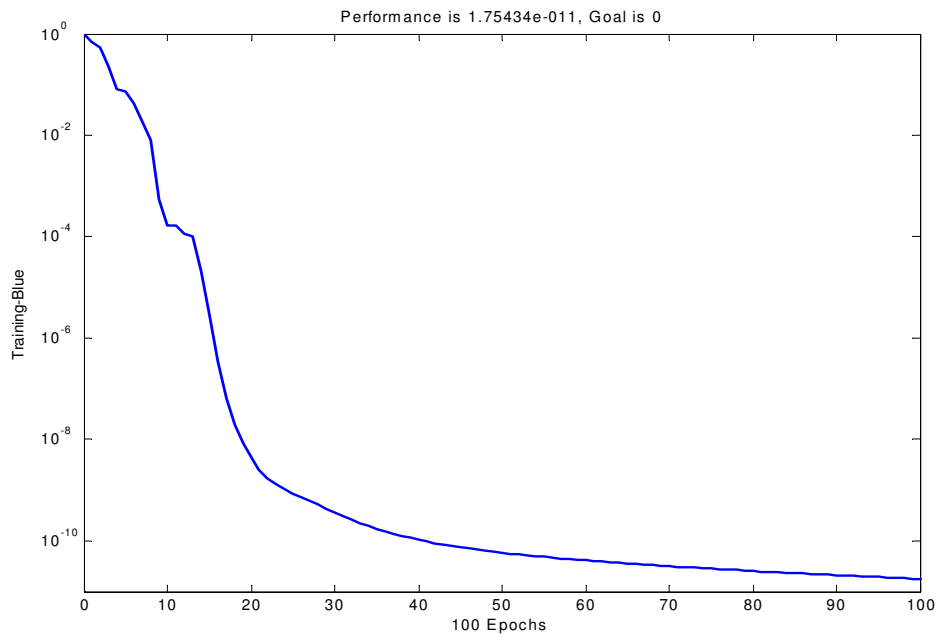
Stop Training

```
>> out=sim(Net2,P);
>> plot(P,out)
```



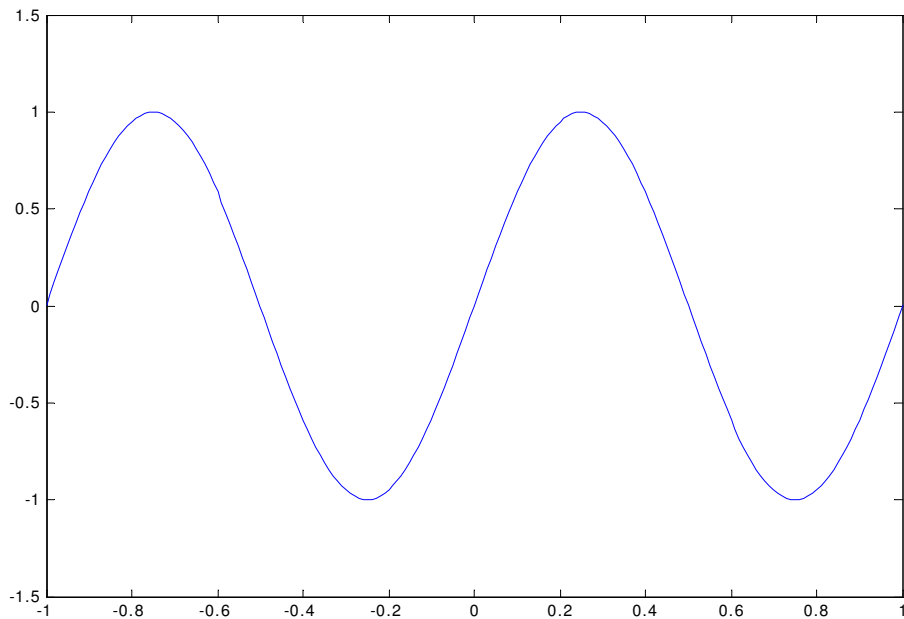
```
>> Net=newff([-1 1],[5 10 1],{'logsig','logsig','purelin'},'trainlm');
>> Net2=train(Net,T,P);
TRAINLM, Epoch 0/100, MSE 0.950262/0, Gradient 342.981/1e-010
TRAINLM, Epoch 25/100, MSE 8.71064e-010/0, Gradient 0.00853448/1e-010
TRAINLM, Epoch 50/100, MSE 5.82999e-011/0, Gradient 0.00154002/1e-010
TRAINLM, Epoch 75/100, MSE 2.83034e-011/0, Gradient 0.000704718/1e-010
```

TRAINLM, Epoch 100/100, MSE 1.75434e-011/0, Gradient 0.000417156/1e-010
TRAINLM, Maximum epoch reached, performance goal was not met.



Stop Training

```
>> out=sim(NeT2,P);  
>> plot(P,out)
```



XOR Problem:

```
>> Net=newff([0 1;0 1],[2 1],{'logsig','purelin'},'trainlm');  
>> P=[1 1 0 0;1 0 1 0]
```

P =

```
1 1 0 0
1 0 1 0
```

```
>> T=[0 1 1 0];
```

```
>> Net2=train(Net,P,T);
```

```
TRAINLM, Epoch 0/100, MSE 0.60726/0, Gradient 3.4996/1e-010
```

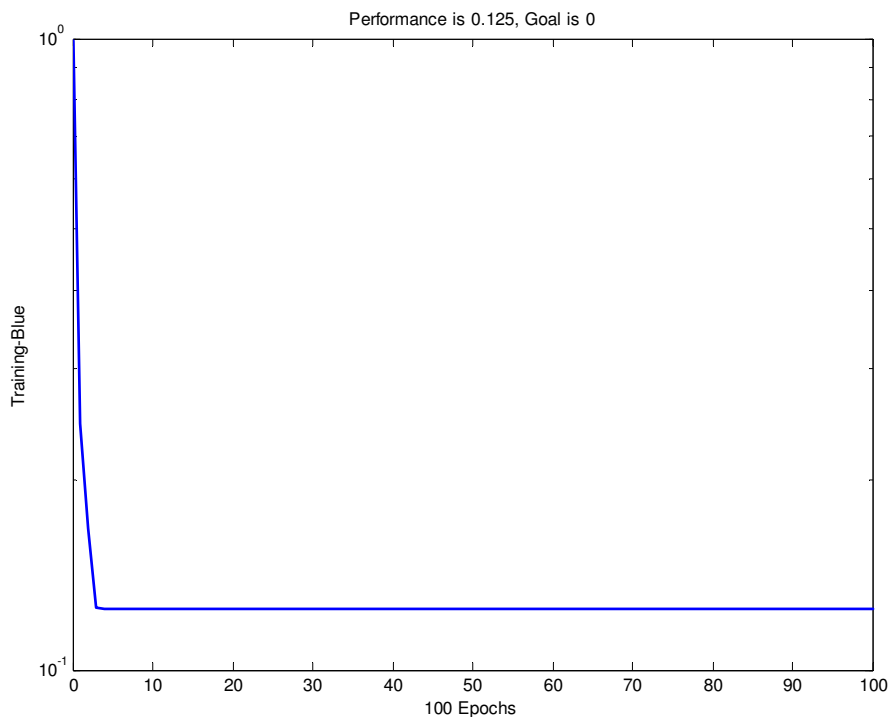
```
TRAINLM, Epoch 25/100, MSE 0.125003/0, Gradient 2.60498e-005/1e-010
```

```
TRAINLM, Epoch 50/100, MSE 0.125/0, Gradient 0.000136139/1e-010
```

```
TRAINLM, Epoch 75/100, MSE 0.125/0, Gradient 0.000176697/1e-010
```

```
TRAINLM, Epoch 100/100, MSE 0.124993/0, Gradient 0.00317179/1e-010
```

```
TRAINLM, Maximum epoch reached, performance goal was not met.
```



Stop Training

```
>> out=sim(Net2,P);
```

```
out =
```

```
0.0000 0.5000 0.9984 0.5000
```

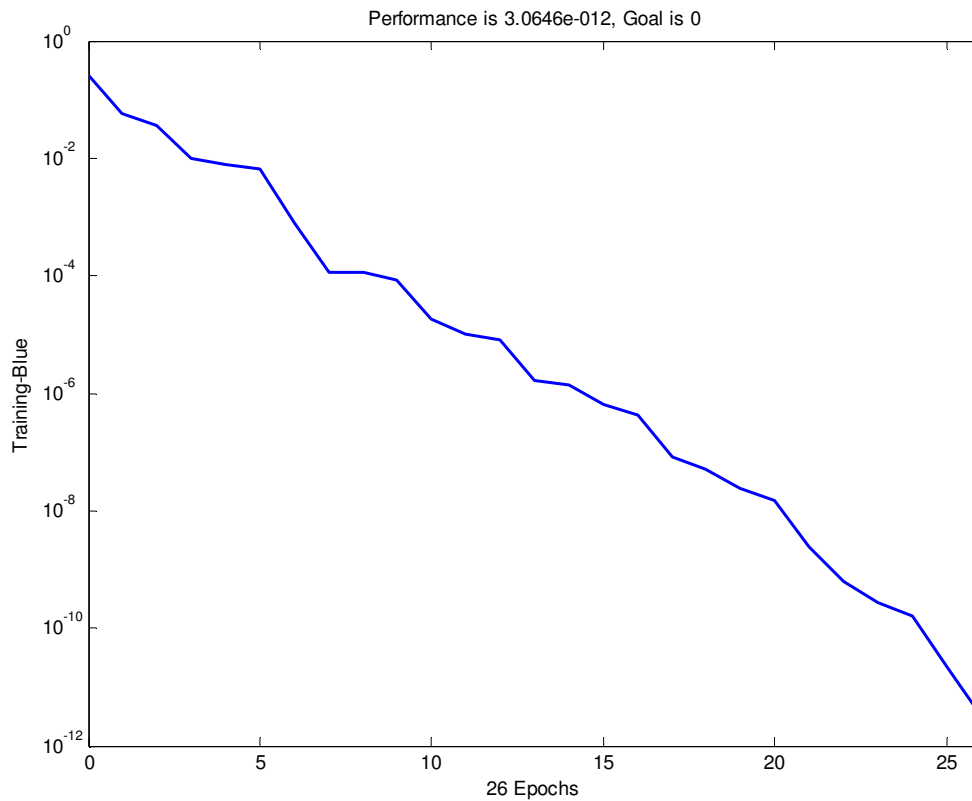
```
>> Net=newff([0 1;0 1],[2 1],{'logsig','logsig'},'trainlm');
```

```
>> Net2=train(Net,T,P);
```

```
TRAINLM, Epoch 0/100, MSE 0.443649/0, Gradient 0.352497/1e-010
```

```
TRAINLM, Epoch 17/100, MSE 1.45239e-011/0, Gradient 5.17889e-011/1e-010
```

```
TRAINLM, Minimum gradient reached, performance goal was not met.
```



Stop Training

```
>> out=sim(Net2,P)
```

out =

```
0.0000 1.0000 1.0000 0.0000
```

```
>> Net.IW{1,1}
```

ans =

```
-5.4858 -5.7119
7.6062 2.2059
```

```
>> Net.LW{2,1}
```

ans =

```
3.0971 4.6656
```

```
>> Net2.IW{1,1}
```

ans =

-11.1389 -11.1417
12.3838 12.3805

>> Net2.LW{2,1}

ans =

31.6764 37.8103

>> Net.b{1,1}

ans =

9.5587
-0.9463

>> Net2.b{1,1}

ans =

16.5079
-5.9014

>> Net.b{2,1}

ans =

-3.8814

>> Net2.b{2,1}

ans =

-50.4710