MathWorks

MATLAB&SIMULINK

Neural Network Toolbox

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- The Neural Network Toolbox makes the working with neural networks easier in Matlab.
- The toolbox consists of a set of structures and functions that we need to deal with neural networks .
- The toolbox saves us the time of writing the code to handle the neural network.
- Therefore, the user will concern about the ideas behind his NN rather than programing .

- **Classification of linearly separable data with a perceptron**

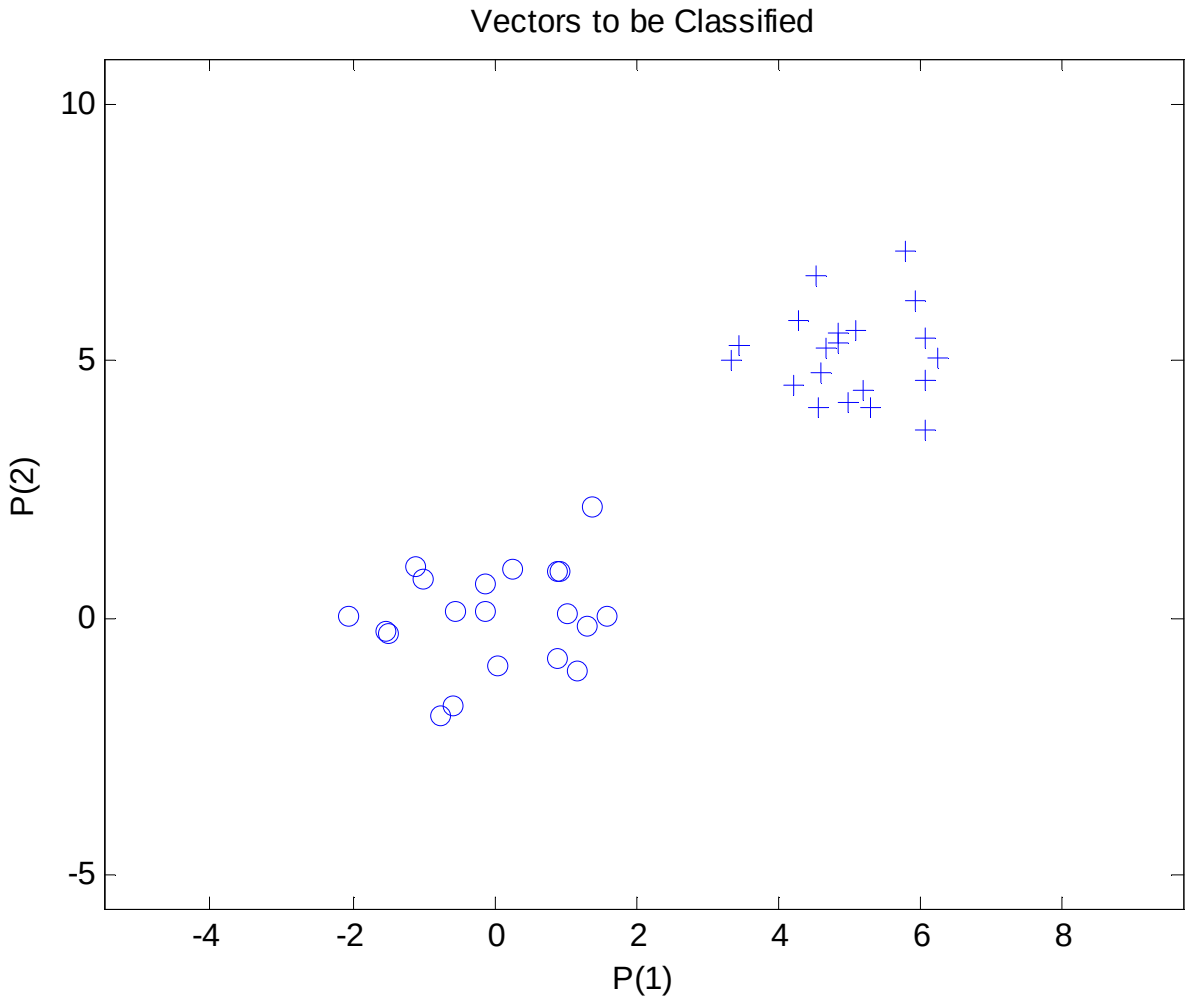
PROBLEM DESCRIPTION:

Two clusters of data, belonging to two classes, are defined in a 2-dimensional input space. Classes are linearly separable.

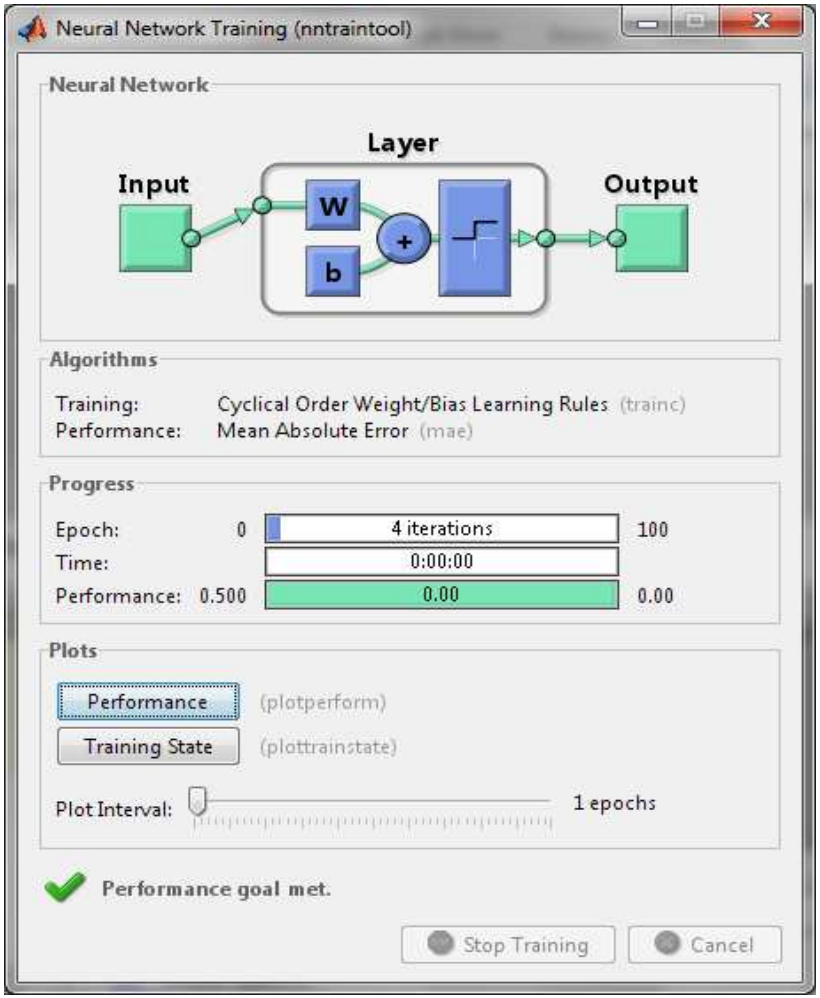
THE TASK:

To construct a Perceptron for the classification of data.

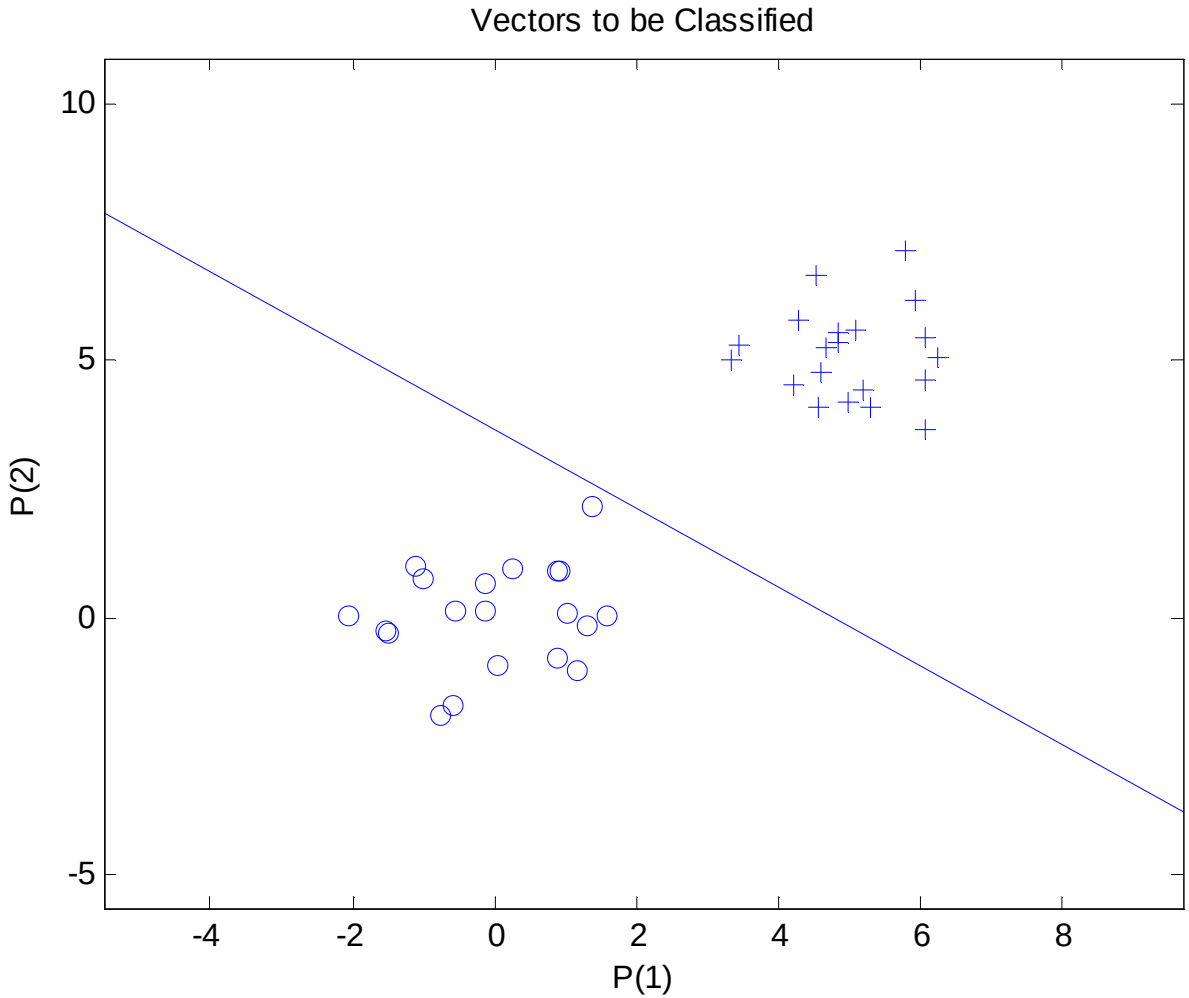
- **Classification of linearly separable data with a perceptron**



- # Classification of linearly separable data with a Single Layer Perceptron



- **Classification of linearly separable data with a perceptron**



- **Classification of linearly separable data with a perceptron**

Java Applet

- **Using a 2-Neuron perceptron to solve a 4-Class classification problem**

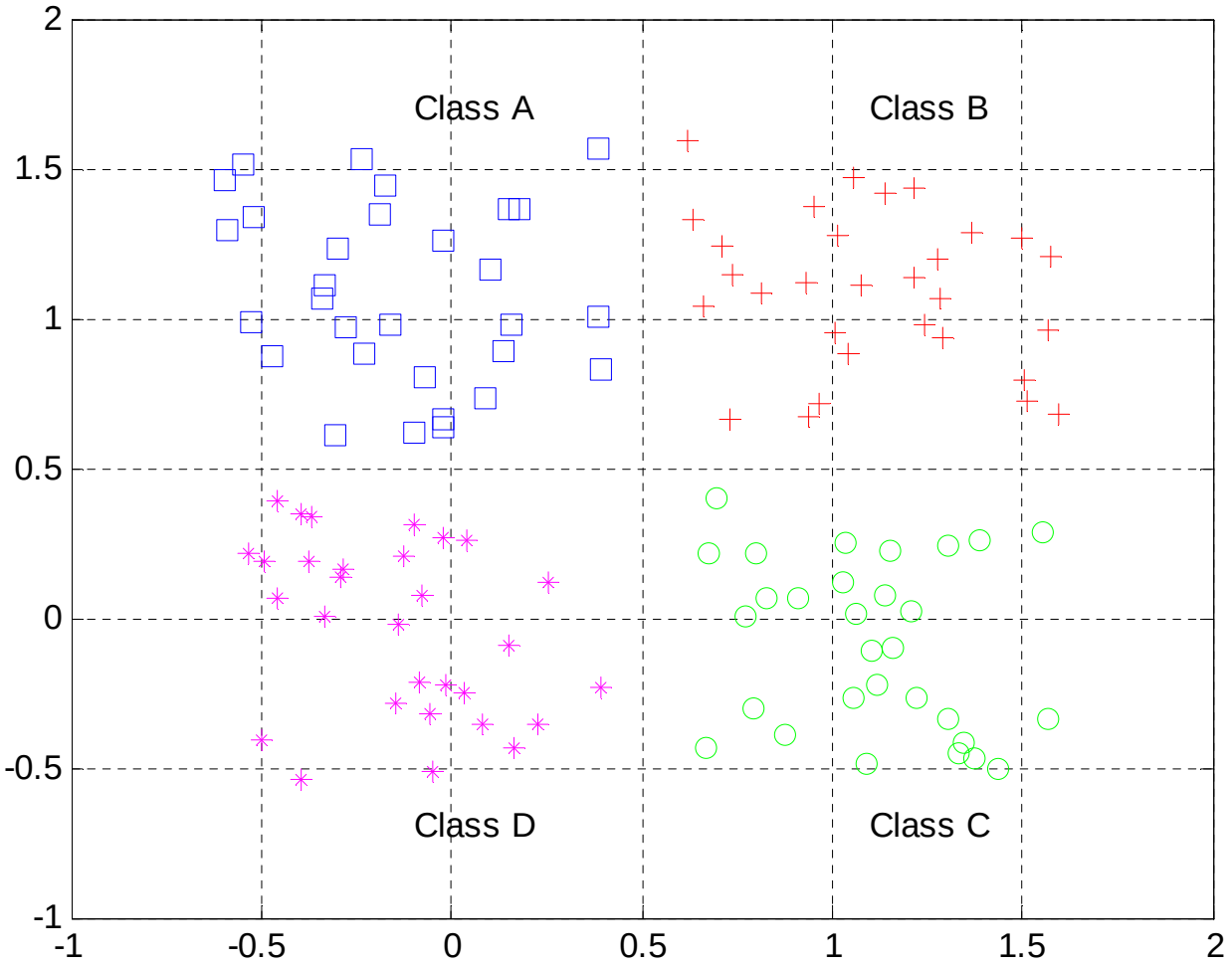
PROBLEM DESCRIPTION:

To classify input vectors into 4 classes using perceptron with 2- inputs and 2- outputs.

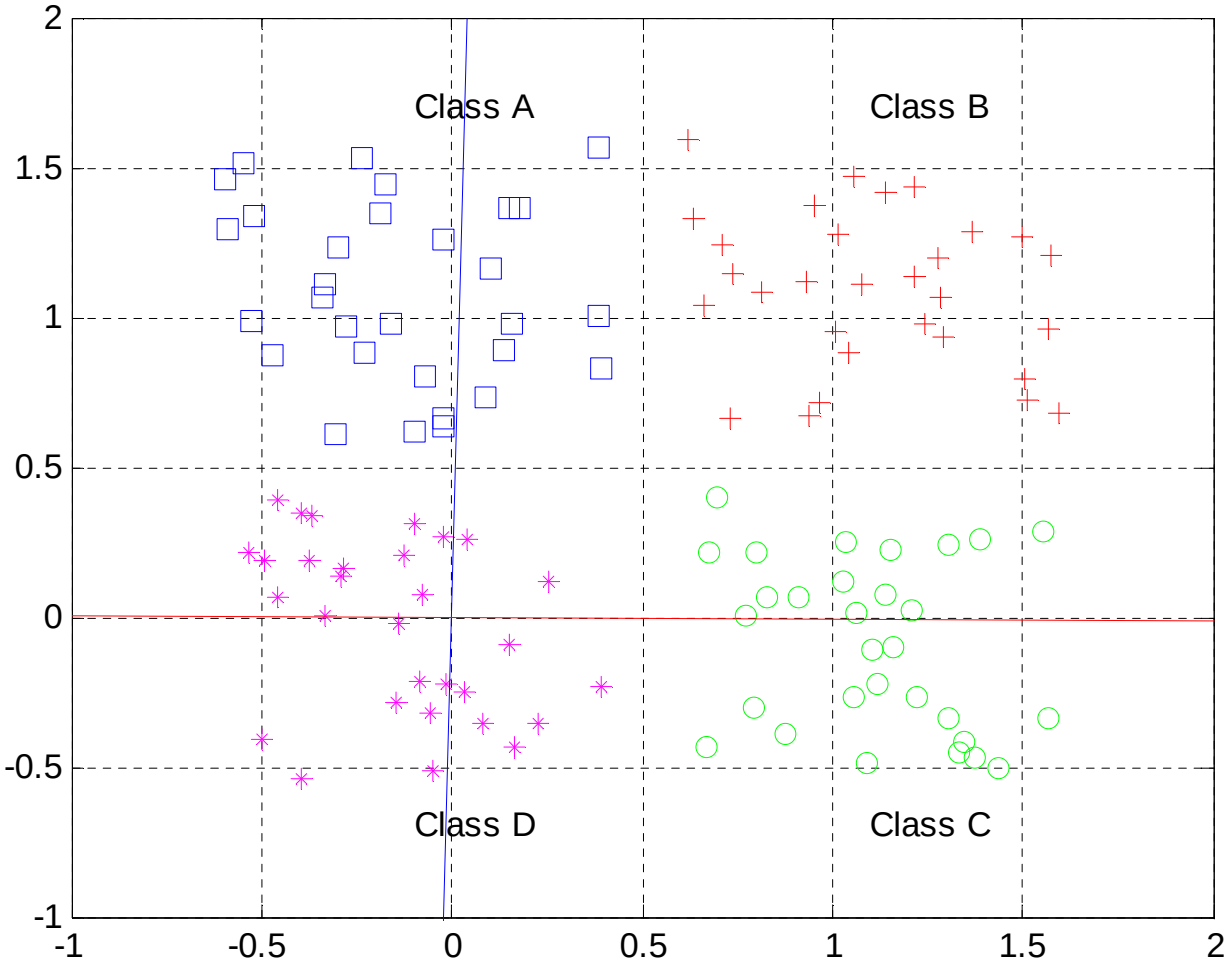
THE TASK:

To construct Multi-Input-Multi-Output perceptron for the classification of data.

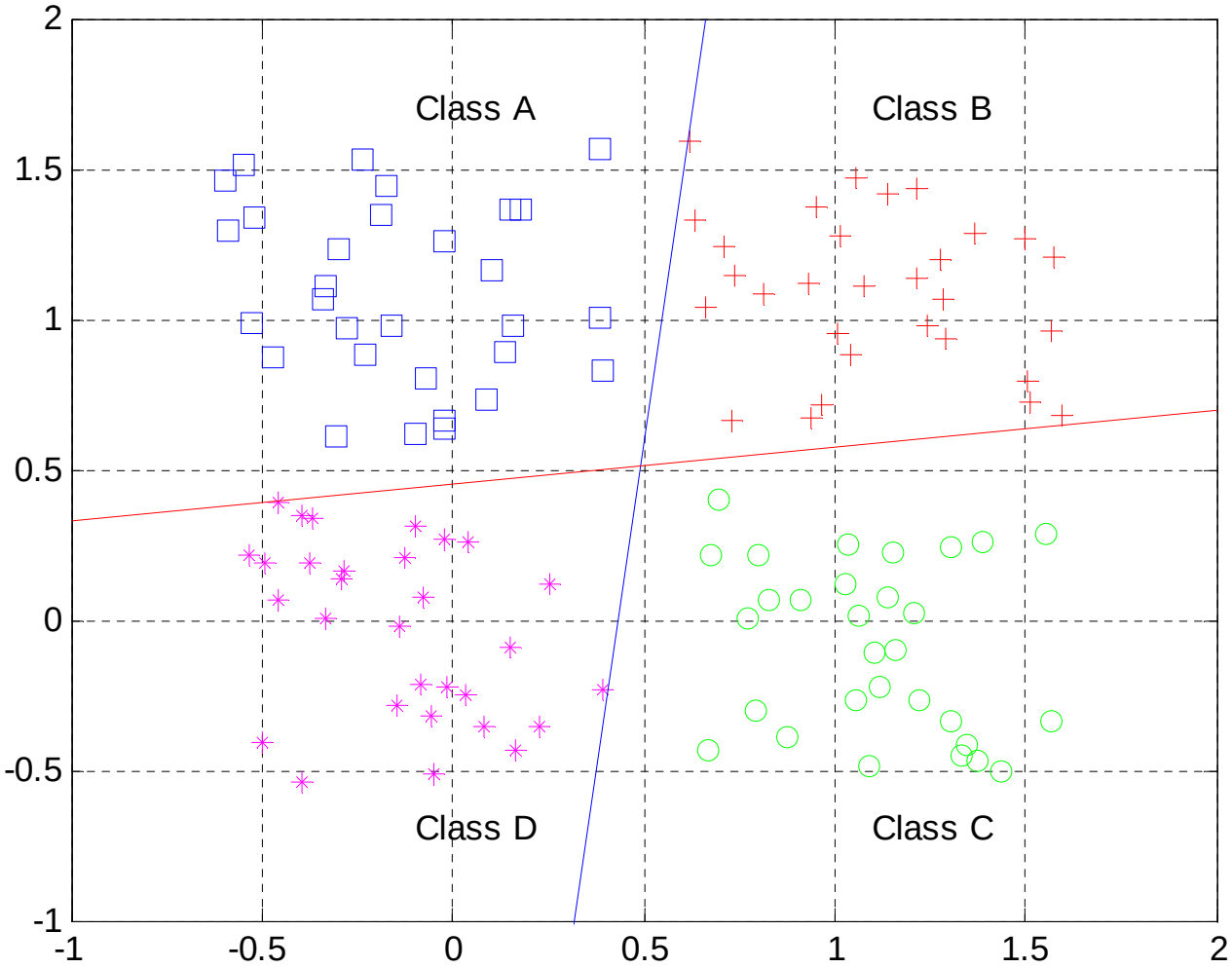
- # Using a 2-Neuron perceptron to solve a 4-Class classification problem



- # Using a 2-Neuron perceptron to solve a 4-Class classification problem



- # Using a 2-Neuron perceptron to solve a 4-Class classification problem



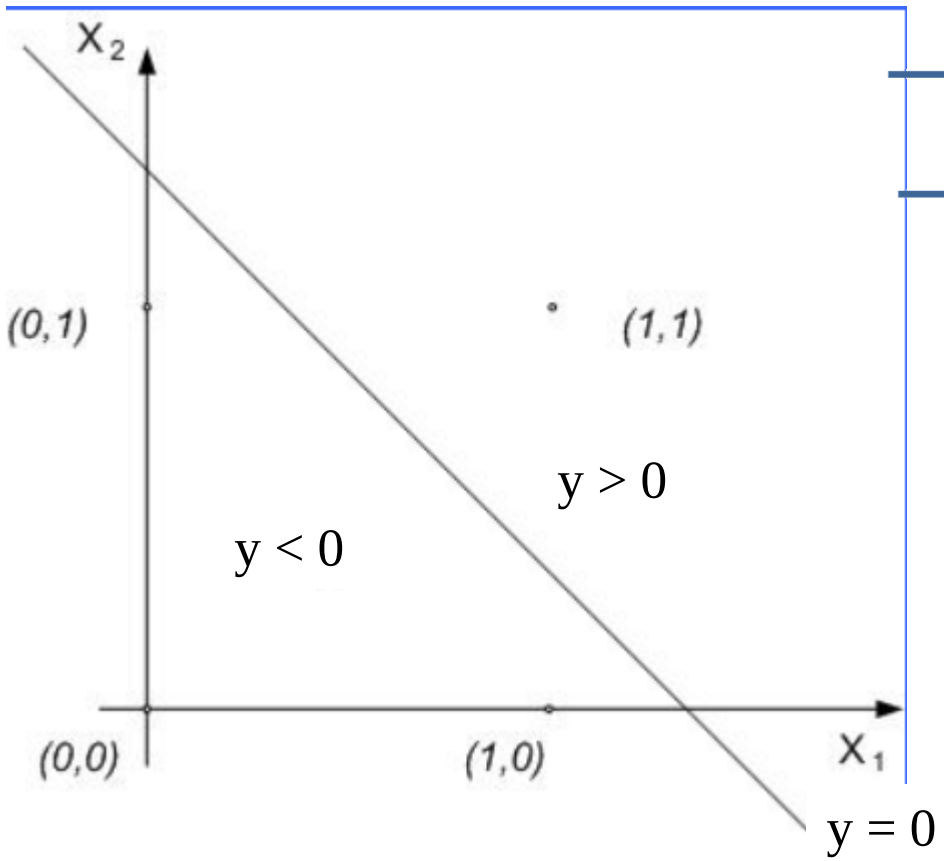
- # Using a 2-Neuron perceptron to solve a 4-Class classification problem

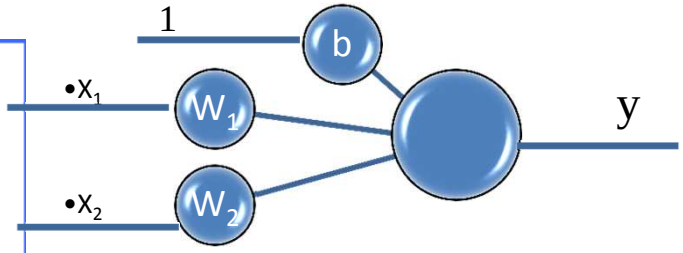
```
%% How to use the trained perceptron
% For example, classify an input vector of [0.7; 1.2].
in = [0.7; 1.2];
class = sim(net,in)
```

```
>> in = [0.7; 1.2];
class = sim(net,in)
class =
     1
     1
>>
```

• XOR Problem

• Review

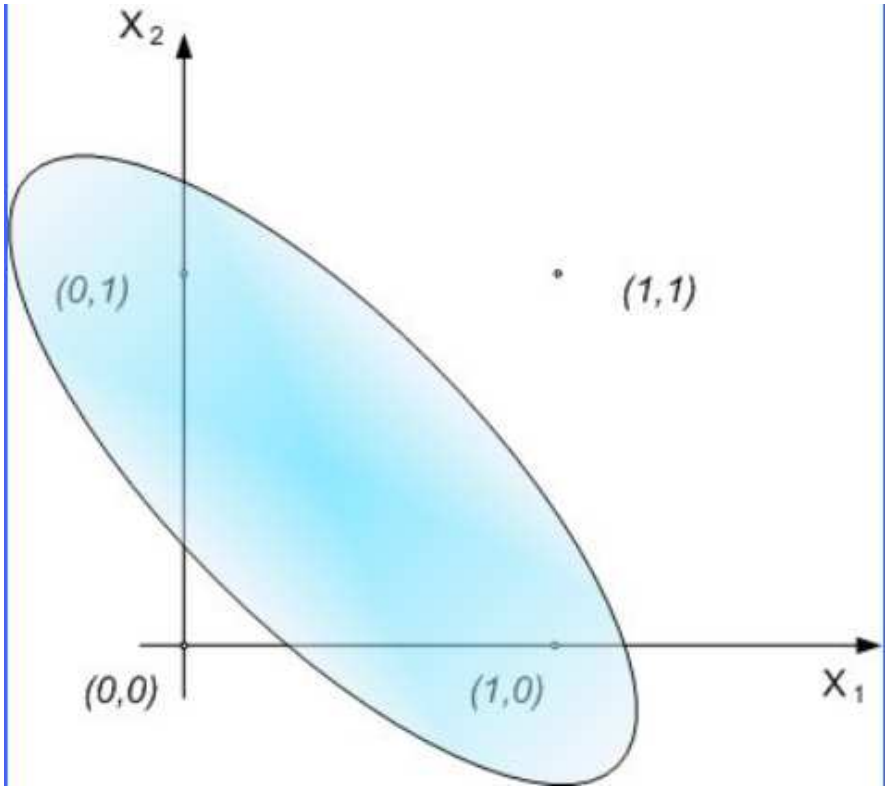




X_1	X_2	y
0	0	0
0	1	0
1	0	0
1	1	1

• XOR Problem

- **It is impossible to find a line which separates the data space**



X_1	X_2	y
0	0	0
0	1	1
1	0	1
1	1	0

- **Classification of an XOR problem with a multilayer perceptron**

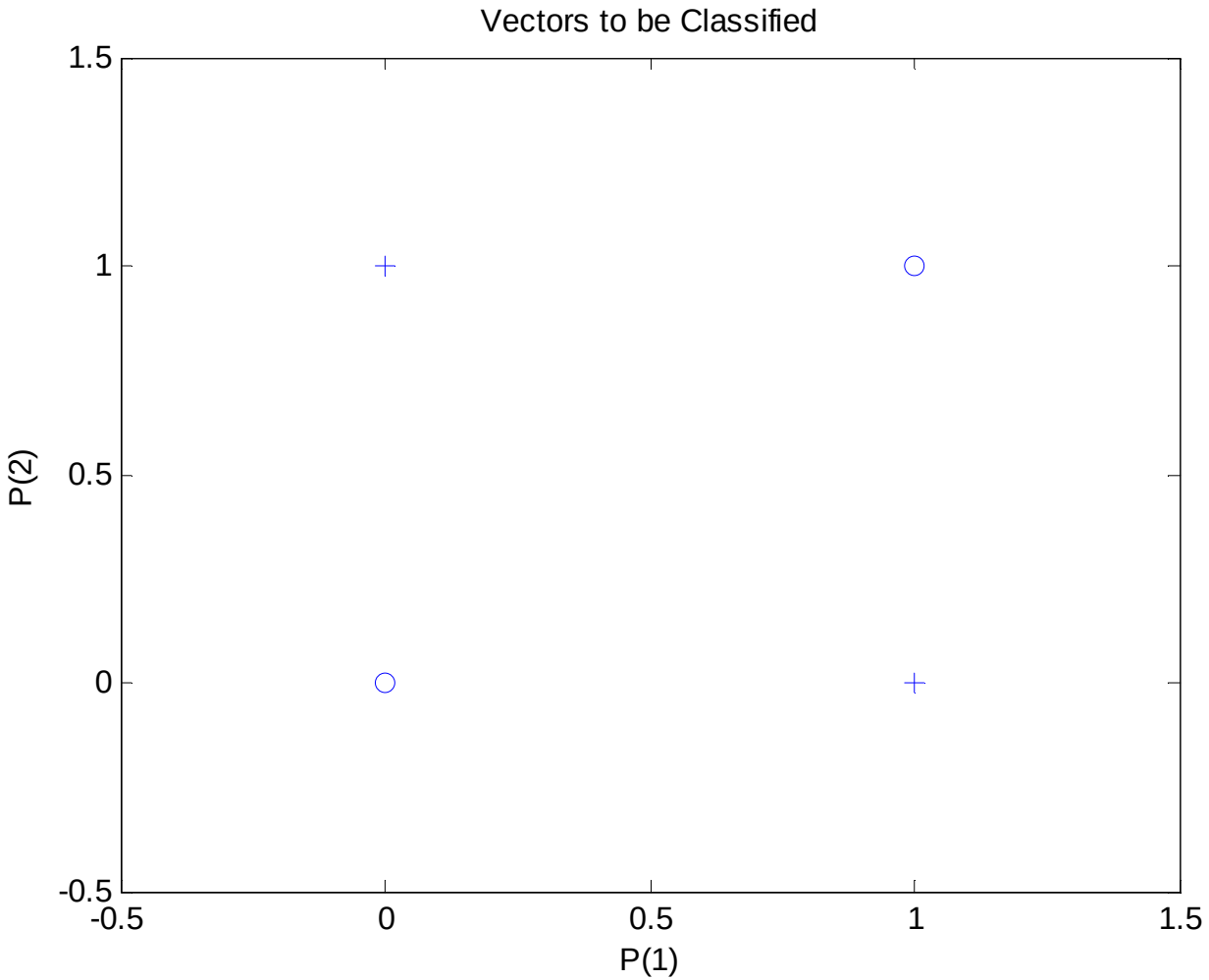
PROBLEM DESCRIPTION:

Clusters of data are defined in a 2-dimensional input space to represent the XOR problem.

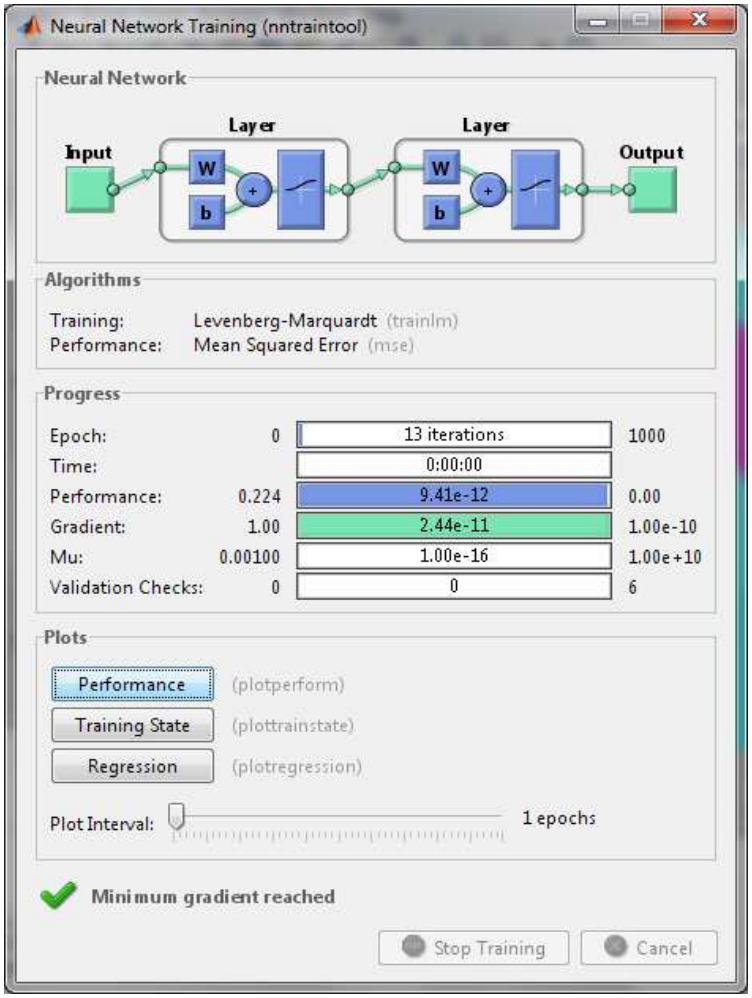
THE TASK:

To create a neural network that solves XOR problem.

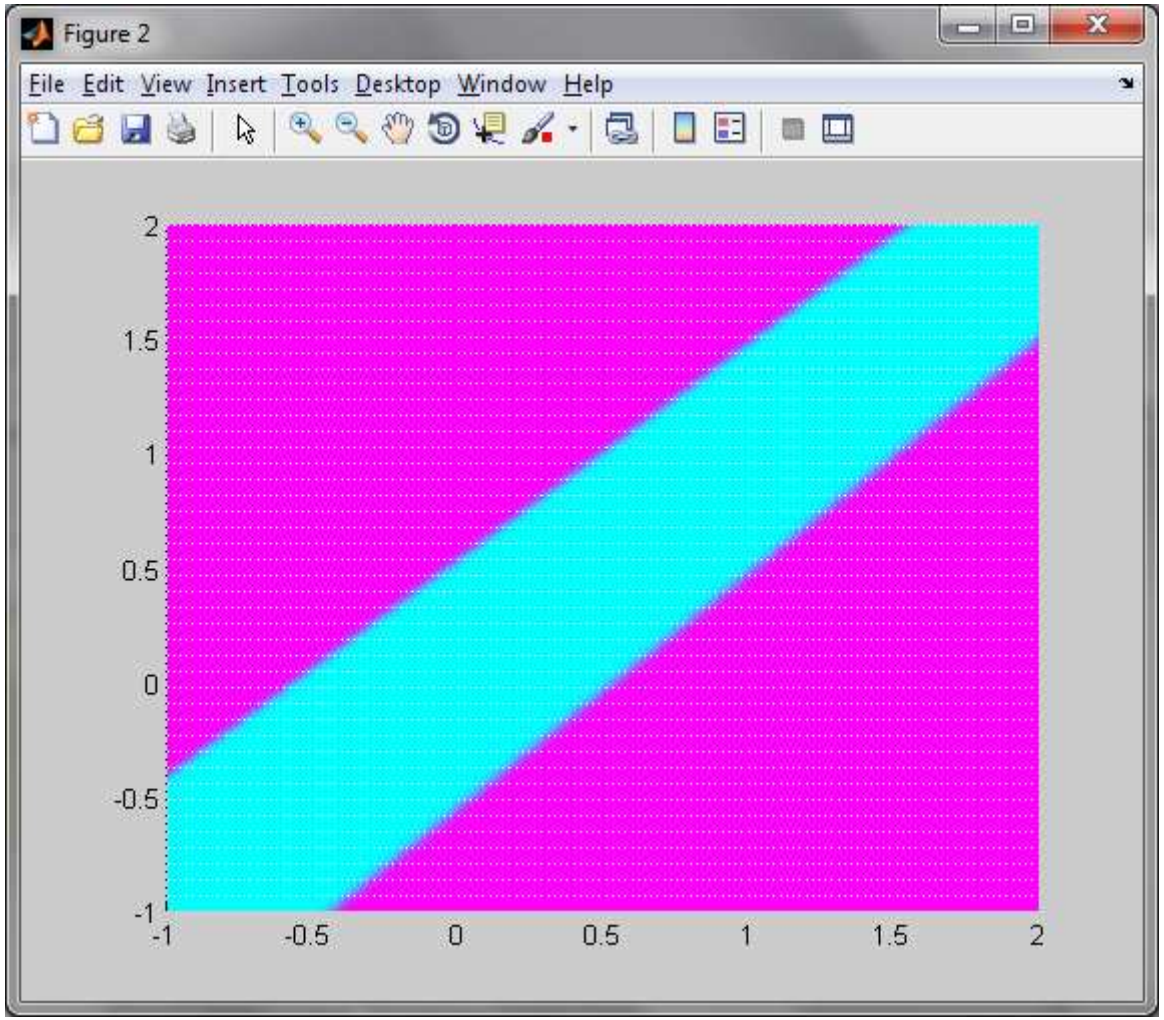
- # Classification of an XOR problem with a multilayer perceptron



- **Classification of an XOR problem with a multilayer perceptron**



- **Classification of an XOR problem with a multilayer perceptron**



- # Classification of an XOR problem with a multilayer perceptron

```
24
25      %% Simulate the Network
26 -    output = sim(net,input)
27
28      %% Examine the weights that the training algorithm has set
29 -    net.IW{1,1}
30 -    net.LW{2,1}
31
```

```
output =
    0.0000    1.0000    1.0000    0.0000
ans =
    9.6589   -9.4132
  -10.4798   11.0915
ans =
   23.7249   25.1226
fx >>
```