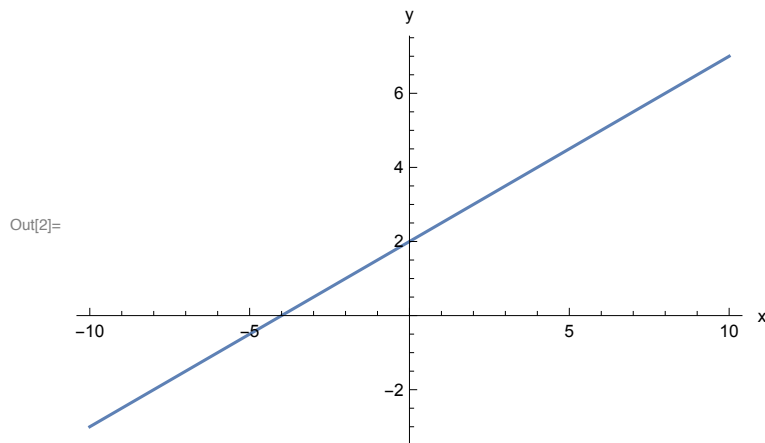


1st Example with support vector machine

In this Mathematica notebook we build a classifier (using SVMs) to classify data according to whether it lies above or below the following straight line:

```
In[1]:= f1[x_] := 0.5 x + 2
```

```
In[2]:= Plot[f1[x], {x, -10, 10}, AxesLabel -> {"x", "y"}]
```



First of all we need to generate some random data points

```
In[3]:= alldata[n_] := RandomReal[{-10, 10}, {n, 2}]
```

We need to prepare a training data set:

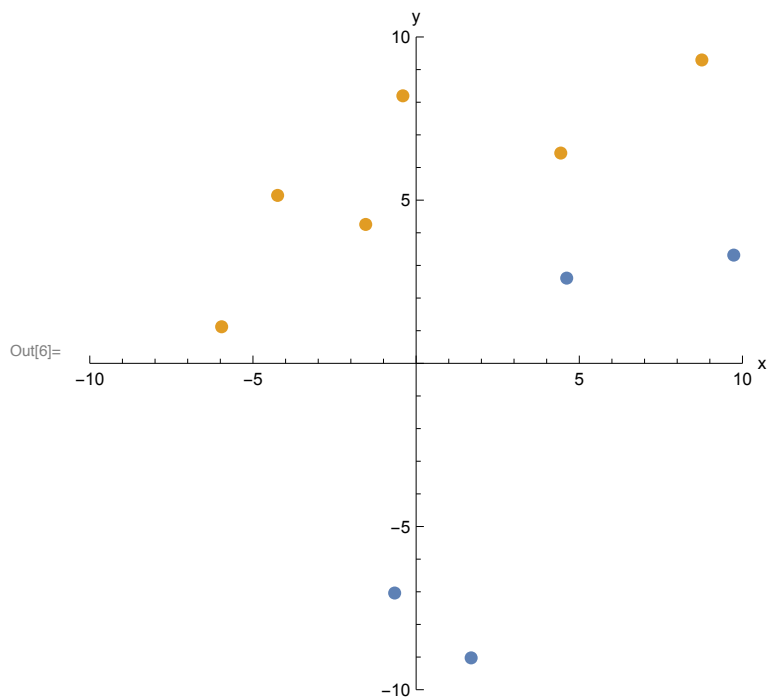
```
In[4]:= ts1[datax_] := Module[{data = datax}, data2 = {};  
  Do[If[(f1[data[[i, 1]]] - data[[i, 2]]) ≥ 0, data2 = Append[data2, {data[[i]],  
    1}], data2 = Append[data2, {data[[i]], -1}]], {i, 1, Length[data]}];  
  data2]
```

The following separates the two classes:

```
In[5]:= gb[datax_] := Module[{data = datax}, g = {};  
  b = {};  
  Do[If[data[[i, 2]] == 1, g = Append[g, data[[i, 1]]],  
    b = Append[b, data[[i, 1]]]], {i, 1, Length[data]}];  
  {g, b}]
```

We can look at our data sets:

```
In[6]:= ListPlot[gb[ts1[alldata[10]]], PlotRange → {{-10, 10}, {-10, 10}},
  AspectRatio → 1, AxesLabel → {"x", "y"}, PlotStyle → PointSize[0.02]]
```



Classify the data (using 100 data points):

```
In[7]:= data100 = alldata[100];
s1 = gb[ts1[data100]][[1]];
s2 = gb[ts1[data100]][[2]];

In[10]:= c = Classify[<|Yellow → s1, Blue → s2|>,
  Method → {"SupportVectorMachine", "KernelType" → "Linear"}]
```

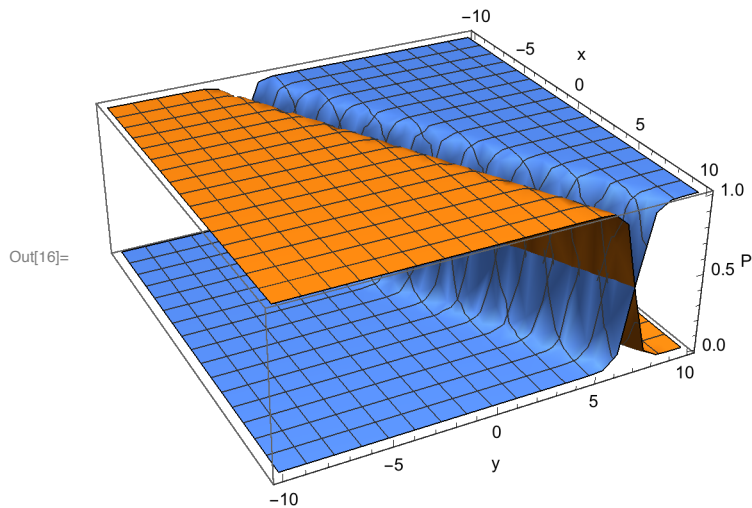
Out[10]= ClassifierFunction [ Input type: NumericalVector (length: 2)
Classes: , ]

We can take a look at the probability distributions:

```

In[16]:= Plot3D[{
  c[{x, y}, "Probability" → Yellow],
  c[{x, y}, "Probability" → Blue]
},
{x, -10, 10}, {y, -10, 10},
Exclusions → None, AxesLabel → {"x", "y", "P"}]

```



OK, how does this look like when we look at a data set with only 10 points:

```

In[32]:= data10 = alldata[10];
s1 = gb[ts1[data10]][[1]];
s2 = gb[ts1[data10]][[2]];
c10 = Classify[<|Yellow → s1, Blue → s2|>,
  Method → {"SupportVectorMachine", "KernelType" → "Linear"}]

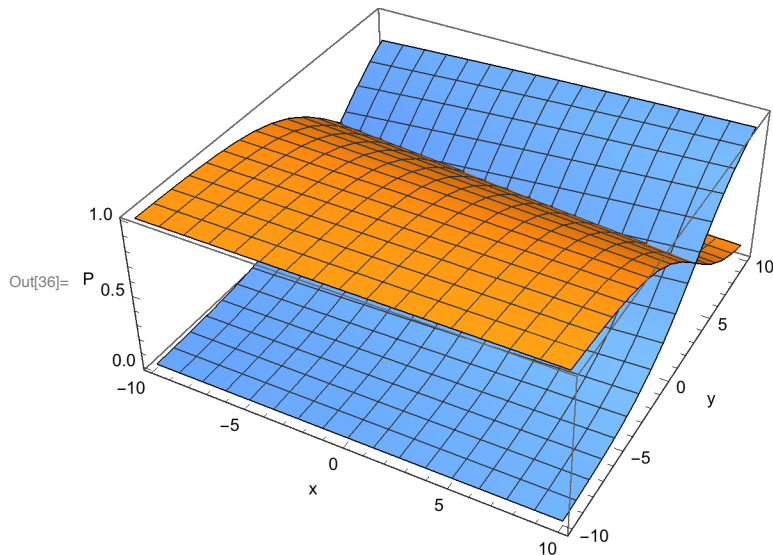
```

Out[35]= ClassifierFunction [ Input type: NumericalVector (length: 2)
Classes: , ]

```

In[36]:= Plot3D[{
  c10[{x, y}, "Probability" → Yellow],
  c10[{x, y}, "Probability" → Blue]
},
{x, -10, 10}, {y, -10, 10},
Exclusions → None, AxesLabel → {"x", "y", "P"}]

```



Let's compare 10, 100, 1000 data points:

```

In[27]:= data1000 = alldata[1000];
s1 = gb[ts1[data1000]][[1]];
s2 = gb[ts1[data1000]][[2]];
c1000 = Classify[<|Yellow → s1, Blue → s2|>,
  Method → {"SupportVectorMachine", "KernelType" → "Linear"}]

```

Out[30]= ClassifierFunction [ Input type: NumericalVector (length: 2)
Classes: , ]

```

In[37]:= Plot3D[{
  c10[{x, y}, "Probability" → Yellow],
  c[{x, y}, "Probability" → Yellow], c1000[{x, y}, "Probability" → Yellow]
},
{x, -10, 10}, {y, -10, 10},
Exclusions → None, AxesLabel → {"x", "y", "P"}]

```

Out[37]=

