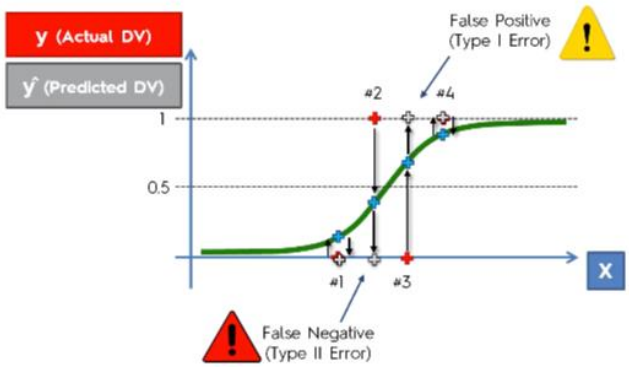
Evaluating Classification Models

1. False Positives vs False Negatives

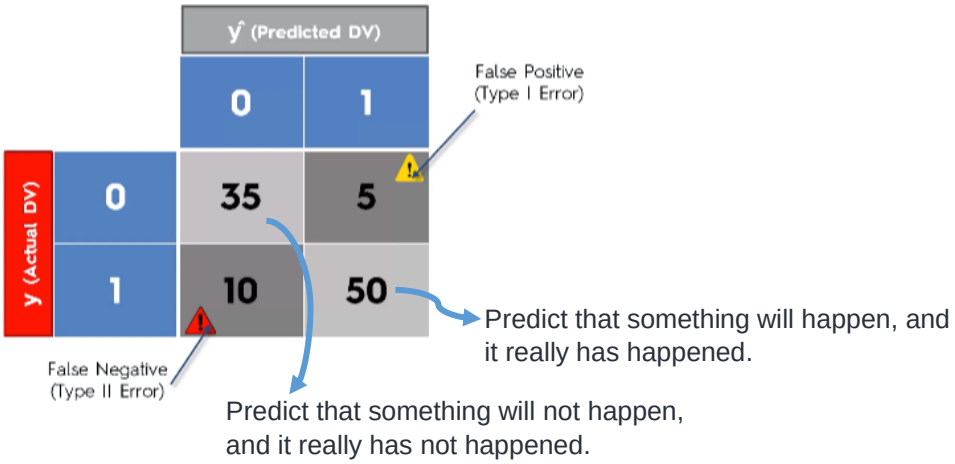
False Positives => I predicted that something was going to happen, but it has not happened.

False Negatives => I predicted that something was not going to happen, but it happened. Pay attention to the false negatives, so we try to reduce this value due to the negative impact in our models.



2. Confusion Matrix

In the matrix confusion the prediction results are positioned, both those that have been real and those that have not:



Other ratios:

- **Accurate Rate = Correct/Total**

  AR = 85/100 = 85%

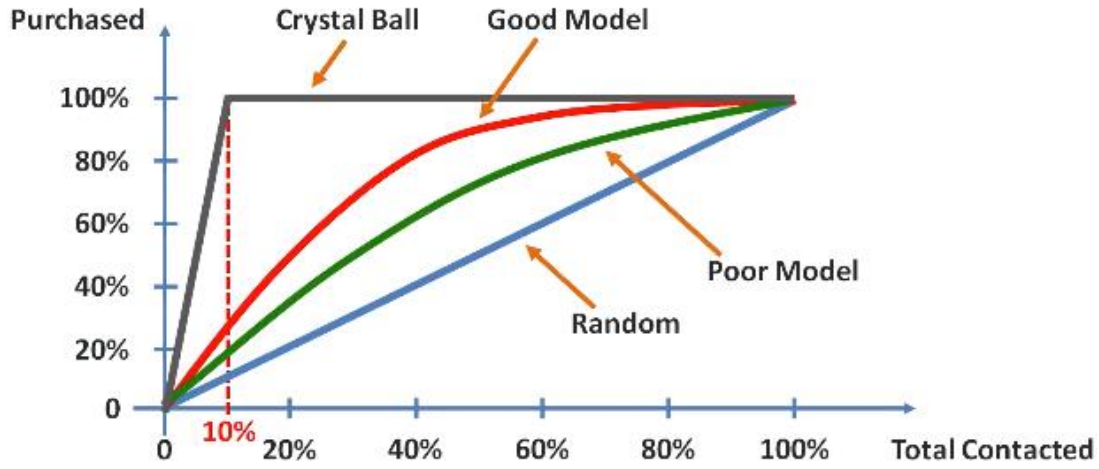
- **Error Rate = Wrong/Total**

  ER = 15/100 = 15%

3. Cumulative Accuracy Profile (CAP)

3.1 The concept

The CAP is the space between the red line and the blue line (the longer the space, the better the model).



Blue line => random selection process.

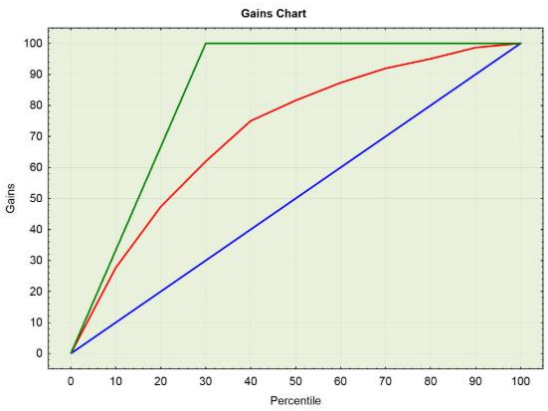
Green line => poor model (better than the random model, but it's not as good as the red line).

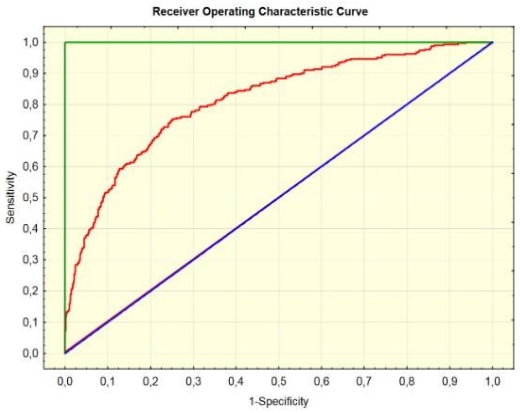
Red line => a good model.

Crystal Ball => the optimal model.

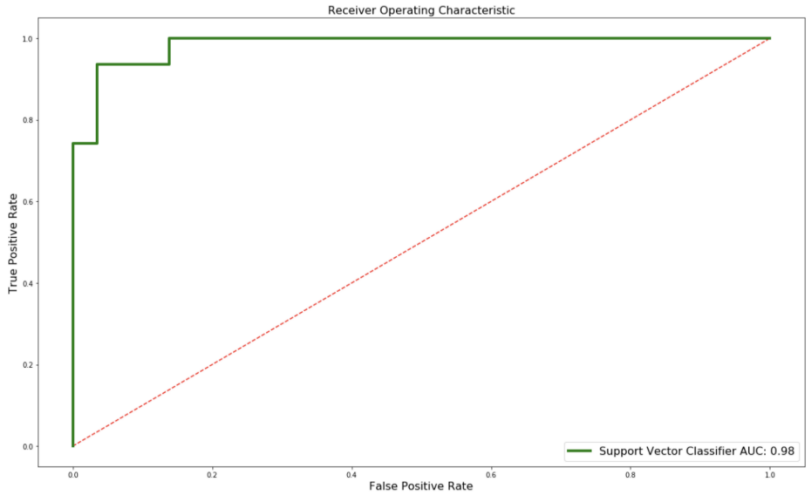
It is really important to know the difference between the CAP and the ROC:

CAP = Cumulative Accuracy Profile **ROC = Receiver Operating Characteristic**

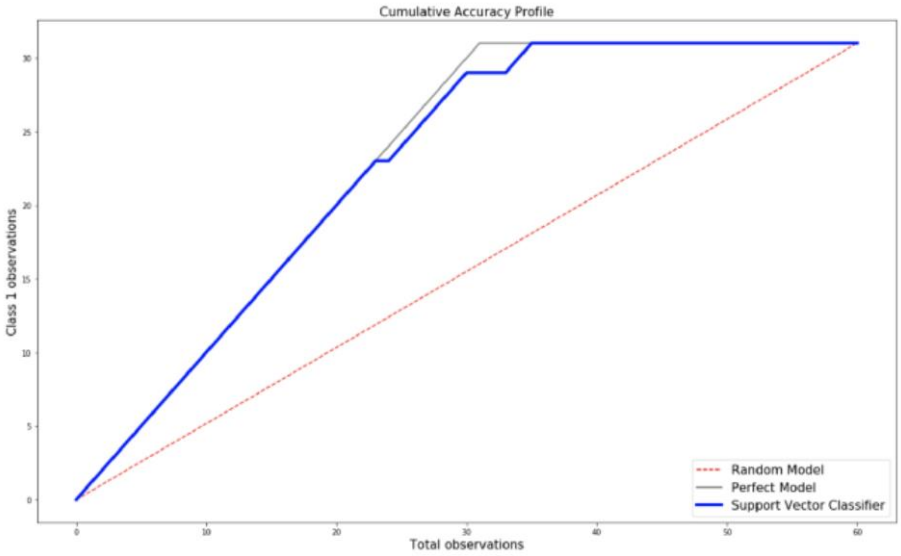




The Receiver Operating Characteristic curve (**ROC curve)** is an excellent method for measuring the performance of a Classification model. The **True Positive Rate** is plot against **False Positive Rate** for the probabilities of the classifier predictions. Then, the area under the plot is calculated:



The **Cumulative Accuracy Profile curve** (CAP curve) tries to analyse how to effectively identify all data points of a given class using minimum number of tries:

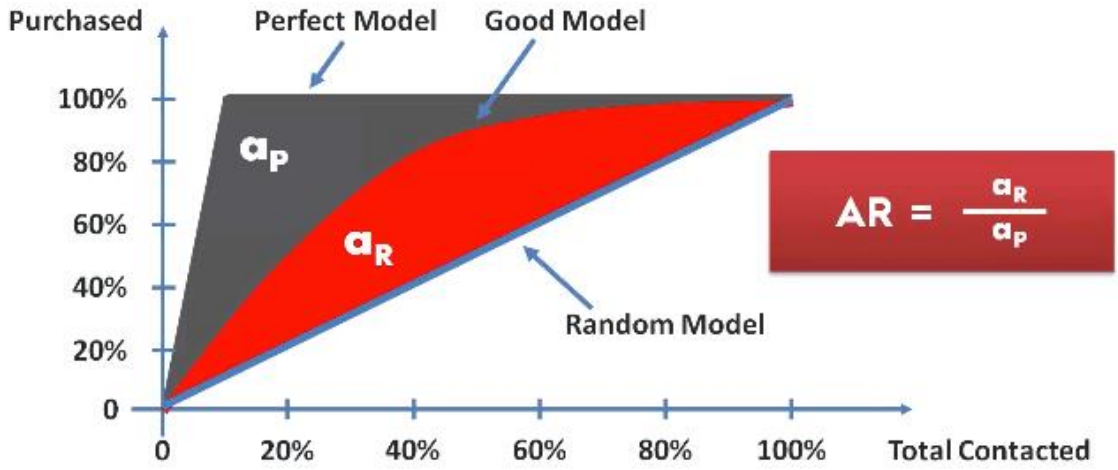


	Gains	ROC
X axis:	$\frac{count\ TP + count\ FP}{count\ all\ observations}$	$\frac{count\ FP}{count\ TN + count\ FP}$
Y axis:	$\frac{count\ TP}{count\ TP + count\ FN}$	$\frac{count\ TP}{count\ TP + count\ FN}$

3.2 CAP Analysis

There is a standard approach to calculate the accuracy ratio. In order to achieve it, you have to take the area under the perfect model or the perfect line, which is colour in gray here and it's called “ap”.

Then, you need to take that area under the red line called “ar”, which is coloured in red, and you need to divide one by the other.



Let’s analyse the results:

AR close to 1 => good
AR close to 0 => bad

More analysis and calculations to keep in mind: