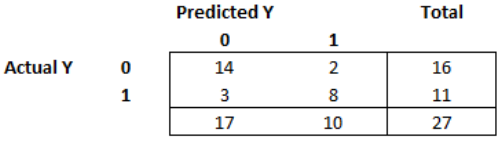
7.4 Logistic Regression - Model Evaluation

Tuesday, 08 November 2022 17:39

Summary	• Measures to evaluate the performance of the model
	Evaluation of the Model How do we judge whether this logistic regression model is a good? • Typical statistical indicators: (generally based on the Log-likelihood) – deviance, R^2, and information criteria (Akaike, and Baye's). • Some of them have a threshold (often χ^2 based statistic) or sometime it is higher-the-better type (e.g. R^2). • Other performance indicators: (generally based on correct identification) – Accuracy, Precision, Recall. • Obviously, they are all large-the-better type performance indicators.
• What measures do we use in Logistic Regression to evaluate the performance of the model?	**Evaluation of the Model** • ***Accuracy***: Measure of the total number of predictions a model gets right, including both True Positives and True Negatives. • ***Recall:*** Indicates the percentage of the response values (that we are interested in) were actually captured by the model. • ***Precision***: Measures the percentage of the predicted response values (that we are interested in) that were correct.
• To understand the formulae better, see 7.6 page.	**Evaluation of the Model** For the student placement example, the response variable was binary (and we were interested in the chances of student getting placed, $Y = 1$). The performance measures can be interpreted as: • Accuracy: The ratio of the number of times predicted and actual Y values matched (for both $Y = 0$ and $Y = 1$) to the total observations in the sample. • Recall: The ratio of the number of times the prediction for Y was 1, to the total number of instances in the sample where Y was actually 1. • Precision: The ratio of the number of times the actual Y was 1, to the total number of instances where the prediction for Y was 1. • For better understanding, refer here. • We want these values as large as possible to conclude that the model is good.
	
	At Cut off = 0.5, we get these values of the performance indicators: **Accuracy** 81.48% **Recall** 72.73% **Precision** 80.00%

	Predicted Y		Total
	0	1	
Actual Y 0	14	2	16
1	3	8	11
	17	10	27

$$\text{Accuracy} = \frac{14+8}{27}$$

	Predicted Y		Total
	0	1	
Actual Y 0	14	2	16
1	3	8	11
	17	10	27

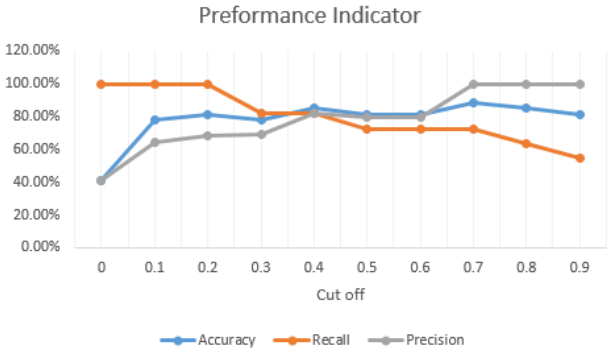
$$\text{Recall} = \frac{8}{11}$$

	Predicted Y		Total
	0	1	
Actual Y 0	14	2	16
1	3	8	11
	17	10	27

$$\text{Precision} = \frac{8}{10}$$

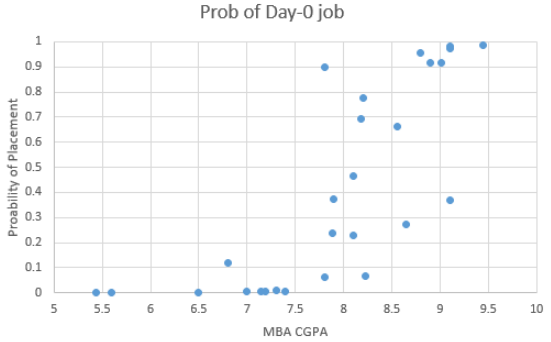
So, to predict the appropriate cut-off, we try different numbers and observe which cut off gives us the best values of the performance indicators

Cut off	Accuracy	Recall	Precision
0	40.74%	100.00%	40.74%
0.1	77.78%	100.00%	64.71%
0.2	81.48%	100.00%	68.75%
0.3	77.78%	81.82%	69.23%
0.4	85.19%	81.82%	81.82%
0.5	81.48%	72.73%	80.00%
0.6	81.48%	72.73%	80.00%
0.7	88.89%	72.73%	100.00%
0.8	85.19%	63.64%	100.00%
0.9	81.48%	54.55%	100.00%



It seems that 0.4 is the best cut-off choice for the given data.

Here probability vs. MBA CGPA graph is plotted.



It tells something I don't have the energy to care about.

Something about since $b1$ is some value that's why we're seeing this kind of graph.