

Classification Metrics

Machine Learning Course

Dataset: Iris



Versicolor



Virginica



Setosa

Dataset: Iris

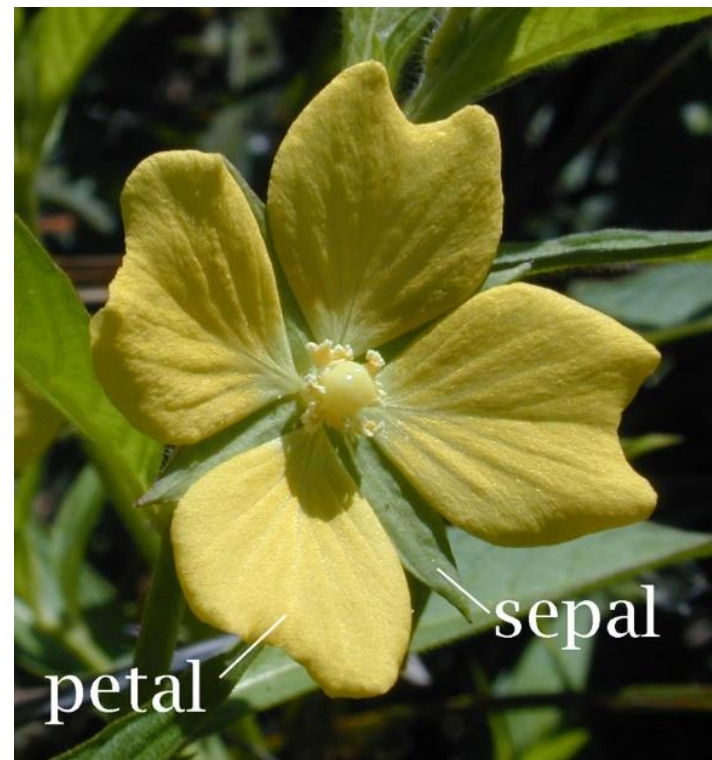
- Versicolor: 50 Samples
- Virginica: 50 Samples
- Setosa: 50 Samples

Total: 150 Samples

- 4 Features (**Sepal Length, Sepal Width, Petal Length, Petal Width**)

Dataset: Iris

(Sepal Length, Sepal Width, Petal Length, Petal Width)



Dataset: Iris



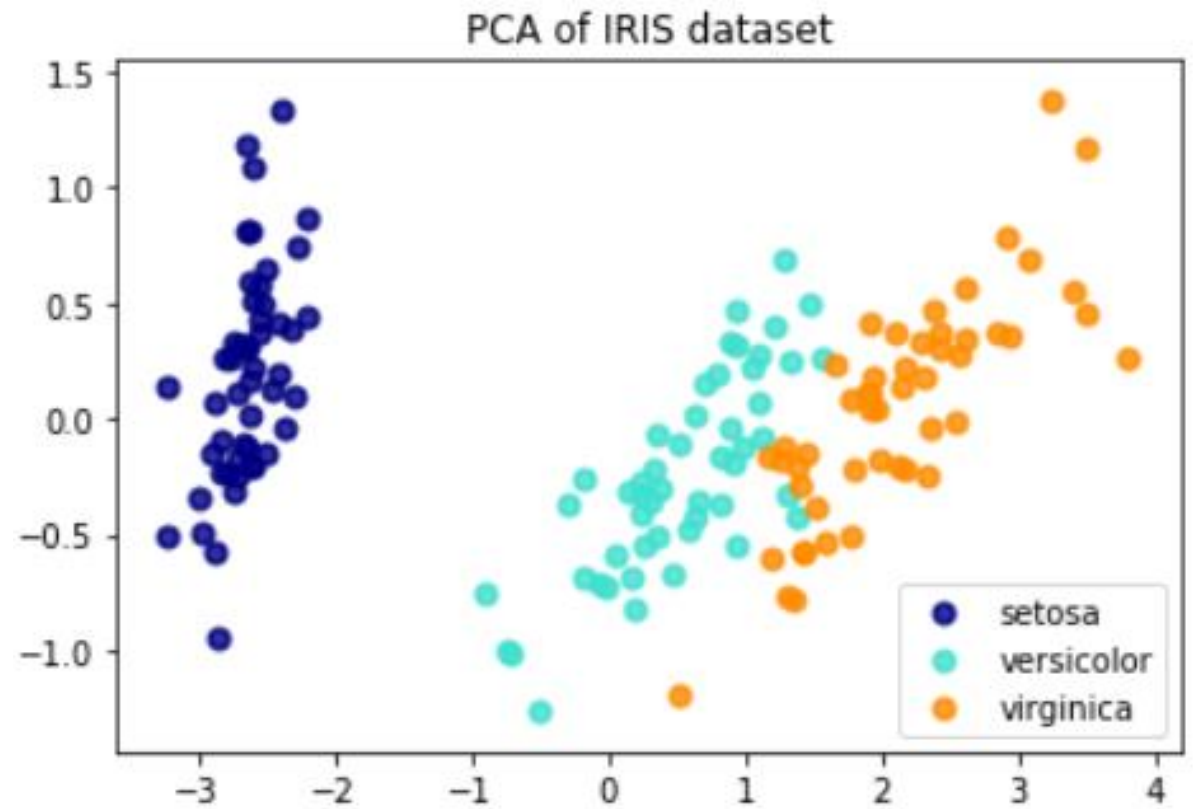
Versicolor



Virginica



Setosa



Binary Classification

- 100 Samples



Versicolor



Virginica

Binary Classification

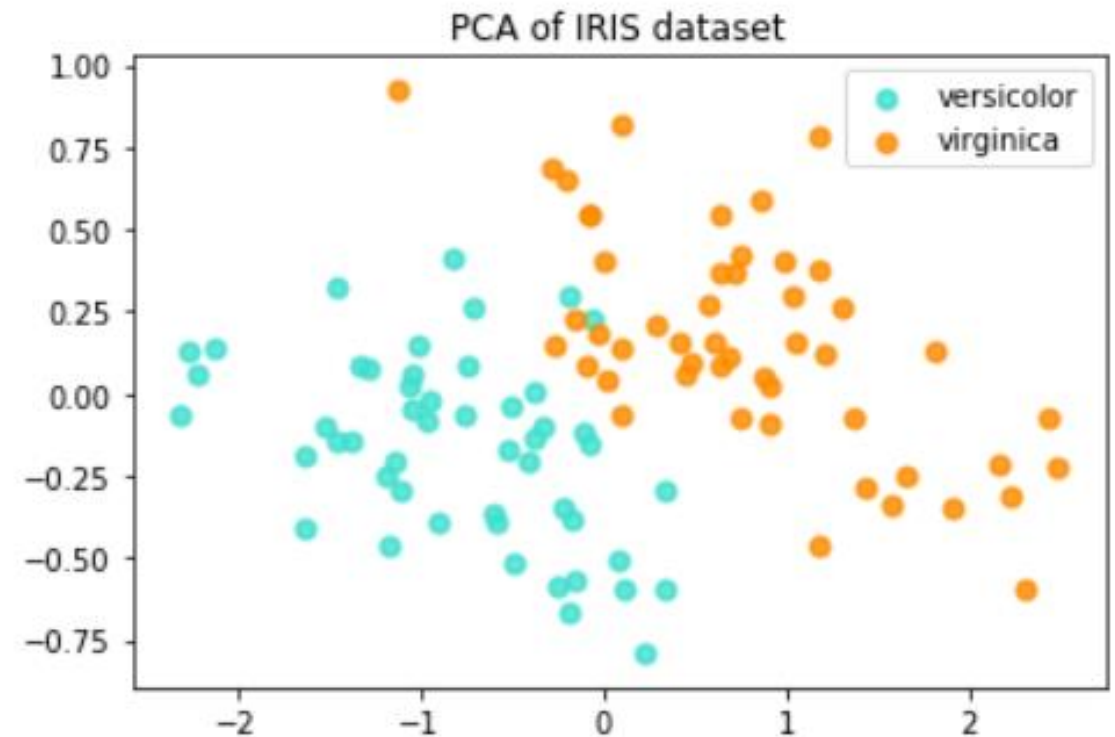
- 100 Samples



Versicolor

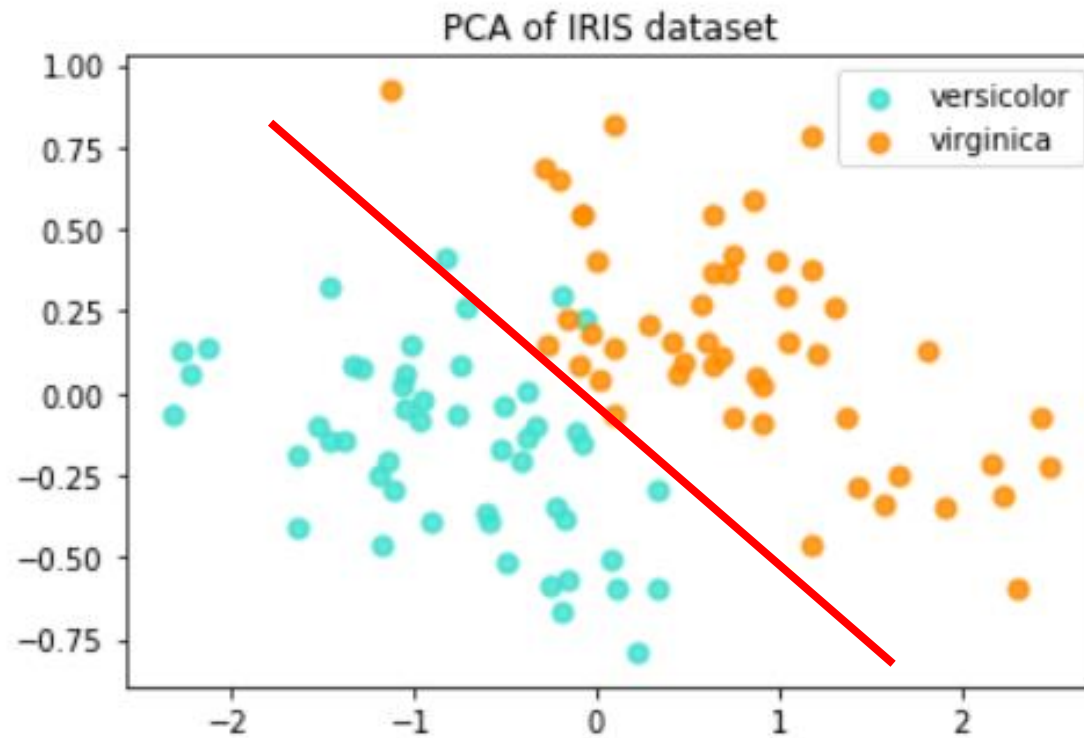


Virginica



Binary Classification

- Logistic Regression



Classification Metrics

- Accuracy
- Precision
- Recall
- F1-Score
- ROC and AUC

Classification Metrics

- Confusion Matrix

		Predicted class	
		P	N
Actual Class	P	True Positives (TP)	False Negatives (FN)
	N	False Positives (FP)	True Negatives (TN)

Classification Metrics

- Accuracy
 - $(TP + TN) / \text{Total N. Predictions}$
- Error Rate
 - $(FP + FN) / \text{Total N. Predictions}$
 - Equivalent to $(1 - \text{Accuracy})$

		Predicted class	
		P	N
Actual Class	P	True Positives (TP)	False Negatives (FN)
	N	False Positives (FP)	True Negatives (TN)

Classification Metrics

- Precision
 - When it predicts yes, how often is it correct?
 - $TP / TP + FP$

		Predicted class	
		P	N
Actual Class	P	True Positives (TP)	False Negatives (FN)
	N	False Positives (FP)	True Negatives (TN)

Classification Metrics

- Recall(True Positive Rate)
 - When it's actually yes, how often does it predict yes?
 - $TP / TP + FN$

		Predicted class	
		P	N
Actual Class	P	True Positives (TP)	False Negatives (FN)
	N	False Positives (FP)	True Negatives (TN)

Classification Metrics

- False Positive Rate
 - When it's actually no, how often does it predict yes?
 - $FP / FP + TN$

		Predicted class	
		P	N
Actual Class	P	True Positives (TP)	False Negatives (FN)
	N	False Positives (FP)	True Negatives (TN)

Classification Metrics

- F1-Score
 - Harmonic Mean of Precision and Recall
 - $2 * TP / 2 * TP + FP + FN$

$$H = \frac{n}{\frac{1}{x_1} + \frac{1}{x_2} + \dots + \frac{1}{x_n}} = \frac{n}{\sum_{i=1}^n \frac{1}{x_i}} = \left(\frac{\sum_{i=1}^n x_i^{-1}}{n} \right)^{-1}.$$

		Predicted class	
		<i>P</i>	<i>N</i>
Actual Class	<i>P</i>	True Positives (TP)	False Negatives (FN)
	<i>N</i>	False Positives (FP)	True Negatives (TN)

Classification Metrics

- ROC and AUC
 - summarizes the performance of a classifier over all possible thresholds. It is generated by plotting the **True Positive Rate** (y-axis) against the **False Positive Rate** (x-axis) as you vary the threshold for assigning observations to a given class
 - AUC = Area Under the Curve

		Predicted class	
		P	N
Actual Class	P	True Positives (TP)	False Negatives (FN)
	N	False Positives (FP)	True Negatives (TN)