

Iris_naive_bayes.R

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```
# Install e1071 package which has a Naïve Bayes Classifier
#install.packages("e1071")
```

```
# Add the e1071 package to your R Library
library("e1071")
```

```
## Warning: package 'e1071' was built under R version 3.3.3
```

```
# Have a Look at the iris flower data set
iris
```

##	Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
## 1	5.1	3.5	1.4	0.2	setosa
## 2	4.9	3.0	1.4	0.2	setosa
## 3	4.7	3.2	1.3	0.2	setosa
## 4	4.6	3.1	1.5	0.2	setosa
## 5	5.0	3.6	1.4	0.2	setosa
## 6	5.4	3.9	1.7	0.4	setosa
## 7	4.6	3.4	1.4	0.3	setosa
## 8	5.0	3.4	1.5	0.2	setosa
## 9	4.4	2.9	1.4	0.2	setosa
## 10	4.9	3.1	1.5	0.1	setosa
## 11	5.4	3.7	1.5	0.2	setosa
## 12	4.8	3.4	1.6	0.2	setosa
## 13	4.8	3.0	1.4	0.1	setosa
## 14	4.3	3.0	1.1	0.1	setosa
## 15	5.8	4.0	1.2	0.2	setosa
## 16	5.7	4.4	1.5	0.4	setosa
## 17	5.4	3.9	1.3	0.4	setosa
## 18	5.1	3.5	1.4	0.3	setosa
## 19	5.7	3.8	1.7	0.3	setosa
## 20	5.1	3.8	1.5	0.3	setosa
## 21	5.4	3.4	1.7	0.2	setosa
## 22	5.1	3.7	1.5	0.4	setosa
## 23	4.6	3.6	1.0	0.2	setosa
## 24	5.1	3.3	1.7	0.5	setosa
## 25	4.8	3.4	1.9	0.2	setosa
## 26	5.0	3.0	1.6	0.2	setosa
## 27	5.0	3.4	1.6	0.4	setosa
## 28	5.2	3.5	1.5	0.2	setosa
## 29	5.2	3.4	1.4	0.2	setosa
## 30	4.7	3.2	1.6	0.2	setosa

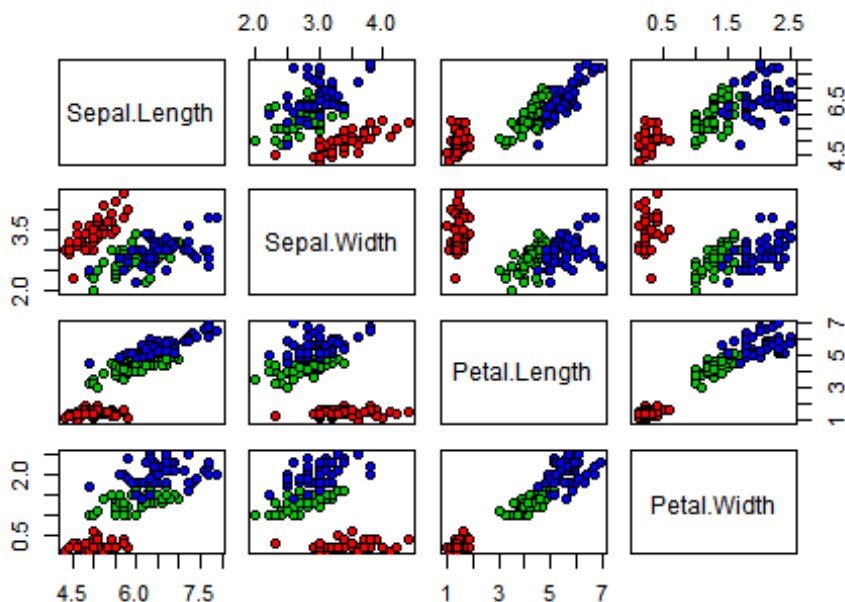
## 31	4.8	3.1	1.6	0.2	setosa
## 32	5.4	3.4	1.5	0.4	setosa
## 33	5.2	4.1	1.5	0.1	setosa
## 34	5.5	4.2	1.4	0.2	setosa
## 35	4.9	3.1	1.5	0.2	setosa
## 36	5.0	3.2	1.2	0.2	setosa
## 37	5.5	3.5	1.3	0.2	setosa
## 38	4.9	3.6	1.4	0.1	setosa
## 39	4.4	3.0	1.3	0.2	setosa
## 40	5.1	3.4	1.5	0.2	setosa
## 41	5.0	3.5	1.3	0.3	setosa
## 42	4.5	2.3	1.3	0.3	setosa
## 43	4.4	3.2	1.3	0.2	setosa
## 44	5.0	3.5	1.6	0.6	setosa
## 45	5.1	3.8	1.9	0.4	setosa
## 46	4.8	3.0	1.4	0.3	setosa
## 47	5.1	3.8	1.6	0.2	setosa
## 48	4.6	3.2	1.4	0.2	setosa
## 49	5.3	3.7	1.5	0.2	setosa
## 50	5.0	3.3	1.4	0.2	setosa
## 51	7.0	3.2	4.7	1.4	versicolor
## 52	6.4	3.2	4.5	1.5	versicolor
## 53	6.9	3.1	4.9	1.5	versicolor
## 54	5.5	2.3	4.0	1.3	versicolor
## 55	6.5	2.8	4.6	1.5	versicolor
## 56	5.7	2.8	4.5	1.3	versicolor
## 57	6.3	3.3	4.7	1.6	versicolor
## 58	4.9	2.4	3.3	1.0	versicolor
## 59	6.6	2.9	4.6	1.3	versicolor
## 60	5.2	2.7	3.9	1.4	versicolor
## 61	5.0	2.0	3.5	1.0	versicolor
## 62	5.9	3.0	4.2	1.5	versicolor
## 63	6.0	2.2	4.0	1.0	versicolor
## 64	6.1	2.9	4.7	1.4	versicolor
## 65	5.6	2.9	3.6	1.3	versicolor
## 66	6.7	3.1	4.4	1.4	versicolor
## 67	5.6	3.0	4.5	1.5	versicolor
## 68	5.8	2.7	4.1	1.0	versicolor
## 69	6.2	2.2	4.5	1.5	versicolor
## 70	5.6	2.5	3.9	1.1	versicolor
## 71	5.9	3.2	4.8	1.8	versicolor
## 72	6.1	2.8	4.0	1.3	versicolor
## 73	6.3	2.5	4.9	1.5	versicolor
## 74	6.1	2.8	4.7	1.2	versicolor
## 75	6.4	2.9	4.3	1.3	versicolor
## 76	6.6	3.0	4.4	1.4	versicolor
## 77	6.8	2.8	4.8	1.4	versicolor
## 78	6.7	3.0	5.0	1.7	versicolor
## 79	6.0	2.9	4.5	1.5	versicolor
## 80	5.7	2.6	3.5	1.0	versicolor

## 81	5.5	2.4	3.8	1.1 versicolor
## 82	5.5	2.4	3.7	1.0 versicolor
## 83	5.8	2.7	3.9	1.2 versicolor
## 84	6.0	2.7	5.1	1.6 versicolor
## 85	5.4	3.0	4.5	1.5 versicolor
## 86	6.0	3.4	4.5	1.6 versicolor
## 87	6.7	3.1	4.7	1.5 versicolor
## 88	6.3	2.3	4.4	1.3 versicolor
## 89	5.6	3.0	4.1	1.3 versicolor
## 90	5.5	2.5	4.0	1.3 versicolor
## 91	5.5	2.6	4.4	1.2 versicolor
## 92	6.1	3.0	4.6	1.4 versicolor
## 93	5.8	2.6	4.0	1.2 versicolor
## 94	5.0	2.3	3.3	1.0 versicolor
## 95	5.6	2.7	4.2	1.3 versicolor
## 96	5.7	3.0	4.2	1.2 versicolor
## 97	5.7	2.9	4.2	1.3 versicolor
## 98	6.2	2.9	4.3	1.3 versicolor
## 99	5.1	2.5	3.0	1.1 versicolor
## 100	5.7	2.8	4.1	1.3 versicolor
## 101	6.3	3.3	6.0	2.5 virginica
## 102	5.8	2.7	5.1	1.9 virginica
## 103	7.1	3.0	5.9	2.1 virginica
## 104	6.3	2.9	5.6	1.8 virginica
## 105	6.5	3.0	5.8	2.2 virginica
## 106	7.6	3.0	6.6	2.1 virginica
## 107	4.9	2.5	4.5	1.7 virginica
## 108	7.3	2.9	6.3	1.8 virginica
## 109	6.7	2.5	5.8	1.8 virginica
## 110	7.2	3.6	6.1	2.5 virginica
## 111	6.5	3.2	5.1	2.0 virginica
## 112	6.4	2.7	5.3	1.9 virginica
## 113	6.8	3.0	5.5	2.1 virginica
## 114	5.7	2.5	5.0	2.0 virginica
## 115	5.8	2.8	5.1	2.4 virginica
## 116	6.4	3.2	5.3	2.3 virginica
## 117	6.5	3.0	5.5	1.8 virginica
## 118	7.7	3.8	6.7	2.2 virginica
## 119	7.7	2.6	6.9	2.3 virginica
## 120	6.0	2.2	5.0	1.5 virginica
## 121	6.9	3.2	5.7	2.3 virginica
## 122	5.6	2.8	4.9	2.0 virginica
## 123	7.7	2.8	6.7	2.0 virginica
## 124	6.3	2.7	4.9	1.8 virginica
## 125	6.7	3.3	5.7	2.1 virginica
## 126	7.2	3.2	6.0	1.8 virginica
## 127	6.2	2.8	4.8	1.8 virginica
## 128	6.1	3.0	4.9	1.8 virginica
## 129	6.4	2.8	5.6	2.1 virginica
## 130	7.2	3.0	5.8	1.6 virginica

```
## 131      7.4      2.8      6.1      1.9 virginica
## 132      7.9      3.8      6.4      2.0 virginica
## 133      6.4      2.8      5.6      2.2 virginica
## 134      6.3      2.8      5.1      1.5 virginica
## 135      6.1      2.6      5.6      1.4 virginica
## 136      7.7      3.0      6.1      2.3 virginica
## 137      6.3      3.4      5.6      2.4 virginica
## 138      6.4      3.1      5.5      1.8 virginica
## 139      6.0      3.0      4.8      1.8 virginica
## 140      6.9      3.1      5.4      2.1 virginica
## 141      6.7      3.1      5.6      2.4 virginica
## 142      6.9      3.1      5.1      2.3 virginica
## 143      5.8      2.7      5.1      1.9 virginica
## 144      6.8      3.2      5.9      2.3 virginica
## 145      6.7      3.3      5.7      2.5 virginica
## 146      6.7      3.0      5.2      2.3 virginica
## 147      6.3      2.5      5.0      1.9 virginica
## 148      6.5      3.0      5.2      2.0 virginica
## 149      6.2      3.4      5.4      2.3 virginica
## 150      5.9      3.0      5.1      1.8 virginica
```

```
pairs(iris[1:4], main="Iris Data
(red=setosa,green=versicolor,blue=virginica)", pch=21,
bg=c("red","green3","blue")[unclass(iris$Species)])
```

is Data (red=setosa,green=versicolor,blue=virginica



```
# Train a naïve Bayes model using the iris dataset
nb <- naiveBayes(iris[,1:4], iris[,5])
```

Call back the trained model - The naive Bayes classifier function generates three Gaussian (Normal) distributions for each predictor variable, one for each value of the class variable Species. The first column [,1] is the mean, the 2nd [,2] is the standard deviation.

nb

##

Naive Bayes Classifier for Discrete Predictors

##

Call:

naiveBayes.default(x = iris[, 1:4], y = iris[, 5])

##

A-priori probabilities:

iris[, 5]

setosa versicolor virginica

0.3333333 0.3333333 0.3333333

##

Conditional probabilities:

Sepal.Length

iris[, 5] [,1] [,2]

setosa 5.006 0.3524897

versicolor 5.936 0.5161711

virginica 6.588 0.6358796

##

Sepal.Width

iris[, 5] [,1] [,2]

setosa 3.428 0.3790644

versicolor 2.770 0.3137983

virginica 2.974 0.3224966

##

Petal.Length

iris[, 5] [,1] [,2]

setosa 1.462 0.1736640

versicolor 4.260 0.4699110

virginica 5.552 0.5518947

##

Petal.Width

iris[, 5] [,1] [,2]

setosa 0.246 0.1053856

versicolor 1.326 0.1977527

virginica 2.026 0.2746501

Make predictions on iris data using nb model

pred <- **predict**(nb, iris[,1:4])

View the Naïve Bayes predictions

pred

```
## [1] setosa setosa setosa setosa setosa setosa
## [7] setosa setosa setosa setosa setosa setosa
## [13] setosa setosa setosa setosa setosa setosa
## [19] setosa setosa setosa setosa setosa setosa
## [25] setosa setosa setosa setosa setosa setosa
## [31] setosa setosa setosa setosa setosa setosa
## [37] setosa setosa setosa setosa setosa setosa
## [43] setosa setosa setosa setosa setosa setosa
## [49] setosa setosa versicolor versicolor virginica versicolor
## [55] versicolor versicolor versicolor versicolor versicolor versicolor
## [61] versicolor versicolor versicolor versicolor versicolor versicolor
## [67] versicolor versicolor versicolor versicolor virginica versicolor
## [73] versicolor versicolor versicolor versicolor versicolor virginica
## [79] versicolor versicolor versicolor versicolor versicolor versicolor
## [85] versicolor versicolor versicolor versicolor versicolor versicolor
## [91] versicolor versicolor versicolor versicolor versicolor versicolor
## [97] versicolor versicolor versicolor versicolor virginica virginica
## [103] virginica virginica virginica virginica versicolor virginica
## [109] virginica virginica virginica virginica virginica virginica
## [115] virginica virginica virginica virginica virginica versicolor
## [121] virginica virginica virginica virginica virginica virginica
## [127] virginica virginica virginica virginica virginica virginica
## [133] virginica versicolor virginica virginica virginica virginica
## [139] virginica virginica virginica virginica virginica virginica
## [145] virginica virginica virginica virginica virginica virginica
## Levels: setosa versicolor virginica
```

View the predictions against the actual data
data.frame(pred,iris[,5])

```
##      pred  iris...5.
## 1    setosa    setosa
## 2    setosa    setosa
## 3    setosa    setosa
## 4    setosa    setosa
## 5    setosa    setosa
## 6    setosa    setosa
## 7    setosa    setosa
## 8    setosa    setosa
## 9    setosa    setosa
## 10   setosa    setosa
## 11   setosa    setosa
## 12   setosa    setosa
## 13   setosa    setosa
## 14   setosa    setosa
## 15   setosa    setosa
## 16   setosa    setosa
## 17   setosa    setosa
## 18   setosa    setosa
## 19   setosa    setosa
```

## 20	setosa	setosa
## 21	setosa	setosa
## 22	setosa	setosa
## 23	setosa	setosa
## 24	setosa	setosa
## 25	setosa	setosa
## 26	setosa	setosa
## 27	setosa	setosa
## 28	setosa	setosa
## 29	setosa	setosa
## 30	setosa	setosa
## 31	setosa	setosa
## 32	setosa	setosa
## 33	setosa	setosa
## 34	setosa	setosa
## 35	setosa	setosa
## 36	setosa	setosa
## 37	setosa	setosa
## 38	setosa	setosa
## 39	setosa	setosa
## 40	setosa	setosa
## 41	setosa	setosa
## 42	setosa	setosa
## 43	setosa	setosa
## 44	setosa	setosa
## 45	setosa	setosa
## 46	setosa	setosa
## 47	setosa	setosa
## 48	setosa	setosa
## 49	setosa	setosa
## 50	setosa	setosa
## 51	versicolor	versicolor
## 52	versicolor	versicolor
## 53	virginica	versicolor
## 54	versicolor	versicolor
## 55	versicolor	versicolor
## 56	versicolor	versicolor
## 57	versicolor	versicolor
## 58	versicolor	versicolor
## 59	versicolor	versicolor
## 60	versicolor	versicolor
## 61	versicolor	versicolor
## 62	versicolor	versicolor
## 63	versicolor	versicolor
## 64	versicolor	versicolor
## 65	versicolor	versicolor
## 66	versicolor	versicolor
## 67	versicolor	versicolor
## 68	versicolor	versicolor
## 69	versicolor	versicolor

```
## 70 versicolor versicolor
## 71 virginica versicolor
## 72 versicolor versicolor
## 73 versicolor versicolor
## 74 versicolor versicolor
## 75 versicolor versicolor
## 76 versicolor versicolor
## 77 versicolor versicolor
## 78 virginica versicolor
## 79 versicolor versicolor
## 80 versicolor versicolor
## 81 versicolor versicolor
## 82 versicolor versicolor
## 83 versicolor versicolor
## 84 versicolor versicolor
## 85 versicolor versicolor
## 86 versicolor versicolor
## 87 versicolor versicolor
## 88 versicolor versicolor
## 89 versicolor versicolor
## 90 versicolor versicolor
## 91 versicolor versicolor
## 92 versicolor versicolor
## 93 versicolor versicolor
## 94 versicolor versicolor
## 95 versicolor versicolor
## 96 versicolor versicolor
## 97 versicolor versicolor
## 98 versicolor versicolor
## 99 versicolor versicolor
## 100 versicolor versicolor
## 101 virginica virginica
## 102 virginica virginica
## 103 virginica virginica
## 104 virginica virginica
## 105 virginica virginica
## 106 virginica virginica
## 107 versicolor virginica
## 108 virginica virginica
## 109 virginica virginica
## 110 virginica virginica
## 111 virginica virginica
## 112 virginica virginica
## 113 virginica virginica
## 114 virginica virginica
## 115 virginica virginica
## 116 virginica virginica
## 117 virginica virginica
## 118 virginica virginica
## 119 virginica virginica
```



```
## 120 versicolor virginica
## 121 virginica virginica
## 122 virginica virginica
## 123 virginica virginica
## 124 virginica virginica
## 125 virginica virginica
## 126 virginica virginica
## 127 virginica virginica
## 128 virginica virginica
## 129 virginica virginica
## 130 virginica virginica
## 131 virginica virginica
## 132 virginica virginica
## 133 virginica virginica
## 134 versicolor virginica
## 135 virginica virginica
## 136 virginica virginica
## 137 virginica virginica
## 138 virginica virginica
## 139 virginica virginica
## 140 virginica virginica
## 141 virginica virginica
## 142 virginica virginica
## 143 virginica virginica
## 144 virginica virginica
## 145 virginica virginica
## 146 virginica virginica
## 147 virginica virginica
## 148 virginica virginica
## 149 virginica virginica
## 150 virginica virginica
```