

# homework5.R

2019-11-09

```
setwd("~/Downloads/")
library(rpart)
library(data.table)
library(party)
```

```
## Loading required package: grid
```

```
## Loading required package: mvtnorm
```

```
## Loading required package: modeltools
```

```
## Loading required package: stats4
```

```
## Loading required package: strucchange
```

```
## Loading required package: zoo
```

```
##
```

```
## Attaching package: 'zoo'
```

```
## The following objects are masked from 'package:base':
```

```
##
```

```
##      as.Date, as.Date.numeric
```

```
## Loading required package: sandwich
```

```
data <- read.table("iris.data", sep="," , header=F)
```

```
names(data) <- c("sepalLength", "sepalWidth", "petalLength", "petalWidth", "category")
print(data)
```

```
##      sepalLength sepalWidth petalLength petalWidth      category
## 1           5.1         3.5         1.4         0.2      Iris-setosa
## 2           4.9         3.0         1.4         0.2      Iris-setosa
## 3           4.7         3.2         1.3         0.2      Iris-setosa
## 4           4.6         3.1         1.5         0.2      Iris-setosa
## 5           5.0         3.6         1.4         0.2      Iris-setosa
## 6           5.4         3.9         1.7         0.4      Iris-setosa
## 7           4.6         3.4         1.4         0.3      Iris-setosa
## 8           5.0         3.4         1.5         0.2      Iris-setosa
## 9           4.4         2.9         1.4         0.2      Iris-setosa
## 10          4.9         3.1         1.5         0.1      Iris-setosa
## 11          5.4         3.7         1.5         0.2      Iris-setosa
```

## 12	4.8	3.4	1.6	0.2	Iris-setosa
## 13	4.8	3.0	1.4	0.1	Iris-setosa
## 14	4.3	3.0	1.1	0.1	Iris-setosa
## 15	5.8	4.0	1.2	0.2	Iris-setosa
## 16	5.7	4.4	1.5	0.4	Iris-setosa
## 17	5.4	3.9	1.3	0.4	Iris-setosa
## 18	5.1	3.5	1.4	0.3	Iris-setosa
## 19	5.7	3.8	1.7	0.3	Iris-setosa
## 20	5.1	3.8	1.5	0.3	Iris-setosa
## 21	5.4	3.4	1.7	0.2	Iris-setosa
## 22	5.1	3.7	1.5	0.4	Iris-setosa
## 23	4.6	3.6	1.0	0.2	Iris-setosa
## 24	5.1	3.3	1.7	0.5	Iris-setosa
## 25	4.8	3.4	1.9	0.2	Iris-setosa
## 26	5.0	3.0	1.6	0.2	Iris-setosa
## 27	5.0	3.4	1.6	0.4	Iris-setosa
## 28	5.2	3.5	1.5	0.2	Iris-setosa
## 29	5.2	3.4	1.4	0.2	Iris-setosa
## 30	4.7	3.2	1.6	0.2	Iris-setosa
## 31	4.8	3.1	1.6	0.2	Iris-setosa
## 32	5.4	3.4	1.5	0.4	Iris-setosa
## 33	5.2	4.1	1.5	0.1	Iris-setosa
## 34	5.5	4.2	1.4	0.2	Iris-setosa
## 35	4.9	3.1	1.5	0.1	Iris-setosa
## 36	5.0	3.2	1.2	0.2	Iris-setosa
## 37	5.5	3.5	1.3	0.2	Iris-setosa
## 38	4.9	3.1	1.5	0.1	Iris-setosa
## 39	4.4	3.0	1.3	0.2	Iris-setosa
## 40	5.1	3.4	1.5	0.2	Iris-setosa
## 41	5.0	3.5	1.3	0.3	Iris-setosa
## 42	4.5	2.3	1.3	0.3	Iris-setosa
## 43	4.4	3.2	1.3	0.2	Iris-setosa
## 44	5.0	3.5	1.6	0.6	Iris-setosa
## 45	5.1	3.8	1.9	0.4	Iris-setosa
## 46	4.8	3.0	1.4	0.3	Iris-setosa
## 47	5.1	3.8	1.6	0.2	Iris-setosa
## 48	4.6	3.2	1.4	0.2	Iris-setosa
## 49	5.3	3.7	1.5	0.2	Iris-setosa
## 50	5.0	3.3	1.4	0.2	Iris-setosa
## 51	7.0	3.2	4.7	1.4	Iris-versicolor
## 52	6.4	3.2	4.5	1.5	Iris-versicolor
## 53	6.9	3.1	4.9	1.5	Iris-versicolor
## 54	5.5	2.3	4.0	1.3	Iris-versicolor
## 55	6.5	2.8	4.6	1.5	Iris-versicolor
## 56	5.7	2.8	4.5	1.3	Iris-versicolor
## 57	6.3	3.3	4.7	1.6	Iris-versicolor
## 58	4.9	2.4	3.3	1.0	Iris-versicolor
## 59	6.6	2.9	4.6	1.3	Iris-versicolor
## 60	5.2	2.7	3.9	1.4	Iris-versicolor
## 61	5.0	2.0	3.5	1.0	Iris-versicolor
## 62	5.9	3.0	4.2	1.5	Iris-versicolor
## 63	6.0	2.2	4.0	1.0	Iris-versicolor
## 64	6.1	2.9	4.7	1.4	Iris-versicolor
## 65	5.6	2.9	3.6	1.3	Iris-versicolor

## 66	6.7	3.1	4.4	1.4 Iris-versicolor
## 67	5.6	3.0	4.5	1.5 Iris-versicolor
## 68	5.8	2.7	4.1	1.0 Iris-versicolor
## 69	6.2	2.2	4.5	1.5 Iris-versicolor
## 70	5.6	2.5	3.9	1.1 Iris-versicolor
## 71	5.9	3.2	4.8	1.8 Iris-versicolor
## 72	6.1	2.8	4.0	1.3 Iris-versicolor
## 73	6.3	2.5	4.9	1.5 Iris-versicolor
## 74	6.1	2.8	4.7	1.2 Iris-versicolor
## 75	6.4	2.9	4.3	1.3 Iris-versicolor
## 76	6.6	3.0	4.4	1.4 Iris-versicolor
## 77	6.8	2.8	4.8	1.4 Iris-versicolor
## 78	6.7	3.0	5.0	1.7 Iris-versicolor
## 79	6.0	2.9	4.5	1.5 Iris-versicolor
## 80	5.7	2.6	3.5	1.0 Iris-versicolor
## 81	5.5	2.4	3.8	1.1 Iris-versicolor
## 82	5.5	2.4	3.7	1.0 Iris-versicolor
## 83	5.8	2.7	3.9	1.2 Iris-versicolor
## 84	6.0	2.7	5.1	1.6 Iris-versicolor
## 85	5.4	3.0	4.5	1.5 Iris-versicolor
## 86	6.0	3.4	4.5	1.6 Iris-versicolor
## 87	6.7	3.1	4.7	1.5 Iris-versicolor
## 88	6.3	2.3	4.4	1.3 Iris-versicolor
## 89	5.6	3.0	4.1	1.3 Iris-versicolor
## 90	5.5	2.5	4.0	1.3 Iris-versicolor
## 91	5.5	2.6	4.4	1.2 Iris-versicolor
## 92	6.1	3.0	4.6	1.4 Iris-versicolor
## 93	5.8	2.6	4.0	1.2 Iris-versicolor
## 94	5.0	2.3	3.3	1.0 Iris-versicolor
## 95	5.6	2.7	4.2	1.3 Iris-versicolor
## 96	5.7	3.0	4.2	1.2 Iris-versicolor
## 97	5.7	2.9	4.2	1.3 Iris-versicolor
## 98	6.2	2.9	4.3	1.3 Iris-versicolor
## 99	5.1	2.5	3.0	1.1 Iris-versicolor
## 100	5.7	2.8	4.1	1.3 Iris-versicolor
## 101	6.3	3.3	6.0	2.5 Iris-virginica
## 102	5.8	2.7	5.1	1.9 Iris-virginica
## 103	7.1	3.0	5.9	2.1 Iris-virginica
## 104	6.3	2.9	5.6	1.8 Iris-virginica
## 105	6.5	3.0	5.8	2.2 Iris-virginica
## 106	7.6	3.0	6.6	2.1 Iris-virginica
## 107	4.9	2.5	4.5	1.7 Iris-virginica
## 108	7.3	2.9	6.3	1.8 Iris-virginica
## 109	6.7	2.5	5.8	1.8 Iris-virginica
## 110	7.2	3.6	6.1	2.5 Iris-virginica
## 111	6.5	3.2	5.1	2.0 Iris-virginica
## 112	6.4	2.7	5.3	1.9 Iris-virginica
## 113	6.8	3.0	5.5	2.1 Iris-virginica
## 114	5.7	2.5	5.0	2.0 Iris-virginica
## 115	5.8	2.8	5.1	2.4 Iris-virginica
## 116	6.4	3.2	5.3	2.3 Iris-virginica
## 117	6.5	3.0	5.5	1.8 Iris-virginica
## 118	7.7	3.8	6.7	2.2 Iris-virginica
## 119	7.7	2.6	6.9	2.3 Iris-virginica

## 120	6.0	2.2	5.0	1.5	Iris-virginica
## 121	6.9	3.2	5.7	2.3	Iris-virginica
## 122	5.6	2.8	4.9	2.0	Iris-virginica
## 123	7.7	2.8	6.7	2.0	Iris-virginica
## 124	6.3	2.7	4.9	1.8	Iris-virginica
## 125	6.7	3.3	5.7	2.1	Iris-virginica
## 126	7.2	3.2	6.0	1.8	Iris-virginica
## 127	6.2	2.8	4.8	1.8	Iris-virginica
## 128	6.1	3.0	4.9	1.8	Iris-virginica
## 129	6.4	2.8	5.6	2.1	Iris-virginica
## 130	7.2	3.0	5.8	1.6	Iris-virginica
## 131	7.4	2.8	6.1	1.9	Iris-virginica
## 132	7.9	3.8	6.4	2.0	Iris-virginica
## 133	6.4	2.8	5.6	2.2	Iris-virginica
## 134	6.3	2.8	5.1	1.5	Iris-virginica
## 135	6.1	2.6	5.6	1.4	Iris-virginica
## 136	7.7	3.0	6.1	2.3	Iris-virginica
## 137	6.3	3.4	5.6	2.4	Iris-virginica
## 138	6.4	3.1	5.5	1.8	Iris-virginica
## 139	6.0	3.0	4.8	1.8	Iris-virginica
## 140	6.9	3.1	5.4	2.1	Iris-virginica
## 141	6.7	3.1	5.6	2.4	Iris-virginica
## 142	6.9	3.1	5.1	2.3	Iris-virginica
## 143	5.8	2.7	5.1	1.9	Iris-virginica
## 144	6.8	3.2	5.9	2.3	Iris-virginica
## 145	6.7	3.3	5.7	2.5	Iris-virginica
## 146	6.7	3.0	5.2	2.3	Iris-virginica
## 147	6.3	2.5	5.0	1.9	Iris-virginica
## 148	6.5	3.0	5.2	2.0	Iris-virginica
## 149	6.2	3.4	5.4	2.3	Iris-virginica
## 150	5.9	3.0	5.1	1.8	Iris-virginica

```
set.seed(666)
print(data)
```

##	sepalLength	sepalWidth	petalLength	petalWidth	category
## 1	5.1	3.5	1.4	0.2	Iris-setosa
## 2	4.9	3.0	1.4	0.2	Iris-setosa
## 3	4.7	3.2	1.3	0.2	Iris-setosa
## 4	4.6	3.1	1.5	0.2	Iris-setosa
## 5	5.0	3.6	1.4	0.2	Iris-setosa
## 6	5.4	3.9	1.7	0.4	Iris-setosa
## 7	4.6	3.4	1.4	0.3	Iris-setosa
## 8	5.0	3.4	1.5	0.2	Iris-setosa
## 9	4.4	2.9	1.4	0.2	Iris-setosa
## 10	4.9	3.1	1.5	0.1	Iris-setosa
## 11	5.4	3.7	1.5	0.2	Iris-setosa
## 12	4.8	3.4	1.6	0.2	Iris-setosa
## 13	4.8	3.0	1.4	0.1	Iris-setosa
## 14	4.3	3.0	1.1	0.1	Iris-setosa
## 15	5.8	4.0	1.2	0.2	Iris-setosa
## 16	5.7	4.4	1.5	0.4	Iris-setosa
## 17	5.4	3.9	1.3	0.4	Iris-setosa
## 18	5.1	3.5	1.4	0.3	Iris-setosa

## 19	5.7	3.8	1.7	0.3	Iris-setosa
## 20	5.1	3.8	1.5	0.3	Iris-setosa
## 21	5.4	3.4	1.7	0.2	Iris-setosa
## 22	5.1	3.7	1.5	0.4	Iris-setosa
## 23	4.6	3.6	1.0	0.2	Iris-setosa
## 24	5.1	3.3	1.7	0.5	Iris-setosa
## 25	4.8	3.4	1.9	0.2	Iris-setosa
## 26	5.0	3.0	1.6	0.2	Iris-setosa
## 27	5.0	3.4	1.6	0.4	Iris-setosa
## 28	5.2	3.5	1.5	0.2	Iris-setosa
## 29	5.2	3.4	1.4	0.2	Iris-setosa
## 30	4.7	3.2	1.6	0.2	Iris-setosa
## 31	4.8	3.1	1.6	0.2	Iris-setosa
## 32	5.4	3.4	1.5	0.4	Iris-setosa
## 33	5.2	4.1	1.5	0.1	Iris-setosa
## 34	5.5	4.2	1.4	0.2	Iris-setosa
## 35	4.9	3.1	1.5	0.1	Iris-setosa
## 36	5.0	3.2	1.2	0.2	Iris-setosa
## 37	5.5	3.5	1.3	0.2	Iris-setosa
## 38	4.9	3.1	1.5	0.1	Iris-setosa
## 39	4.4	3.0	1.3	0.2	Iris-setosa
## 40	5.1	3.4	1.5	0.2	Iris-setosa
## 41	5.0	3.5	1.3	0.3	Iris-setosa
## 42	4.5	2.3	1.3	0.3	Iris-setosa
## 43	4.4	3.2	1.3	0.2	Iris-setosa
## 44	5.0	3.5	1.6	0.6	Iris-setosa
## 45	5.1	3.8	1.9	0.4	Iris-setosa
## 46	4.8	3.0	1.4	0.3	Iris-setosa
## 47	5.1	3.8	1.6	0.2	Iris-setosa
## 48	4.6	3.2	1.4	0.2	Iris-setosa
## 49	5.3	3.7	1.5	0.2	Iris-setosa
## 50	5.0	3.3	1.4	0.2	Iris-setosa
## 51	7.0	3.2	4.7	1.4	Iris-versicolor
## 52	6.4	3.2	4.5	1.5	Iris-versicolor
## 53	6.9	3.1	4.9	1.5	Iris-versicolor
## 54	5.5	2.3	4.0	1.3	Iris-versicolor
## 55	6.5	2.8	4.6	1.5	Iris-versicolor
## 56	5.7	2.8	4.5	1.3	Iris-versicolor
## 57	6.3	3.3	4.7	1.6	Iris-versicolor
## 58	4.9	2.4	3.3	1.0	Iris-versicolor
## 59	6.6	2.9	4.6	1.3	Iris-versicolor
## 60	5.2	2.7	3.9	1.4	Iris-versicolor
## 61	5.0	2.0	3.5	1.0	Iris-versicolor
## 62	5.9	3.0	4.2	1.5	Iris-versicolor
## 63	6.0	2.2	4.0	1.0	Iris-versicolor
## 64	6.1	2.9	4.7	1.4	Iris-versicolor
## 65	5.6	2.9	3.6	1.3	Iris-versicolor
## 66	6.7	3.1	4.4	1.4	Iris-versicolor
## 67	5.6	3.0	4.5	1.5	Iris-versicolor
## 68	5.8	2.7	4.1	1.0	Iris-versicolor
## 69	6.2	2.2	4.5	1.5	Iris-versicolor
## 70	5.6	2.5	3.9	1.1	Iris-versicolor
## 71	5.9	3.2	4.8	1.8	Iris-versicolor
## 72	6.1	2.8	4.0	1.3	Iris-versicolor

## 73	6.3	2.5	4.9	1.5 Iris-versicolor
## 74	6.1	2.8	4.7	1.2 Iris-versicolor
## 75	6.4	2.9	4.3	1.3 Iris-versicolor
## 76	6.6	3.0	4.4	1.4 Iris-versicolor
## 77	6.8	2.8	4.8	1.4 Iris-versicolor
## 78	6.7	3.0	5.0	1.7 Iris-versicolor
## 79	6.0	2.9	4.5	1.5 Iris-versicolor
## 80	5.7	2.6	3.5	1.0 Iris-versicolor
## 81	5.5	2.4	3.8	1.1 Iris-versicolor
## 82	5.5	2.4	3.7	1.0 Iris-versicolor
## 83	5.8	2.7	3.9	1.2 Iris-versicolor
## 84	6.0	2.7	5.1	1.6 Iris-versicolor
## 85	5.4	3.0	4.5	1.5 Iris-versicolor
## 86	6.0	3.4	4.5	1.6 Iris-versicolor
## 87	6.7	3.1	4.7	1.5 Iris-versicolor
## 88	6.3	2.3	4.4	1.3 Iris-versicolor
## 89	5.6	3.0	4.1	1.3 Iris-versicolor
## 90	5.5	2.5	4.0	1.3 Iris-versicolor
## 91	5.5	2.6	4.4	1.2 Iris-versicolor
## 92	6.1	3.0	4.6	1.4 Iris-versicolor
## 93	5.8	2.6	4.0	1.2 Iris-versicolor
## 94	5.0	2.3	3.3	1.0 Iris-versicolor
## 95	5.6	2.7	4.2	1.3 Iris-versicolor
## 96	5.7	3.0	4.2	1.2 Iris-versicolor
## 97	5.7	2.9	4.2	1.3 Iris-versicolor
## 98	6.2	2.9	4.3	1.3 Iris-versicolor
## 99	5.1	2.5	3.0	1.1 Iris-versicolor
## 100	5.7	2.8	4.1	1.3 Iris-versicolor
## 101	6.3	3.3	6.0	2.5 Iris-virginica
## 102	5.8	2.7	5.1	1.9 Iris-virginica
## 103	7.1	3.0	5.9	2.1 Iris-virginica
## 104	6.3	2.9	5.6	1.8 Iris-virginica
## 105	6.5	3.0	5.8	2.2 Iris-virginica
## 106	7.6	3.0	6.6	2.1 Iris-virginica
## 107	4.9	2.5	4.5	1.7 Iris-virginica
## 108	7.3	2.9	6.3	1.8 Iris-virginica
## 109	6.7	2.5	5.8	1.8 Iris-virginica
## 110	7.2	3.6	6.1	2.5 Iris-virginica
## 111	6.5	3.2	5.1	2.0 Iris-virginica
## 112	6.4	2.7	5.3	1.9 Iris-virginica
## 113	6.8	3.0	5.5	2.1 Iris-virginica
## 114	5.7	2.5	5.0	2.0 Iris-virginica
## 115	5.8	2.8	5.1	2.4 Iris-virginica
## 116	6.4	3.2	5.3	2.3 Iris-virginica
## 117	6.5	3.0	5.5	1.8 Iris-virginica
## 118	7.7	3.8	6.7	2.2 Iris-virginica
## 119	7.7	2.6	6.9	2.3 Iris-virginica
## 120	6.0	2.2	5.0	1.5 Iris-virginica
## 121	6.9	3.2	5.7	2.3 Iris-virginica
## 122	5.6	2.8	4.9	2.0 Iris-virginica
## 123	7.7	2.8	6.7	2.0 Iris-virginica
## 124	6.3	2.7	4.9	1.8 Iris-virginica
## 125	6.7	3.3	5.7	2.1 Iris-virginica
## 126	7.2	3.2	6.0	1.8 Iris-virginica

## 127	6.2	2.8	4.8	1.8	Iris-virginica
## 128	6.1	3.0	4.9	1.8	Iris-virginica
## 129	6.4	2.8	5.6	2.1	Iris-virginica
## 130	7.2	3.0	5.8	1.6	Iris-virginica
## 131	7.4	2.8	6.1	1.9	Iris-virginica
## 132	7.9	3.8	6.4	2.0	Iris-virginica
## 133	6.4	2.8	5.6	2.2	Iris-virginica
## 134	6.3	2.8	5.1	1.5	Iris-virginica
## 135	6.1	2.6	5.6	1.4	Iris-virginica
## 136	7.7	3.0	6.1	2.3	Iris-virginica
## 137	6.3	3.4	5.6	2.4	Iris-virginica
## 138	6.4	3.1	5.5	1.8	Iris-virginica
## 139	6.0	3.0	4.8	1.8	Iris-virginica
## 140	6.9	3.1	5.4	2.1	Iris-virginica
## 141	6.7	3.1	5.6	2.4	Iris-virginica
## 142	6.9	3.1	5.1	2.3	Iris-virginica
## 143	5.8	2.7	5.1	1.9	Iris-virginica
## 144	6.8	3.2	5.9	2.3	Iris-virginica
## 145	6.7	3.3	5.7	2.5	Iris-virginica
## 146	6.7	3.0	5.2	2.3	Iris-virginica
## 147	6.3	2.5	5.0	1.9	Iris-virginica
## 148	6.5	3.0	5.2	2.0	Iris-virginica
## 149	6.2	3.4	5.4	2.3	Iris-virginica
## 150	5.9	3.0	5.1	1.8	Iris-virginica

```
train <- sample(nrow(data),0.7*nrow(data))
```

```
tdata <- data[train,]
vdata <- data[-train,]
```

```
print(tdata)
```

##	sepalLength	sepalWidth	petalLength	petalWidth	category
## 62	5.9	3.0	4.2	1.5	Iris-versicolor
## 126	7.2	3.2	6.0	1.8	Iris-virginica
## 96	5.7	3.0	4.2	1.2	Iris-versicolor
## 139	6.0	3.0	4.8	1.8	Iris-virginica
## 123	7.7	2.8	6.7	2.0	Iris-virginica
## 28	5.2	3.5	1.5	0.2	Iris-setosa
## 142	6.9	3.1	5.1	2.3	Iris-virginica
## 133	6.4	2.8	5.6	2.2	Iris-virginica
## 105	6.5	3.0	5.8	2.2	Iris-virginica
## 140	6.9	3.1	5.4	2.1	Iris-virginica
## 50	5.0	3.3	1.4	0.2	Iris-setosa
## 131	7.4	2.8	6.1	1.9	Iris-virginica
## 101	6.3	3.3	6.0	2.5	Iris-virginica
## 13	4.8	3.0	1.4	0.1	Iris-setosa
## 92	6.1	3.0	4.6	1.4	Iris-versicolor
## 67	5.6	3.0	4.5	1.5	Iris-versicolor
## 120	6.0	2.2	5.0	1.5	Iris-virginica
## 58	4.9	2.4	3.3	1.0	Iris-versicolor
## 112	6.4	2.7	5.3	1.9	Iris-virginica
## 70	5.6	2.5	3.9	1.1	Iris-versicolor
## 128	6.1	3.0	4.9	1.8	Iris-virginica

## 68	5.8	2.7	4.1	1.0	Iris-versicolor
## 75	6.4	2.9	4.3	1.3	Iris-versicolor
## 125	6.7	3.3	5.7	2.1	Iris-virginica
## 72	6.1	2.8	4.0	1.3	Iris-versicolor
## 10	4.9	3.1	1.5	0.1	Iris-setosa
## 8	5.0	3.4	1.5	0.2	Iris-setosa
## 55	6.5	2.8	4.6	1.5	Iris-versicolor
## 34	5.5	4.2	1.4	0.2	Iris-setosa
## 60	5.2	2.7	3.9	1.4	Iris-versicolor
## 27	5.0	3.4	1.6	0.4	Iris-setosa
## 20	5.1	3.8	1.5	0.3	Iris-setosa
## 110	7.2	3.6	6.1	2.5	Iris-virginica
## 80	5.7	2.6	3.5	1.0	Iris-versicolor
## 64	6.1	2.9	4.7	1.4	Iris-versicolor
## 84	6.0	2.7	5.1	1.6	Iris-versicolor
## 119	7.7	2.6	6.9	2.3	Iris-virginica
## 24	5.1	3.3	1.7	0.5	Iris-setosa
## 46	4.8	3.0	1.4	0.3	Iris-setosa
## 32	5.4	3.4	1.5	0.4	Iris-setosa
## 116	6.4	3.2	5.3	2.3	Iris-virginica
## 51	7.0	3.2	4.7	1.4	Iris-versicolor
## 42	4.5	2.3	1.3	0.3	Iris-setosa
## 69	6.2	2.2	4.5	1.5	Iris-versicolor
## 3	4.7	3.2	1.3	0.2	Iris-setosa
## 6	5.4	3.9	1.7	0.4	Iris-setosa
## 136	7.7	3.0	6.1	2.3	Iris-virginica
## 30	4.7	3.2	1.6	0.2	Iris-setosa
## 41	5.0	3.5	1.3	0.3	Iris-setosa
## 95	5.6	2.7	4.2	1.3	Iris-versicolor
## 100	5.7	2.8	4.1	1.3	Iris-versicolor
## 146	6.7	3.0	5.2	2.3	Iris-virginica
## 79	6.0	2.9	4.5	1.5	Iris-versicolor
## 111	6.5	3.2	5.1	2.0	Iris-virginica
## 122	5.6	2.8	4.9	2.0	Iris-virginica
## 141	6.7	3.1	5.6	2.4	Iris-virginica
## 48	4.6	3.2	1.4	0.2	Iris-setosa
## 12	4.8	3.4	1.6	0.2	Iris-setosa
## 19	5.7	3.8	1.7	0.3	Iris-setosa
## 127	6.2	2.8	4.8	1.8	Iris-virginica
## 7	4.6	3.4	1.4	0.3	Iris-setosa
## 148	6.5	3.0	5.2	2.0	Iris-virginica
## 33	5.2	4.1	1.5	0.1	Iris-setosa
## 74	6.1	2.8	4.7	1.2	Iris-versicolor
## 124	6.3	2.7	4.9	1.8	Iris-virginica
## 97	5.7	2.9	4.2	1.3	Iris-versicolor
## 22	5.1	3.7	1.5	0.4	Iris-setosa
## 103	7.1	3.0	5.9	2.1	Iris-virginica
## 1	5.1	3.5	1.4	0.2	Iris-setosa
## 145	6.7	3.3	5.7	2.5	Iris-virginica
## 47	5.1	3.8	1.6	0.2	Iris-setosa
## 94	5.0	2.3	3.3	1.0	Iris-versicolor
## 26	5.0	3.0	1.6	0.2	Iris-setosa
## 73	6.3	2.5	4.9	1.5	Iris-versicolor
## 144	6.8	3.2	5.9	2.3	Iris-virginica



## 102	5.8	2.7	5.1	1.9	Iris-virginica
## 11	5.4	3.7	1.5	0.2	Iris-setosa
## 18	5.1	3.5	1.4	0.3	Iris-setosa
## 85	5.4	3.0	4.5	1.5	Iris-versicolor
## 99	5.1	2.5	3.0	1.1	Iris-versicolor
## 36	5.0	3.2	1.2	0.2	Iris-setosa
## 53	6.9	3.1	4.9	1.5	Iris-versicolor
## 81	5.5	2.4	3.8	1.1	Iris-versicolor
## 106	7.6	3.0	6.6	2.1	Iris-virginica
## 37	5.5	3.5	1.3	0.2	Iris-setosa
## 117	6.5	3.0	5.5	1.8	Iris-virginica
## 114	5.7	2.5	5.0	2.0	Iris-virginica
## 65	5.6	2.9	3.6	1.3	Iris-versicolor
## 135	6.1	2.6	5.6	1.4	Iris-virginica
## 17	5.4	3.9	1.3	0.4	Iris-setosa
## 107	4.9	2.5	4.5	1.7	Iris-virginica
## 44	5.0	3.5	1.6	0.6	Iris-setosa
## 35	4.9	3.1	1.5	0.1	Iris-setosa
## 54	5.5	2.3	4.0	1.3	Iris-versicolor
## 89	5.6	3.0	4.1	1.3	Iris-versicolor
## 87	6.7	3.1	4.7	1.5	Iris-versicolor
## 134	6.3	2.8	5.1	1.5	Iris-virginica
## 77	6.8	2.8	4.8	1.4	Iris-versicolor
## 113	6.8	3.0	5.5	2.1	Iris-virginica
## 5	5.0	3.6	1.4	0.2	Iris-setosa
## 76	6.6	3.0	4.4	1.4	Iris-versicolor
## 57	6.3	3.3	4.7	1.6	Iris-versicolor
## 132	7.9	3.8	6.4	2.0	Iris-virginica
## 130	7.2	3.0	5.8	1.6	Iris-virginica
## 38	4.9	3.1	1.5	0.1	Iris-setosa

```
print(vdata)
```

##	sepalLength	sepalWidth	petalLength	petalWidth	category
## 2	4.9	3.0	1.4	0.2	Iris-setosa
## 4	4.6	3.1	1.5	0.2	Iris-setosa
## 9	4.4	2.9	1.4	0.2	Iris-setosa
## 14	4.3	3.0	1.1	0.1	Iris-setosa
## 15	5.8	4.0	1.2	0.2	Iris-setosa
## 16	5.7	4.4	1.5	0.4	Iris-setosa
## 21	5.4	3.4	1.7	0.2	Iris-setosa
## 23	4.6	3.6	1.0	0.2	Iris-setosa
## 25	4.8	3.4	1.9	0.2	Iris-setosa
## 29	5.2	3.4	1.4	0.2	Iris-setosa
## 31	4.8	3.1	1.6	0.2	Iris-setosa
## 39	4.4	3.0	1.3	0.2	Iris-setosa
## 40	5.1	3.4	1.5	0.2	Iris-setosa
## 43	4.4	3.2	1.3	0.2	Iris-setosa
## 45	5.1	3.8	1.9	0.4	Iris-setosa
## 49	5.3	3.7	1.5	0.2	Iris-setosa
## 52	6.4	3.2	4.5	1.5	Iris-versicolor
## 56	5.7	2.8	4.5	1.3	Iris-versicolor
## 59	6.6	2.9	4.6	1.3	Iris-versicolor
## 61	5.0	2.0	3.5	1.0	Iris-versicolor

```
## 63      6.0      2.2      4.0      1.0 Iris-versicolor
## 66      6.7      3.1      4.4      1.4 Iris-versicolor
## 71      5.9      3.2      4.8      1.8 Iris-versicolor
## 78      6.7      3.0      5.0      1.7 Iris-versicolor
## 82      5.5      2.4      3.7      1.0 Iris-versicolor
## 83      5.8      2.7      3.9      1.2 Iris-versicolor
## 86      6.0      3.4      4.5      1.6 Iris-versicolor
## 88      6.3      2.3      4.4      1.3 Iris-versicolor
## 90      5.5      2.5      4.0      1.3 Iris-versicolor
## 91      5.5      2.6      4.4      1.2 Iris-versicolor
## 93      5.8      2.6      4.0      1.2 Iris-versicolor
## 98      6.2      2.9      4.3      1.3 Iris-versicolor
## 104     6.3      2.9      5.6      1.8 Iris-virginica
## 108     7.3      2.9      6.3      1.8 Iris-virginica
## 109     6.7      2.5      5.8      1.8 Iris-virginica
## 115     5.8      2.8      5.1      2.4 Iris-virginica
## 118     7.7      3.8      6.7      2.2 Iris-virginica
## 121     6.9      3.2      5.7      2.3 Iris-virginica
## 129     6.4      2.8      5.6      2.1 Iris-virginica
## 137     6.3      3.4      5.6      2.4 Iris-virginica
## 138     6.4      3.1      5.5      1.8 Iris-virginica
## 143     5.8      2.7      5.1      1.9 Iris-virginica
## 147     6.3      2.5      5.0      1.9 Iris-virginica
## 149     6.2      3.4      5.4      2.3 Iris-virginica
## 150     5.9      3.0      5.1      1.8 Iris-virginica
```

```
decisionTree <- rpart(category~., data=tdata, method = "class", parms = list(split="information"))
decisionTree$cptable
```

```
##          CP nsplit  rel error    xerror    xstd
## 1 0.50000000      0 1.00000000 1.1323529 0.06663783
## 2 0.44117647      1 0.50000000 0.6176471 0.07382294
## 3 0.01470588      2 0.05882353 0.1176471 0.03997857
## 4 0.01000000      3 0.04411765 0.1323529 0.04218454
```

```
tree <- prune(decisionTree,cp=0.014)
```

```
opar<-par(no.readonly = T)
par(mfrow=c(1,2))
library(rpart.plot)
png(file = "tree1.png")
rpart.plot(decisionTree,branch=1, extra=106, under=T, faclen=0, cex=0.8, main="before pruning")
```

```
## Warning: extra=106 but the response has 3 levels (only the 2nd level is
## displayed)
```

```
png(file = "tree2.png")
rpart.plot(tree, branch=1, extra=106, under=T, faclen=0, cex=0.8, main="after pruning")
```

```
## Warning: extra=106 but the response has 3 levels (only the 2nd level is
## displayed)
```

```
par(opar)
dev.off()
```

```
## pdf
## 2
```

```
predtree<-predict(tree,newdata=vdata,type="class")
table(vdata$category,predtree,dnn=c("true value","predict value"))
```

```
##               predict value
## true value   Iris-setosa Iris-versicolor Iris-virginica
## Iris-setosa         16           0           0
## Iris-versicolor      0          14           2
## Iris-virginica       0           0          13
```