## 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)</pre>
names(data) <- c("sepalLength", "sepalWidth", "petalLength", "petalWidth", "category")</pre>
print(data)
       sepalLength sepalWidth petalLength petalWidth
##
                                                             category
                          3.5
## 1
               5.1
                                      1.4
                                                  0.2
                                                          Iris-setosa
## 2
               4.9
                          3.0
                                      1.4
                                                  0.2
                                                          Iris-setosa
                          3.2
## 3
               4.7
                                      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
               5.4
                          3.7
                                                 0.2
## 11
                                      1.5
                                                         Iris-setosa
```

шш	10	4 0	0 4	1 0	0 0	T
##		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	3.4	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
##		5.0	3.3	1.4	0.2	Iris-setosa
##		7.0	3.2	4.7	1.4 Ir	is-versicolor
##		6.4	3.2	4.5		is-versicolor
##		6.9	3.1	4.9		is-versicolor
##		5.5	2.3	4.0		is-versicolor
##		6.5	2.8	4.6		is-versicolor
##		5.7	2.8	4.5		is-versicolor
	57	6.3	3.3	4.7		is-versicolor
	58	4.9	2.4	3.3		is-versicolor
##		6.6				
			2.9	4.6		is-versicolor
##		5.2	2.7	3.9		is-versicolor
##		5.0	2.0	3.5		is-versicolor
##		5.9	3.0	4.2		is-versicolor
##		6.0	2.2	4.0		is-versicolor
##		6.1	2.9	4.7		is-versicolor
##	65	5.6	2.9	3.6	1.3 Ir	is-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		Iris-versicolor
	88	6.3	2.3	4.4		Iris-versicolor
	89	5.6	3.0	4.1		Iris-versicolor
	90	5.5	2.5	4.0		Iris-versicolor
##	91	5.5	2.6	4.4		Iris-versicolor
##	92	6.1	3.0	4.6		Iris-versicolor
	93	5.8	2.6	4.0		Iris-versicolor
##	94	5.0	2.3	3.3		Iris-versicolor
##	95	5.6	2.7	4.2		Iris-versicolor
##	96	5.7	3.0	4.2		Iris-versicolor
##	97	5.7	2.9	4.2		Iris-versicolor
##	98	6.2	2.9	4.3		Iris-versicolor
	99	5.1	2.5	3.0		Iris-versicolor
## ##	100 101	5.7 6.3	2.8 3.3	4.1 6.0	2.5	Iris-versicolor
	101		2.7	5.1	1.9	Iris-virginica Iris-virginica
	102	5.8 7.1	3.0	5.9		_
	103	6.3	2.9	5.6	1.8	Iris-virginica
	104	6.5	3.0	5.8	2.2	Iris-virginica 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
						9

	100		0 0		4 -	
	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

##	10	5.7	3.8	1.7	0.3	Tria-actors
##	20	5.1	3.8	1.7	0.3	Iris-setosa
						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		ris-versicolor
##	52	6.4	3.2	4.5		ris-versicolor
##	53	6.9	3.1	4.9		ris-versicolor
##	54	5.5	2.3	4.0		ris-versicolor
##		6.5	2.8	4.6		ris-versicolor
			2.8			
##		5.7 6.3	3.3	4.5		ris-versicolor ris-versicolor
##		4.9	2.4	3.3		ris-versicolor
##						
		6.6	2.9	4.6		ris-versicolor
##		5.2	2.7	3.9		ris-versicolor
##		5.0	2.0	3.5		ris-versicolor
	62	5.9	3.0	4.2		ris-versicolor
##		6.0	2.2	4.0		ris-versicolor
	64	6.1	2.9	4.7		ris-versicolor
	65	5.6	2.9	3.6		ris-versicolor
	66	6.7	3.1	4.4		ris-versicolor
	67	5.6	3.0	4.5		ris-versicolor
	68	5.8	2.7	4.1		ris-versicolor
	69	6.2	2.2	4.5		ris-versicolor
##		5.6	2.5	3.9		ris-versicolor
##	71	5.9	3.2	4.8	1.8 I	ris-versicolor
##	72	6.1	2.8	4.0	1.3 Iı	ris-versicolor

##		6.3	2.5	4.9		Iris-versicolor
	74	6.1	2.8	4.7		Iris-versicolor
	75	6.4	2.9	4.3		Iris-versicolor
##	76	6.6	3.0	4.4		Iris-versicolor
##	77	6.8	2.8	4.8		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		Iris-versicolor
##	88	6.3	2.3	4.4		Iris-versicolor
##	89	5.6	3.0	4.1		Iris-versicolor
##	90	5.5	2.5	4.0		Iris-versicolor
##	91	5.5	2.6	4.4		Iris-versicolor
##	92	6.1	3.0	4.6		Iris-versicolor
##	93	5.8	2.6	4.0		Iris-versicolor
##	94	5.0	2.3	3.3		Iris-versicolor
##	95	5.6	2.7	4.2		Iris-versicolor
##	96	5.7	3.0	4.2		Iris-versicolor
##	97	5.7	2.9	4.2		Iris-versicolor
##	98	6.2	2.9	4.3		Iris-versicolor
##	99	5.1	2.5	3.0	1.1	
##	100	5.7	2.8	4.1		Iris-versicolor
##	100	6.3		6.0		
##	101	5.8	3.3 2.7	5.1	2.5	Iris-virginica
		7.1			1.9	Iris-virginica
##	103		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
                                                   2.1 Iris-virginica
               6.4
                           2.8
                                       5.6
## 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
                                                   1.5 Iris-virginica
## 134
               6.3
                           2.8
                                       5.1
## 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
                                                   2.3 Iris-virginica
                                       5.4
## 150
               5.9
                           3.0
                                                   1.8 Iris-virginica
                                       5.1
```

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

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

print(tdata)</pre>
```

```
##
       sepalLength sepalWidth petalLength petalWidth
                                                               category
## 62
               5.9
                           3.0
                                        4.2
                                                    1.5 Iris-versicolor
                7.2
                           3.2
## 126
                                        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
                           3.0
                6.1
                                        4.6
                                                    1.4 Iris-versicolor
## 67
               5.6
                           3.0
                                        4.5
                                                    1.5 Iris-versicolor
                                                    1.5 Iris-virginica
## 120
               6.0
                           2.2
                                        5.0
## 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
                           3.0
## 128
               6.1
                                        4.9
                                                    1.8 Iris-virginica
```

шш	60	5.8	2.7	1 1	1 0	T
	68 75	6.4	2.7	4.1		Iris-versicolor
						Iris-versicolor
##	125	6.7	3.3	5.7	2.1	Iris-virginica
	72	6.1	2.8	4.0		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	
##	34	5.5	4.2	1.4	0.2	Iris-setosa
	60	5.2	2.7	3.9		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		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
	00	0.2		1.0	· · ·	IIID DOODDG
	74	6 1	2.8	4 7	1 2	Tris-versicolor
##	74 124	6.1	2.8	4.7		Iris-versicolor Tris-virginica
	124	6.3	2.7	4.9	1.8	Iris-virginica
##	124 97	6.3 5.7	2.7 2.9	4.9 4.2	1.8 1.3	Iris-virginica Iris-versicolor
## ##	124 97 22	6.3 5.7 5.1	2.7 2.9 3.7	4.9 4.2 1.5	1.8 1.3 0.4	Iris-virginica Iris-versicolor Iris-setosa
## ## ##	124 97 22 103	6.3 5.7 5.1 7.1	2.7 2.9 3.7 3.0	4.9 4.2 1.5 5.9	1.8 1.3 0.4 2.1	Iris-virginica Iris-versicolor Iris-setosa Iris-virginica
## ## ## ##	124 97 22 103 1	6.3 5.7 5.1 7.1 5.1	2.7 2.9 3.7 3.0 3.5	4.9 4.2 1.5 5.9	1.8 1.3 0.4 2.1 0.2	Iris-virginica Iris-versicolor Iris-setosa Iris-virginica Iris-setosa
## ## ## ##	124 97 22 103 1 145	6.3 5.7 5.1 7.1 5.1 6.7	2.7 2.9 3.7 3.0 3.5 3.3	4.9 4.2 1.5 5.9 1.4 5.7	1.8 1.3 0.4 2.1 0.2 2.5	Iris-virginica Iris-versicolor Iris-setosa Iris-virginica Iris-setosa Iris-virginica
## ## ## ## ##	124 97 22 103 1 145 47	6.3 5.7 5.1 7.1 5.1 6.7 5.1	2.7 2.9 3.7 3.0 3.5 3.3	4.9 4.2 1.5 5.9 1.4 5.7 1.6	1.8 1.3 0.4 2.1 0.2 2.5 0.2	Iris-virginica Iris-versicolor Iris-setosa Iris-virginica Iris-setosa Iris-virginica Iris-setosa
## ## ## ## ## ##	124 97 22 103 1 145 47	6.3 5.7 5.1 7.1 5.1 6.7 5.1 5.0	2.7 2.9 3.7 3.0 3.5 3.3 3.8 2.3	4.9 4.2 1.5 5.9 1.4 5.7 1.6 3.3	1.8 1.3 0.4 2.1 0.2 2.5 0.2 1.0	Iris-virginica Iris-versicolor Iris-setosa Iris-virginica Iris-setosa Iris-virginica Iris-setosa Iris-versicolor
## ## ## ## ## ##	124 97 22 103 1 145 47 94 26	6.3 5.7 5.1 7.1 5.1 6.7 5.1 5.0 5.0	2.7 2.9 3.7 3.0 3.5 3.3 3.8 2.3 3.0	4.9 4.2 1.5 5.9 1.4 5.7 1.6 3.3	1.8 1.3 0.4 2.1 0.2 2.5 0.2 1.0 0.2	Iris-virginica Iris-versicolor Iris-setosa Iris-virginica Iris-setosa Iris-virginica Iris-setosa Iris-setosa Iris-setosa
## ## ## ## ## ##	124 97 22 103 1 145 47	6.3 5.7 5.1 7.1 5.1 6.7 5.1 5.0	2.7 2.9 3.7 3.0 3.5 3.3 3.8 2.3	4.9 4.2 1.5 5.9 1.4 5.7 1.6 3.3	1.8 1.3 0.4 2.1 0.2 2.5 0.2 1.0 0.2	Iris-virginica Iris-versicolor Iris-setosa Iris-virginica Iris-setosa Iris-virginica Iris-setosa Iris-versicolor

##	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	<pre>Iris-versicolor</pre>
##	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	<pre>Iris-versicolor</pre>
##	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	<pre>Iris-versicolor</pre>
##	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

```
6.0
                          2.2
                                      4.0
## 63
                                                 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
               6.7
                          3.0
                                                 1.7 Iris-versicolor
## 78
                                      5.0
## 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
               6.3
                          2.3
                                      4.4
                                                 1.3 Iris-versicolor
## 88
## 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
               6.2
                          2.9
                                                 1.3 Iris-versicolor
## 98
                                      4.3
               6.3
## 104
                          2.9
                                      5.6
                                                 1.8 Iris-virginica
## 108
               7.3
                          2.9
                                                 1.8 Iris-virginica
                                      6.3
## 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
               6.3
## 147
                          2.5
                                      5.0
                                                 1.9 Iris-virginica
## 149
               6.2
                          3.4
                                      5.4
                                                 2.3 Iris-virginica
                                                 1.8 Iris-virginica
## 150
               5.9
                          3.0
                                      5.1
decisionTree <- rpart(category~., data=tdata, method = "class", parms = list(split="information"))</pre>
decisionTree$cptable
             CP nsplit rel error
##
                                     xerror
                                                  xstd
## 1 0.5000000
                     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)</pre>
opar<-par(no.readonly = T)</pre>
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"))</pre>
```

##	I	oredict value	e	
##	true value	Iris-setosa	<pre>Iris-versicolor</pre>	Iris-virginica
##	Iris-setosa	16	0	0
##	Iris-versicolor	0	14	2
##	Iris-virginica	0	0	13