

# Data Mining in R

## Assignment 2

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### Q.1

The proportion of variance in the observations is almost completely (1) explained by the model.

### Q.2

$k-1$  integer  $[0:1]$  variables used to represent categories of a categorical variable where  $k$  is the number of categories.

### Q.3

It will fit the training data too perfectly capturing spurious relationships of the training data set, thus performing badly when faced with a new data sample for which predictions are required.

### Q.4

To avoid over-fitting

### Q.5

Calculating the performance metrics using the training data is unreliable because the obtained estimates are biased. The performance metrics would hardly generalize over new samples for which the target variable is unknown.

### Q.6

Testing the model on data not used for its construction

## Q.7

The model is performing very poorly. NMSE values are usually between 0 and 1 with lower values indicating better model performance

## Assignment

First we load the data

```
> load("~/R/PASS/DMinR/AlgaeBlooms/algae.RData")
> head(algae)
```

	season	size	speed	mxPH	mnO2	Cl	NO3	NH4	oP04	P04	Chla	a1
1	winter	small	medium	8.00	9.8	60.800	6.238	578.000	105.000	170.000	50.0	0.0
2	spring	small	medium	8.35	8.0	57.750	1.288	370.000	428.750	558.750	1.3	1.4
3	autumn	small	medium	8.10	11.4	40.020	5.330	346.667	125.667	187.057	15.6	3.3
4	spring	small	medium	8.07	4.8	77.364	2.302	98.182	61.182	138.700	1.4	3.1
5	autumn	small	medium	8.06	9.0	55.350	10.416	233.700	58.222	97.580	10.5	9.2
6	winter	small	high	8.25	13.1	65.750	9.248	430.000	18.250	56.667	28.4	15.1

	a2	a3	a4	a5	a6	a7
1	0.0	0.0	0.0	34.2	8.3	0.0
2	7.6	4.8	1.9	6.7	0.0	2.1
3	53.6	1.9	0.0	0.0	0.0	9.7
4	41.0	18.9	0.0	1.4	0.0	1.4
5	2.9	7.5	0.0	7.5	4.1	1.0
6	14.6	1.4	0.0	22.5	12.6	2.9

Load the DMwR library

```
> library(DMwR)
```

Impute missing data

```
> clean.algae <- knnImputation(algae, k = 10)
```

Prepare cross validation functions

```
> cv.rpart <- function(form,train,test,...) {
+ m <- rpartXse(form,train,...)
+ p <- predict(m,test)
+ mae <- mean(abs(p-resp(form,test)))
+ c(mae=mae)
+ }

> DSs <- sapply(names(clean.algae)[12:18],
+ function(x,names.attrs) {
+ f <- as.formula(paste(x,"~ ."))
+ dataset(f,clean.algae[,c(names.attrs,x)],x)
+ },
+ names(clean.algae)[1:11])
```

Perform comparisons

```
> res.all <- experimentalComparison(  
+ DSs,  
+ c(variants('cv.rpart',se=c(0,0.2,0.4,0.6,0.8,1.0,1.2,1.4,1.6,1.8))),  
+ cvSettings(5,2,1234))
```

##### CROSS VALIDATION EXPERIMENTAL COMPARISON #####

\*\* DATASET :: a1

++ LEARNER :: cv.rpart variant -> cv.rpart.v1

5 x 2 - Fold Cross Validation run with seed = 1234

Repetition 1

Fold: 1 2

Repetition 2

Fold: 1 2

Repetition 3

Fold: 1 2

Repetition 4

Fold: 1 2

Repetition 5

Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v2

5 x 2 - Fold Cross Validation run with seed = 1234

Repetition 1

Fold: 1 2

Repetition 2

Fold: 1 2

Repetition 3

Fold: 1 2

Repetition 4

Fold: 1 2

Repetition 5

Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v3

5 x 2 - Fold Cross Validation run with seed = 1234

Repetition 1

Fold: 1 2

Repetition 2

```
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v4
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v5
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v6
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
```

```
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v7
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v8
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v9
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
```

```
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v10
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
** DATASET :: a2
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v1
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v2
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
```

```
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v3
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v4
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v5
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
```

```
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v6
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v7
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v8
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
```



```
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v9
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v10
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
** DATASET :: a3
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v1
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
```

```
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v2
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v3
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v4
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
```

```
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v5
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v6
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2
```

```
++ LEARNER :: cv.rpart variant -> cv.rpart.v7
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
```

Fold: 1 2  
Repetition 5  
Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v8

5 x 2 - Fold Cross Validation run with seed = 1234  
Repetition 1  
Fold: 1 2  
Repetition 2  
Fold: 1 2  
Repetition 3  
Fold: 1 2  
Repetition 4  
Fold: 1 2  
Repetition 5  
Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v9

5 x 2 - Fold Cross Validation run with seed = 1234  
Repetition 1  
Fold: 1 2  
Repetition 2  
Fold: 1 2  
Repetition 3  
Fold: 1 2  
Repetition 4  
Fold: 1 2  
Repetition 5  
Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v10

5 x 2 - Fold Cross Validation run with seed = 1234  
Repetition 1  
Fold: 1 2  
Repetition 2  
Fold: 1 2  
Repetition 3  
Fold: 1 2  
Repetition 4  
Fold: 1 2

Repetition 5  
Fold: 1 2

\*\* DATASET :: a4

++ LEARNER :: cv.rpart variant -> cv.rpart.v1

5 x 2 - Fold Cross Validation run with seed = 1234  
Repetition 1  
Fold: 1 2  
Repetition 2  
Fold: 1 2  
Repetition 3  
Fold: 1 2  
Repetition 4  
Fold: 1 2  
Repetition 5  
Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v2

5 x 2 - Fold Cross Validation run with seed = 1234  
Repetition 1  
Fold: 1 2  
Repetition 2  
Fold: 1 2  
Repetition 3  
Fold: 1 2  
Repetition 4  
Fold: 1 2  
Repetition 5  
Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v3

5 x 2 - Fold Cross Validation run with seed = 1234  
Repetition 1  
Fold: 1 2  
Repetition 2  
Fold: 1 2  
Repetition 3  
Fold: 1 2  
Repetition 4

Fold: 1 2  
Repetition 5  
Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v4

5 x 2 - Fold Cross Validation run with seed = 1234  
Repetition 1  
Fold: 1 2  
Repetition 2  
Fold: 1 2  
Repetition 3  
Fold: 1 2  
Repetition 4  
Fold: 1 2  
Repetition 5  
Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v5

5 x 2 - Fold Cross Validation run with seed = 1234  
Repetition 1  
Fold: 1 2  
Repetition 2  
Fold: 1 2  
Repetition 3  
Fold: 1 2  
Repetition 4  
Fold: 1 2  
Repetition 5  
Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v6

5 x 2 - Fold Cross Validation run with seed = 1234  
Repetition 1  
Fold: 1 2  
Repetition 2  
Fold: 1 2  
Repetition 3  
Fold: 1 2  
Repetition 4  
Fold: 1 2

Repetition 5  
Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v7

5 x 2 - Fold Cross Validation run with seed = 1234  
Repetition 1  
Fold: 1 2  
Repetition 2  
Fold: 1 2  
Repetition 3  
Fold: 1 2  
Repetition 4  
Fold: 1 2  
Repetition 5  
Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v8

5 x 2 - Fold Cross Validation run with seed = 1234  
Repetition 1  
Fold: 1 2  
Repetition 2  
Fold: 1 2  
Repetition 3  
Fold: 1 2  
Repetition 4  
Fold: 1 2  
Repetition 5  
Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v9

5 x 2 - Fold Cross Validation run with seed = 1234  
Repetition 1  
Fold: 1 2  
Repetition 2  
Fold: 1 2  
Repetition 3  
Fold: 1 2  
Repetition 4  
Fold: 1 2  
Repetition 5

Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v10

5 x 2 - Fold Cross Validation run with seed = 1234

Repetition 1

Fold: 1 2

Repetition 2

Fold: 1 2

Repetition 3

Fold: 1 2

Repetition 4

Fold: 1 2

Repetition 5

Fold: 1 2

\*\* DATASET :: a5

++ LEARNER :: cv.rpart variant -> cv.rpart.v1

5 x 2 - Fold Cross Validation run with seed = 1234

Repetition 1

Fold: 1 2

Repetition 2

Fold: 1 2

Repetition 3

Fold: 1 2

Repetition 4

Fold: 1 2

Repetition 5

Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v2

5 x 2 - Fold Cross Validation run with seed = 1234

Repetition 1

Fold: 1 2

Repetition 2

Fold: 1 2

Repetition 3

Fold: 1 2

Repetition 4

Fold: 1 2



Repetition 5  
Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v3

5 x 2 - Fold Cross Validation run with seed = 1234  
Repetition 1  
Fold: 1 2  
Repetition 2  
Fold: 1 2  
Repetition 3  
Fold: 1 2  
Repetition 4  
Fold: 1 2  
Repetition 5  
Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v4

5 x 2 - Fold Cross Validation run with seed = 1234  
Repetition 1  
Fold: 1 2  
Repetition 2  
Fold: 1 2  
Repetition 3  
Fold: 1 2  
Repetition 4  
Fold: 1 2  
Repetition 5  
Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v5

5 x 2 - Fold Cross Validation run with seed = 1234  
Repetition 1  
Fold: 1 2  
Repetition 2  
Fold: 1 2  
Repetition 3  
Fold: 1 2  
Repetition 4  
Fold: 1 2  
Repetition 5

Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v6

5 x 2 - Fold Cross Validation run with seed = 1234

Repetition 1

Fold: 1 2

Repetition 2

Fold: 1 2

Repetition 3

Fold: 1 2

Repetition 4

Fold: 1 2

Repetition 5

Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v7

5 x 2 - Fold Cross Validation run with seed = 1234

Repetition 1

Fold: 1 2

Repetition 2

Fold: 1 2

Repetition 3

Fold: 1 2

Repetition 4

Fold: 1 2

Repetition 5

Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v8

5 x 2 - Fold Cross Validation run with seed = 1234

Repetition 1

Fold: 1 2

Repetition 2

Fold: 1 2

Repetition 3

Fold: 1 2

Repetition 4

Fold: 1 2

Repetition 5

Fold: 1 2

```

++ LEARNER :: cv.rpart  variant ->  cv.rpart.v9

  5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2

++ LEARNER :: cv.rpart  variant ->  cv.rpart.v10

  5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2

** DATASET :: a6

++ LEARNER :: cv.rpart  variant ->  cv.rpart.v1

  5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5

```

Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v2

5 x 2 - Fold Cross Validation run with seed = 1234

Repetition 1

Fold: 1 2

Repetition 2

Fold: 1 2

Repetition 3

Fold: 1 2

Repetition 4

Fold: 1 2

Repetition 5

Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v3

5 x 2 - Fold Cross Validation run with seed = 1234

Repetition 1

Fold: 1 2

Repetition 2

Fold: 1 2

Repetition 3

Fold: 1 2

Repetition 4

Fold: 1 2

Repetition 5

Fold: 1 2

++ LEARNER :: cv.rpart variant -> cv.rpart.v4

5 x 2 - Fold Cross Validation run with seed = 1234

Repetition 1

Fold: 1 2

Repetition 2

Fold: 1 2

Repetition 3

Fold: 1 2

Repetition 4

Fold: 1 2

Repetition 5

Fold: 1 2

```

++ LEARNER :: cv.rpart  variant ->  cv.rpart.v5

  5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2

++ LEARNER :: cv.rpart  variant ->  cv.rpart.v6

  5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2

++ LEARNER :: cv.rpart  variant ->  cv.rpart.v7

  5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2

```

```

++ LEARNER :: cv.rpart  variant ->  cv.rpart.v8

  5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2

++ LEARNER :: cv.rpart  variant ->  cv.rpart.v9

  5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2

++ LEARNER :: cv.rpart  variant ->  cv.rpart.v10

  5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2

```

```

** DATASET :: a7

++ LEARNER :: cv.rpart  variant ->  cv.rpart.v1

  5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2

++ LEARNER :: cv.rpart  variant ->  cv.rpart.v2

  5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2

++ LEARNER :: cv.rpart  variant ->  cv.rpart.v3

  5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2

```

```

++ LEARNER :: cv.rpart  variant ->  cv.rpart.v4

  5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2

++ LEARNER :: cv.rpart  variant ->  cv.rpart.v5

  5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2

++ LEARNER :: cv.rpart  variant ->  cv.rpart.v6

  5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2

```



```

++ LEARNER :: cv.rpart  variant ->  cv.rpart.v7

  5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2

++ LEARNER :: cv.rpart  variant ->  cv.rpart.v8

  5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2

++ LEARNER :: cv.rpart  variant ->  cv.rpart.v9

  5 x 2 - Fold Cross Validation run with seed = 1234
Repetition 1
Fold: 1 2
Repetition 2
Fold: 1 2
Repetition 3
Fold: 1 2
Repetition 4
Fold: 1 2
Repetition 5
Fold: 1 2

++ LEARNER :: cv.rpart  variant ->  cv.rpart.v10

```

```
5 x 2 - Fold Cross Validation run with seed = 1234
```

```
Repetition 1
```

```
Fold: 1 2
```

```
Repetition 2
```

```
Fold: 1 2
```

```
Repetition 3
```

```
Fold: 1 2
```

```
Repetition 4
```

```
Fold: 1 2
```

```
Repetition 5
```

```
Fold: 1 2
```

```
> summary(res.all)
```

```
== Summary of a Cross Validation Experiment ==
```

```
5 x 2 - Fold Cross Validation run with seed = 1234
```

```
* Data sets :: a1, a2, a3, a4, a5, a6, a7
```

```
* Learners :: cv.rpart.v1, cv.rpart.v2, cv.rpart.v3, cv.rpart.v4, cv.rpart.v5, cv.rpart.v6
```

```
* Summary of Experiment Results:
```

```
-> Datatataset: a1
```

```
*Learner: cv.rpart.v1
```

```
mae
```

```
avg 13.168586
```

```
std 1.038531
```

```
min 11.690518
```

```
max 14.864936
```

```
invalid 0.000000
```

```
*Learner: cv.rpart.v2
```

```
mae
```

```
avg 13.192233
```

```
std 1.090785
```

```
min 11.690518
```

```
max 15.133573
```

```
invalid 0.000000
```

```
*Learner: cv.rpart.v3
```

```
mae
```

```
avg 13.0346549
```

```
std      0.8598161
min      11.6905180
max      14.6787986
invalid  0.0000000
```

```
      *Learner: cv.rpart.v4
      mae
avg      13.004948
std      0.875063
min      11.690518
max      14.678799
invalid  0.000000
```

```
      *Learner: cv.rpart.v5
      mae
avg      13.0910843
std      0.8132827
min      11.6905180
max      14.6787986
invalid  0.0000000
```

```
      *Learner: cv.rpart.v6
      mae
avg      13.0140813
std      0.8148432
min      11.6905180
max      14.6787986
invalid  0.0000000
```

```
      *Learner: cv.rpart.v7
      mae
avg      13.30646
std      1.37453
min      11.69052
max      16.50812
invalid  0.00000
```

```
      *Learner: cv.rpart.v8
      mae
avg      14.187917
std      2.126626
min      11.690518
max      17.882700
invalid  0.000000
```

```
      *Learner: cv.rpart.v9
```

```

      mae
avg      14.518745
std      2.060597
min      11.690518
max      17.882700
invalid  0.000000
```

```

      *Learner: cv.rpart.v10
      mae
avg      14.762992
std      2.135972
min      11.690518
max      17.882700
invalid  0.000000
```

-> Dataset: a2

```

      *Learner: cv.rpart.v1
      mae
avg      7.7581197
std      0.4607866
min      7.0395087
max      8.3397542
invalid  0.000000
```

```

      *Learner: cv.rpart.v2
      mae
avg      7.8075759
std      0.4658171
min      6.9307809
max      8.4900000
invalid  0.000000
```

```

      *Learner: cv.rpart.v3
      mae
avg      7.9054778
std      0.3493966
min      7.2798000
max      8.4900000
invalid  0.000000
```

```

      *Learner: cv.rpart.v4
      mae
avg      7.9054778
std      0.3493966
```

min 7.2798000  
max 8.4900000  
invalid 0.0000000

\*Learner: cv.rpart.v5  
mae  
avg 7.9054778  
std 0.3493966  
min 7.2798000  
max 8.4900000  
invalid 0.0000000

\*Learner: cv.rpart.v6  
mae  
avg 7.9054778  
std 0.3493966  
min 7.2798000  
max 8.4900000  
invalid 0.0000000

\*Learner: cv.rpart.v7  
mae  
avg 7.9054778  
std 0.3493966  
min 7.2798000  
max 8.4900000  
invalid 0.0000000

\*Learner: cv.rpart.v8  
mae  
avg 7.9054778  
std 0.3493966  
min 7.2798000  
max 8.4900000  
invalid 0.0000000

\*Learner: cv.rpart.v9  
mae  
avg 7.9054778  
std 0.3493966  
min 7.2798000  
max 8.4900000  
invalid 0.0000000

\*Learner: cv.rpart.v10  
mae

```
avg      7.9054778
std      0.3493966
min      7.2798000
max      8.4900000
invalid  0.0000000
```

-> Datataset: a3

```
      *Learner: cv.rpart.v1
      mae
avg    4.8639263
std    0.2363568
min    4.5866800
max    5.4568830
invalid 0.0000000
```

```
      *Learner: cv.rpart.v2
      mae
avg    4.7965880
std    0.1117076
min    4.5866800
max    4.9732800
invalid 0.0000000
```

```
      *Learner: cv.rpart.v3
      mae
avg    4.7965880
std    0.1117076
min    4.5866800
max    4.9732800
invalid 0.0000000
```

```
      *Learner: cv.rpart.v4
      mae
avg    4.7965880
std    0.1117076
min    4.5866800
max    4.9732800
invalid 0.0000000
```

```
      *Learner: cv.rpart.v5
      mae
avg    4.7965880
std    0.1117076
min    4.5866800
```

```
max      4.9732800
invalid  0.0000000
```

```
      *Learner: cv.rpart.v6
      mae
avg      4.7965880
std      0.1117076
min      4.5866800
max      4.9732800
invalid  0.0000000
```

```
      *Learner: cv.rpart.v7
      mae
avg      4.7965880
std      0.1117076
min      4.5866800
max      4.9732800
invalid  0.0000000
```

```
      *Learner: cv.rpart.v8
      mae
avg      4.7965880
std      0.1117076
min      4.5866800
max      4.9732800
invalid  0.0000000
```

```
      *Learner: cv.rpart.v9
      mae
avg      4.7965880
std      0.1117076
min      4.5866800
max      4.9732800
invalid  0.0000000
```

```
      *Learner: cv.rpart.v10
      mae
avg      4.7965880
std      0.1117076
min      4.5866800
max      4.9732800
invalid  0.0000000
```

```
-> Datataset:  a4
```

```

        *Learner: cv.rpart.v1
            mae
avg      2.4092525
std      0.1396921
min      2.1612400
max      2.6425400
invalid  0.0000000

```

```

        *Learner: cv.rpart.v2
            mae
avg      2.3564680
std      0.1555852
min      2.1612400
max      2.6425400
invalid  0.0000000

```

```

        *Learner: cv.rpart.v3
            mae
avg      2.3564680
std      0.1555852
min      2.1612400
max      2.6425400
invalid  0.0000000

```

```

        *Learner: cv.rpart.v4
            mae
avg      2.3564680
std      0.1555852
min      2.1612400
max      2.6425400
invalid  0.0000000

```

```

        *Learner: cv.rpart.v5
            mae
avg      2.3564680
std      0.1555852
min      2.1612400
max      2.6425400
invalid  0.0000000

```

```

        *Learner: cv.rpart.v6
            mae
avg      2.3564680
std      0.1555852
min      2.1612400
max      2.6425400

```



invalid 0.0000000

```
      *Learner: cv.rpart.v7
      mae
avg    2.3564680
std    0.1555852
min    2.1612400
max    2.6425400
invalid 0.0000000
```

```
      *Learner: cv.rpart.v8
      mae
avg    2.3564680
std    0.1555852
min    2.1612400
max    2.6425400
invalid 0.0000000
```

```
      *Learner: cv.rpart.v9
      mae
avg    2.3564680
std    0.1555852
min    2.1612400
max    2.6425400
invalid 0.0000000
```

```
      *Learner: cv.rpart.v10
      mae
avg    2.3564680
std    0.1555852
min    2.1612400
max    2.6425400
invalid 0.0000000
```

-> Datataset: a5

```
      *Learner: cv.rpart.v1
      mae
avg    5.4307073
std    0.4128063
min    4.9282613
max    6.0864400
invalid 0.0000000
```

```
      *Learner: cv.rpart.v2
```

```

      mae
avg      5.4499859
std      0.3803334
min      5.0151800
max      6.0864400
invalid  0.0000000
```

```

      *Learner: cv.rpart.v3
      mae
avg      5.4499859
std      0.3803334
min      5.0151800
max      6.0864400
invalid  0.0000000
```

```

      *Learner: cv.rpart.v4
      mae
avg      5.4499859
std      0.3803334
min      5.0151800
max      6.0864400
invalid  0.0000000
```

```

      *Learner: cv.rpart.v5
      mae
avg      5.4499859
std      0.3803334
min      5.0151800
max      6.0864400
invalid  0.0000000
```

```

      *Learner: cv.rpart.v6
      mae
avg      5.4075177
std      0.4357981
min      4.7367600
max      6.0864400
invalid  0.0000000
```

```

      *Learner: cv.rpart.v7
      mae
avg      5.3967614
std      0.4384044
min      4.7367600
max      6.0864400
invalid  0.0000000
```

```

        *Learner: cv.rpart.v8
            mae
avg      5.3967614
std      0.4384044
min      4.7367600
max      6.0864400
invalid  0.0000000

```

```

        *Learner: cv.rpart.v9
            mae
avg      5.4128120
std      0.4529721
min      4.7367600
max      6.0864400
invalid  0.0000000

```

```

        *Learner: cv.rpart.v10
            mae
avg      5.4128120
std      0.4529721
min      4.7367600
max      6.0864400
invalid  0.0000000

```

-> Dataset: a6

```

        *Learner: cv.rpart.v1
            mae
avg      7.4792729
std      0.2135162
min      7.0352800
max      7.6522600
invalid  0.0000000

```

```

        *Learner: cv.rpart.v2
            mae
avg      7.5388080
std      0.2526123
min      7.0352800
max      8.0152600
invalid  0.0000000

```

```

        *Learner: cv.rpart.v3
            mae

```

avg 7.5388080  
std 0.2526123  
min 7.0352800  
max 8.0152600  
invalid 0.0000000

\*Learner: cv.rpart.v4  
mae  
avg 7.5388080  
std 0.2526123  
min 7.0352800  
max 8.0152600  
invalid 0.0000000

\*Learner: cv.rpart.v5  
mae  
avg 7.5388080  
std 0.2526123  
min 7.0352800  
max 8.0152600  
invalid 0.0000000

\*Learner: cv.rpart.v6  
mae  
avg 7.5388080  
std 0.2526123  
min 7.0352800  
max 8.0152600  
invalid 0.0000000

\*Learner: cv.rpart.v7  
mae  
avg 7.5388080  
std 0.2526123  
min 7.0352800  
max 8.0152600  
invalid 0.0000000

\*Learner: cv.rpart.v8  
mae  
avg 7.5388080  
std 0.2526123  
min 7.0352800  
max 8.0152600  
invalid 0.0000000

```

          *Learner: cv.rpart.v9
              mae
avg      7.5388080
std      0.2526123
min      7.0352800
max      8.0152600
invalid  0.0000000

```

```

          *Learner: cv.rpart.v10
              mae
avg      7.5388080
std      0.2526123
min      7.0352800
max      8.0152600
invalid  0.0000000

```

```

-> Datataset:  a7

```

```

          *Learner: cv.rpart.v1
              mae
avg      2.9940087
std      0.1918898
min      2.7243200
max      3.3096472
invalid  0.0000000

```

```

          *Learner: cv.rpart.v2
              mae
avg      2.9658400
std      0.1581088
min      2.7243200
max      3.2191400
invalid  0.0000000

```

```

          *Learner: cv.rpart.v3
              mae
avg      2.9658400
std      0.1581088
min      2.7243200
max      3.2191400
invalid  0.0000000

```

```

          *Learner: cv.rpart.v4
              mae
avg      2.9658400

```

std 0.1581088  
min 2.7243200  
max 3.2191400  
invalid 0.0000000

\*Learner: cv.rpart.v5  
mae  
avg 2.9658400  
std 0.1581088  
min 2.7243200  
max 3.2191400  
invalid 0.0000000

\*Learner: cv.rpart.v6  
mae  
avg 2.9658400  
std 0.1581088  
min 2.7243200  
max 3.2191400  
invalid 0.0000000

\*Learner: cv.rpart.v7  
mae  
avg 2.9658400  
std 0.1581088  
min 2.7243200  
max 3.2191400  
invalid 0.0000000

\*Learner: cv.rpart.v8  
mae  
avg 2.9658400  
std 0.1581088  
min 2.7243200  
max 3.2191400  
invalid 0.0000000

\*Learner: cv.rpart.v9  
mae  
avg 2.9658400  
std 0.1581088  
min 2.7243200  
max 3.2191400  
invalid 0.0000000

\*Learner: cv.rpart.v10

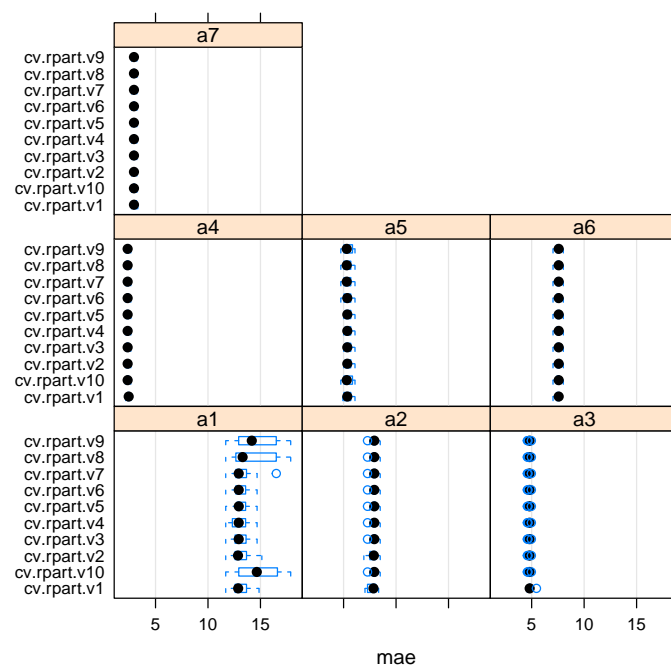
```

      mae
avg    2.9658400
std    0.1581088
min    2.7243200
max    3.2191400
invalid 0.0000000

```

Plotting all results

```
> plot(res.all)
```



Getting best scores

```
> bs <- bestScores(res.all)
> bs
```

```

$a1
      system      score
mae cv.rpart.v4 13.00495

```

```

$a2
      system      score
mae cv.rpart.v1  7.75812

```

```
$a3
      system    score
mae cv.rpart.v2 4.796588
```

```
$a4
      system    score
mae cv.rpart.v2 2.356468
```

```
$a5
      system    score
mae cv.rpart.v7 5.396761
```

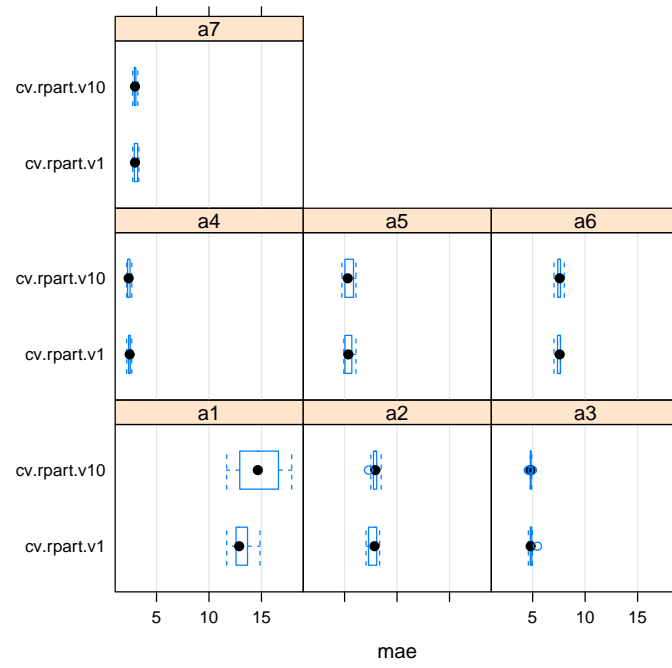
```
$a6
      system    score
mae cv.rpart.v1 7.479273
```

```
$a7
      system    score
mae cv.rpart.v2 2.96584
```

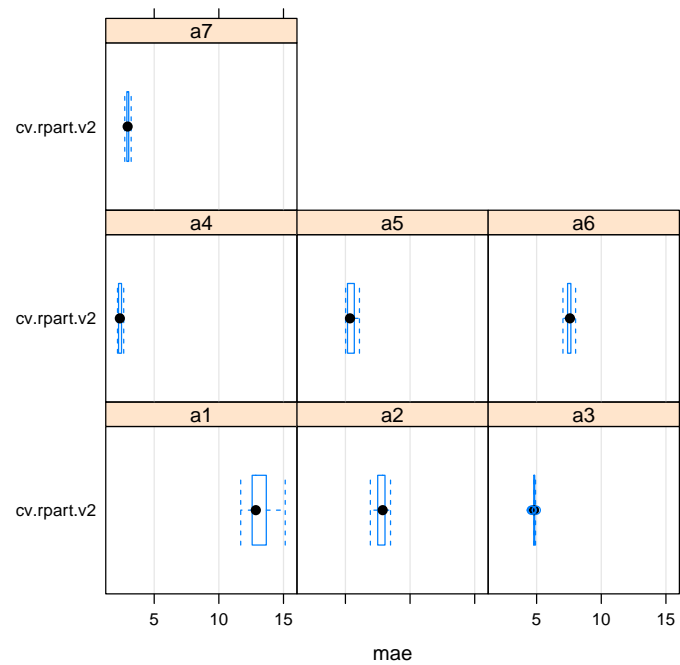
Plotting best variants of models for the given algae

```
> # Subset by name not exact?
> res.all.v1 <- subset(res.all, vars='cv.rpart.v1')
> plot(res.all.v1)
```





```
> # Subset by name not exact?
> res.all.v2 <- subset(res.all, vars='cv.rpart.v2')
> plot(res.all.v2)
```



```
> # Subset by name not exact?
> res.all.v5 <- subset(res.all, vars='cv.rpart.v5')
> plot(res.all.v5)
```

