mtb12

```
m12r<-read.csv("/Users/i Dolphin Online/Documents/12rv.csv")
library(randomForest)
```

```
## randomForest 4.6-14
```

```
## Type rfNews() to see new features/changes/bug fixes.
```

```
m12rv<- randomForest(yield~ . ,data = m12r,importance = TRUE)
library(caret)
```

```
## Loading required package: lattice
```

```
## Loading required package: ggplot2
```

```
##
## Attaching package: 'ggplot2'
```

```
## The following object is masked from 'package:randomForest':
##
##     margin
```

```
imp <- as.data.frame(varImp(m12rv))
imp <- data.frame(overall = imp$Overall, names = rownames(imp))
imp[order(imp$overall, decreasing = T),]
```

```
##      overall                         names
## 1  10.252758 Total.Foreign.Investment.lag
## 9   9.511670           PKR.PER.USD.day.lag
## 53  9.035928             PK10YRPAV.FMAP.MA
## 24  8.391071             PK3YRPAV.FMAP.LAG
## 23  7.301245             PK2YRPAV.FMAP.LAG
## 2   7.193942     NET.RESERVES.WITH.SBP.lag
## 33  7.091402            PK20YRPAV.FMAP.LAG
## 26  6.940297             PK5YRPAV.FMAP.LAG
## 25  6.934011             PK4YRPAV.FMAP.LAG
## 3   6.833931      Workers..Remittances.lag
## 11  6.067255               TREASURY.CMT.LAG
## 32  5.947013            PK15YRPAV.FMAP.LAG
## 27  5.915033             PK6YRPAV.FMAP.LAG
## 5   5.886451                 inflation.yoy
## 10  5.784331              LT.COMPOSITE.LAG
## 57  5.768475                 KHIPKR2WD..MA
## 28  5.607992             PK7YRPAV.FMAP.LAG
```

```
## 56  5.506922              KHIPKRSWD..MA
## 4   5.486603           Trade.Deficit.lag
## 31  5.450170          PK10YRPAV.FMAP.LAG
## 29  5.439493           PK8YRPAV.FMAP.LAG
## 30  5.411812           PK9YRPAV.FMAP.LAG
## 39  5.247966            PK1MRPAV.FMAP.MA
## 22  5.161166           PK1YRPAV.FMAP.LAG
## 38  5.095318            PKSWRPAV.FMAP.MA
## 20  4.589725           PK6MRPAV.FMAP.LAG
## 58  4.559148               KHIPKR1MD..MA
## 59  4.470795               KHIPKR3MD..MA
## 13  4.459808             TREASURY.CMT.MA
## 45  4.331706            PK2YRPAV.FMAP.MA
## 54  4.251588           PK15YRPAV.FMAP.MA
## 7   4.249102              oil.prices.lag
## 14  4.231202           PKSWRPAV.FMAP.lag
## 6   4.158658               inflation.mom
## 12  4.052987             LT.COMPOSITE.MA
## 55  3.974345           PK20YRPAV.FMAP.MA
## 46  3.897783            PK3YRPAV.FMAP.MA
## 34  3.598405              KHIPKRSWD..LAG
## 50  3.562165            PK7YRPAV.FMAP.MA
## 19  3.506980           PK4MRPAV.FMAP.LAG
## 52  3.457336            PK9YRPAV.FMAP.MA
## 49  3.393734            PK6YRPAV.FMAP.MA
## 8   3.330059                OIL.PRICE.MA
## 21  3.247186           PK9MRPAV.FMAP.LAG
## 37  3.181901              KHIPKR6MD..LAG
## 16  2.973169           PK1MRPAV.FMAP.lag
## 15  2.763170           PK2WRPAV.FMAP.lag
## 40  2.737050            PK3MRPAV.FMAP.MA
## 61  2.634922               KHIPKR9MD..MA
## 62  2.586863               KHIPKR1YD..MA
## 60  2.462752               KHIPKR6MD..MA
## 51  2.388734            PK8YRPAV.FMAP.MA
## 35  2.205892              KHIPKR2WD..LAG
## 43  1.990580            PK9MRPAV.FMAP.MA
## 18  1.974998           PK3MRPAV.FMAP.lag
## 36  1.973904              KHIPKR1MD..LAG
## 48  1.866437            PK5YRPAV.FMAP.MA
## 41  1.816087            PK4MRPAV.FMAP.MA
## 17  1.807878           PK2MRPAV.FMAP.lag
## 44  1.575413            PK1YRPAV.FMAP.MA
## 42  1.571376            PK6MRPAV.FMAP.MA
## 47  1.341588            PK4YRPAV.FMAP.MA
```

```
m12c<-read.csv("/Users/i Dolphin Online/Documents/12c.csv")
tmp <- cor(m12c)
tmp[upper.tri(tmp)] <- 0
diag(tmp) <- 0
data.new <- m12c[,! apply(tmp,2,function(x) any(x > 0.8))]
head(data.new)
```

```
##   Total.Foreign.Investment.lag NET.RESERVES.WITH.SBP.lag
```

```
## 1                    270.1325                   7862.6
## 2                    270.1325                   7862.6
## 3                    270.1325                   7862.6
## 4                    270.1325                   7862.6
## 5                    270.1325                   7862.6
## 6                    270.1325                   7862.6
##   Workers..Remittances.lag Trade.Deficit.lag PKR.PER.USD.day.lag KHIPKR1MD..MA
## 1                  2302.02         -2061.011            146.3007        12.024
## 2                  2302.02         -2061.011            146.3007        12.024
## 3                  2302.02         -2061.011            146.3007        12.024
## 4                  2302.02         -2061.011            146.3007        12.024
## 5                  2302.02         -2061.011            146.3007        12.024
## 6                  2302.02         -2061.011            157.0838        12.302
```

```
m12<-read.csv("/Users/i Dolphin Online/Documents/12.csv")
ind <- sample(2, nrow(m12), replace = TRUE, prob = c(0.7 , 0.3))
train12<-m12[ind==1,]
test12<-m12[ind==2,]
library(randomForest)
rf <-randomForest(yield~.,data=train12,mtry=4)
rf
```

```
##
## Call:
##  randomForest(formula = yield ~ ., data = train12, mtry = 4)
##                Type of random forest: regression
##                      Number of trees: 500
## No. of variables tried at each split: 4
##
##           Mean of squared residuals: 1.004854e-06
##                     % Var explained: 99.82
```

```
pred_values2 = predict(rf,test12)
actual_values2 = test12$yield
library(Metrics)
```

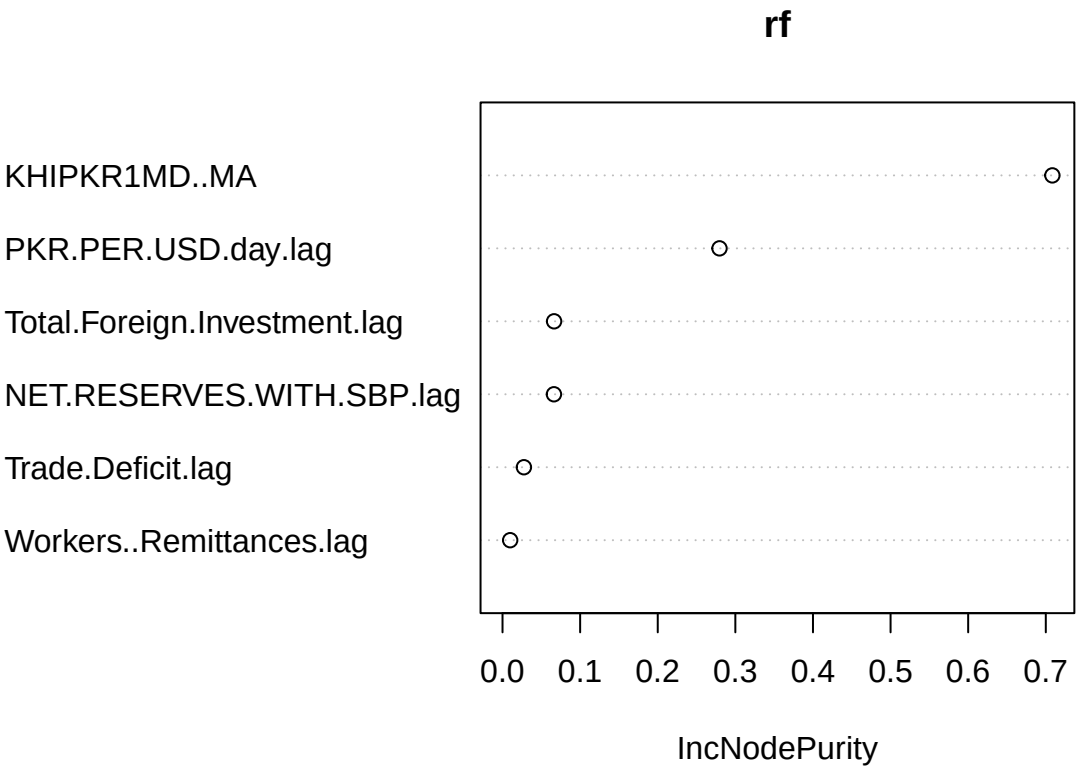
```
##
## Attaching package: 'Metrics'

## The following objects are masked from 'package:caret':
##
##     precision, recall
```

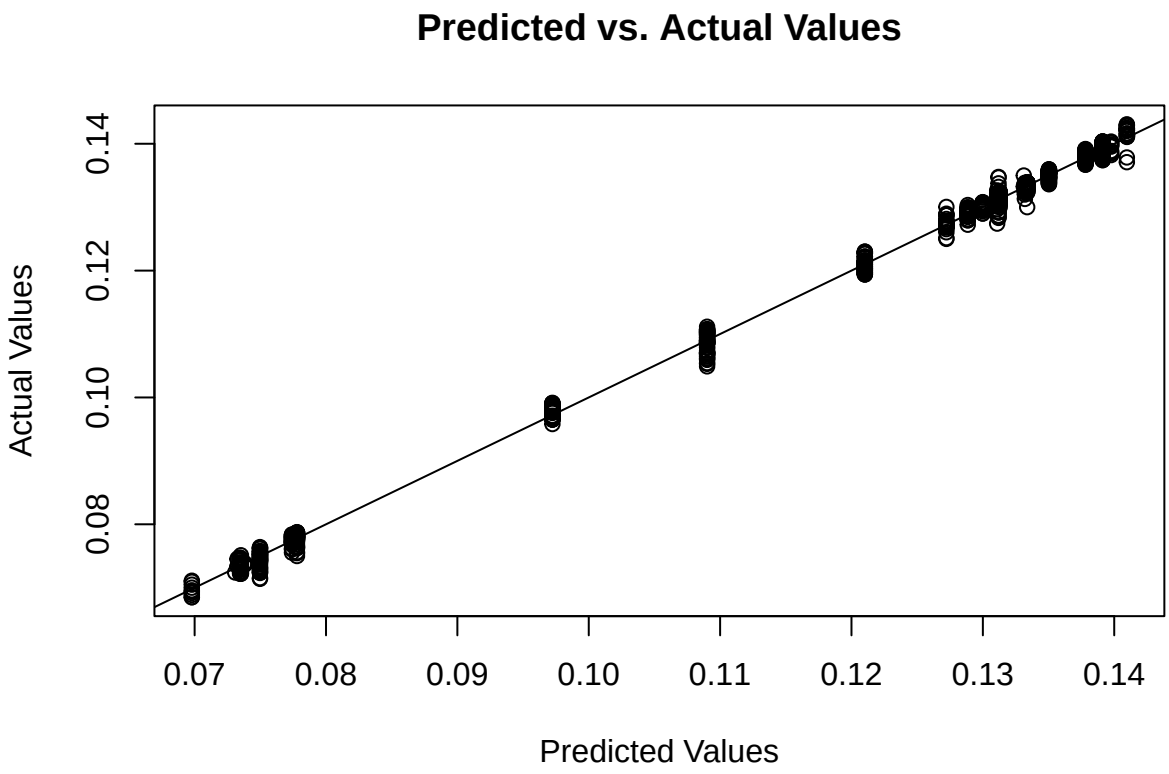
```
metrics_rmse = rmse(actual_values2,pred_values2)
print(metrics_rmse)
```

```
## [1] 0.000940249
```

```
varImpPlot(rf)
```




```
plot(x=pred_values2, y=test12$yield,
     xlab='Predicted Values',
     ylab='Actual Values',
     main='Predicted vs. Actual Values')
abline(a=0, b=1)
```




```
library(gbm)
```

```
## Loaded gbm 2.1.8
```

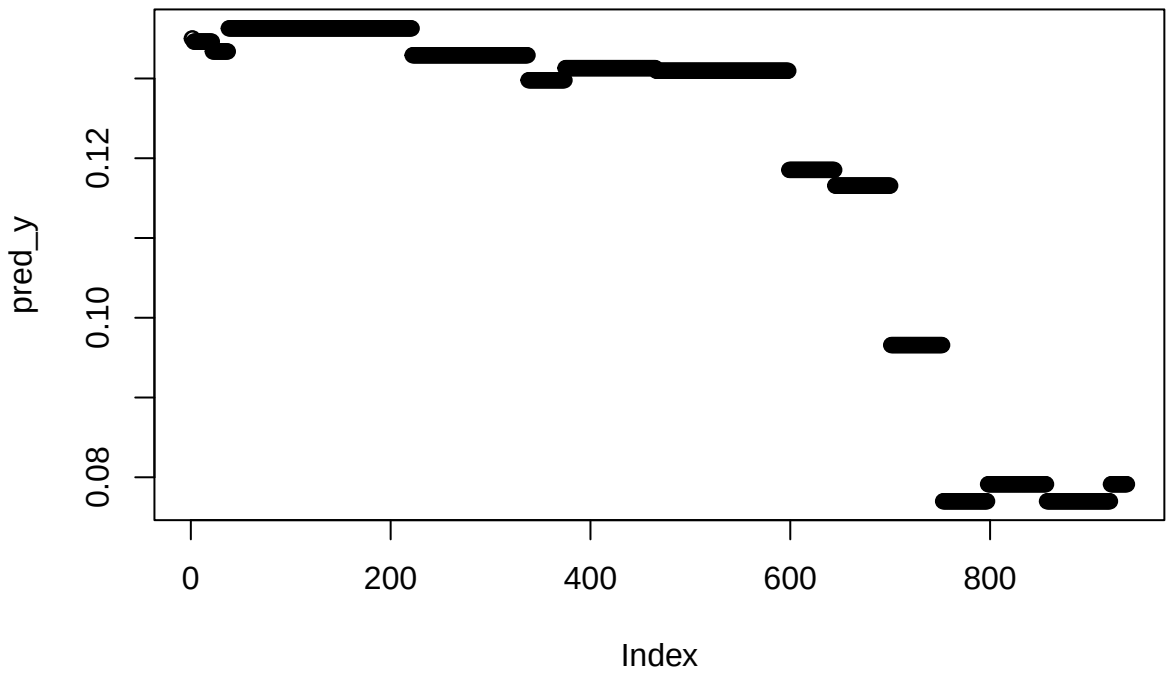
```
model_gbm <- gbm(yield ~. , data = train12, distribution = "gaussian" , cv.folds = 10 , shrinkage = .01
print(model_gbm)
```

```
## gbm(formula = yield ~ ., distribution = "gaussian", data = train12,
##     n.trees = 500, n.minobsinnode = 10, shrinkage = 0.01, cv.folds = 10)
## A gradient boosted model with gaussian loss function.
## 500 iterations were performed.
## The best cross-validation iteration was 500.
## There were 6 predictors of which 5 had non-zero influence.
```

```
pred_y <- predict.gbm(model_gbm,test12)
```

```
## Using 500 trees...
```

```
plot(pred_y)
```



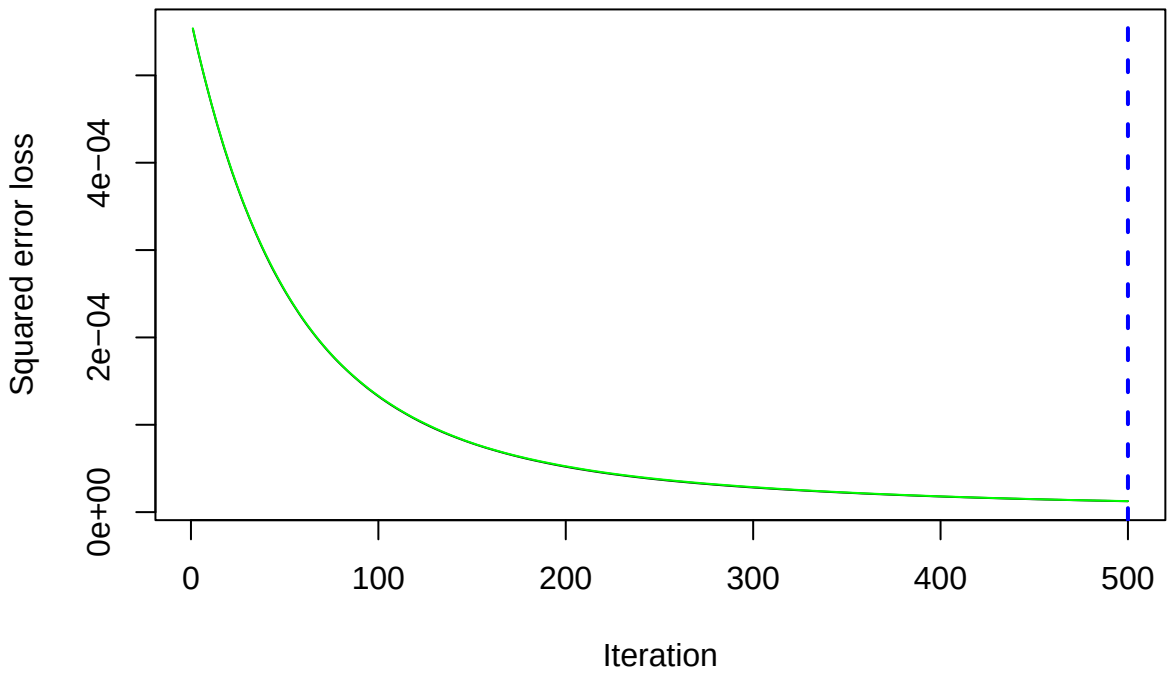

```
mse <- mse(test12$yield,pred_y)
print(mse)
```

```
## [1] 1.200455e-05
```

```
sqrt(mse)
```

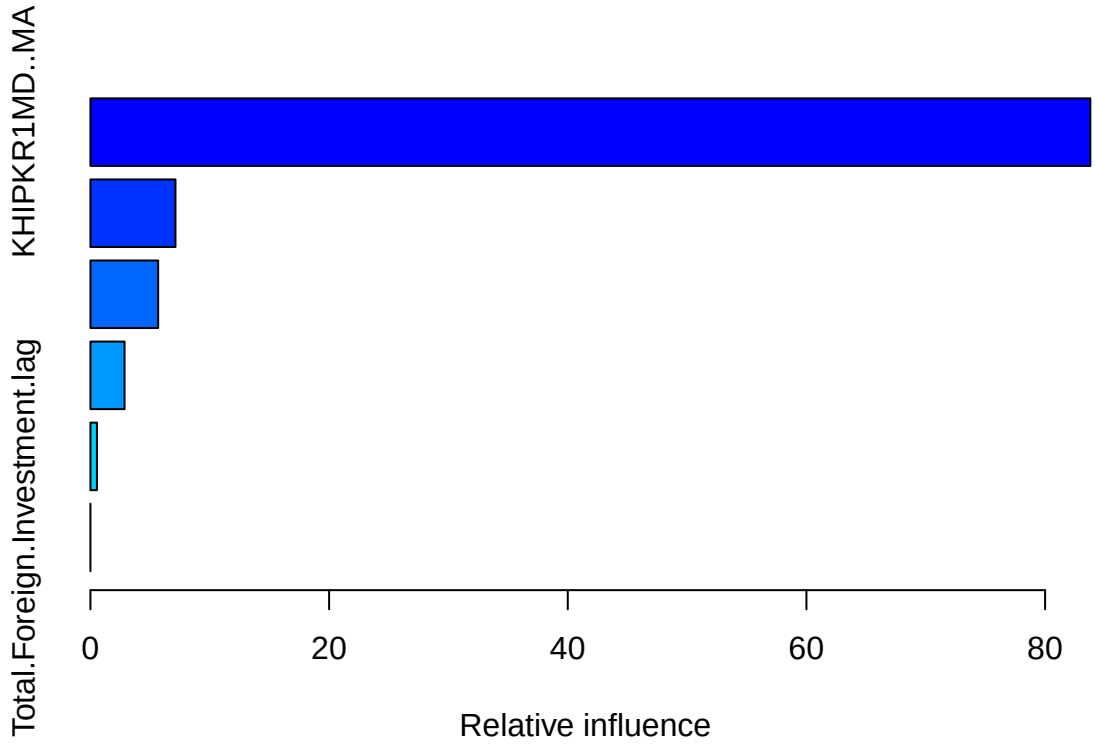
```
## [1] 0.003464758
```

```
gbm.perf(model_gbm,method="cv")
```



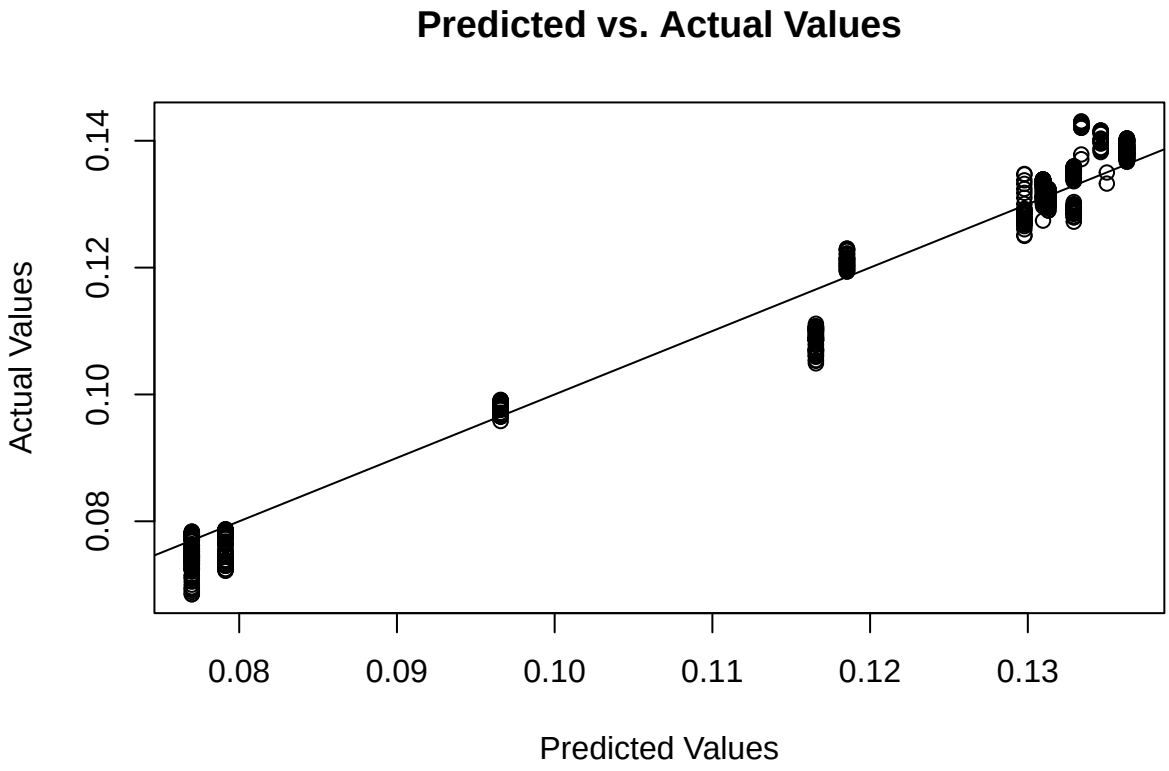

```
## [1] 500
```

```
summary(model_gbm)
```




```
##                                                    var    rel.inf
## KHIPKR1MD..MA                               KHIPKR1MD..MA 83.7917212
## PKR.PER.USD.day.lag                   PKR.PER.USD.day.lag  7.1264160
## NET.RESERVES.WITH.SBP.lag       NET.RESERVES.WITH.SBP.lag  5.6760278
## Trade.Deficit.lag                       Trade.Deficit.lag  2.8607267
## Workers..Remittances.lag         Workers..Remittances.lag  0.5451083
## Total.Foreign.Investment.lag Total.Foreign.Investment.lag  0.0000000
```

```
plot(x=pred_y, y=test12$yield,
     xlab='Predicted Values',
     ylab='Actual Values',
     main='Predicted vs. Actual Values')
abline(a=0, b=1)
```




```
train12[-1]<-scale(train12[-1])
test12[-1]<-scale(test12[-1])
library(e1071)
```

```
## Warning: package 'e1071' was built under R version 4.1.1
```

```
svmreg = svm(formula = yield~ .,
data = train12)
svmreg
```

```
##
## Call:
## svm(formula = yield ~ ., data = train12)
##
##
## Parameters:
##    SVM-Type:  eps-regression
##  SVM-Kernel:  radial
##        cost:  1
##       gamma:  0.1666667
##     epsilon:  0.1
##
##
## Number of Support Vectors:  192
```

```
library(Metrics)
y_pred = predict(svmreg, newdata = test12[,2:7])
rmsesvm <- rmse(test12$yield,y_pred)
rmsesvm
```

```
## [1] 0.001630708
```

```
plot(x=y_pred, y=test12$yield,
     xlab='Predicted Values',
     ylab='Actual Values',
     main='Predicted vs. Actual Values')
abline(a=0, b=1)
```