testing

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```r
# filtering data and lakes to most recent date of test
 df = data %>%
      group_by(Lake.Name) %>%
      filter(phos_date==max(phos_date)) %>%
      filter(trans_date==max(trans_date))
```

```r
t.test(df$avg_phos_ug_l)
```

```
##
##  One Sample t-test
##
## data:  df$avg_phos_ug_l
## t = 34.777, df = 1169, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  10.21926 11.44126
## sample estimates:
## mean of x
##  10.83026
```

```r
boot_function = function() {
  boot_data = df[sample(nrow(df), replace = TRUE), ]

  boot_mean = mean(boot_data$avg_phos_ug_l, na.rm = TRUE)

  return(boot_mean)
}

quantile(replicate(100,boot_function()), c(0.025, 0.975))
```

```
##     2.5%    97.5%
## 10.22947 11.37084
```

jj

```r
df = df %>% mutate(TSI_Depth = (60 - 14.41*log(secchi_depth_m))) %>%
  mutate(TSI_Phos = (14.42*log(avg_phos_ug_l) + 4.15)) %>%
  mutate(TSI = ((TSI_Depth + TSI_Phos) / 2)) %>%
  mutate(classification = case_when(TSI <= 40 ~ "0",
                                    TSI <= 50 ~ "1",
                                    TRUE ~ "2"))

# 0 = oligotrophic
# 1 = mesotrophic
# 2 = eutrophic
```

```
df_rm = df %>% drop_na()
```

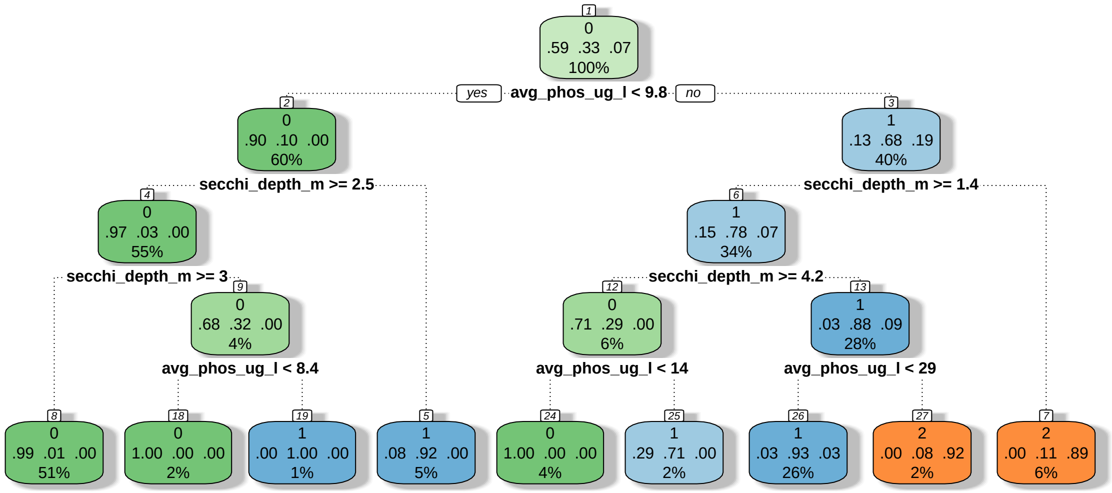
```
final = df_rm
final = final %>% mutate(group_ind = sample(c("train", "test"),
                                             size=1,
                                             prob = c(0.6, 0.4),
                                             replace = T))

final_train = final %>% filter(group_ind == "train")
final_test = final %>% filter(group_ind == "test")
library(rpart)
library(rattle)
```

```
## Loading required package: bitops
```

```
## Rattle: A free graphical interface for data science with R.
## Version 5.5.1 Copyright (c) 2006-2021 Togaware Pty Ltd.
## Type 'rattle()' to shake, rattle, and roll your data.
```

```
tree.m = rpart(classification ~ avg_phos_ug_l + secchi_depth_m, data = final_train,
               method = "class")
fancyRpartPlot(tree.m)
```



Rattle 2024−Mar−31 14:54:02 rstudio

```
library(randomForest)
```

```
## randomForest 4.7-1.1
```

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

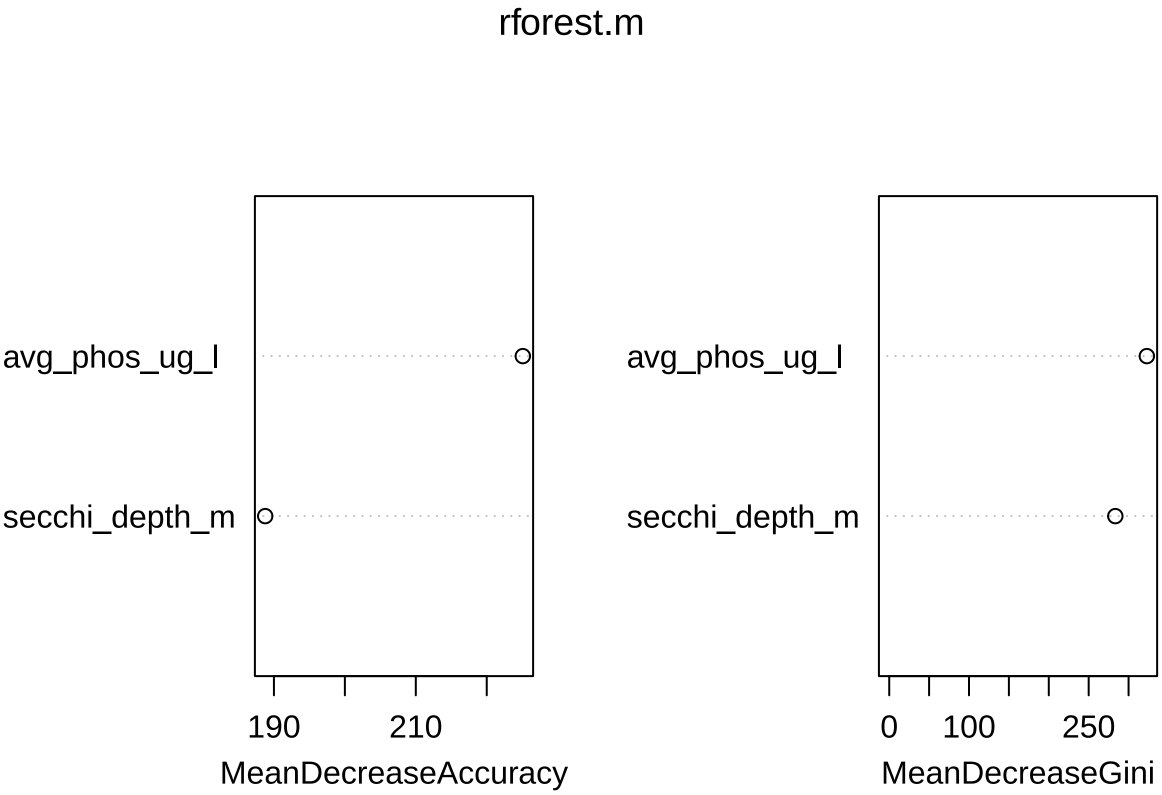
```
##
## Attaching package: 'randomForest'
```

```
## The following object is masked from 'package:rattle':
##
##     importance
## The following object is masked from 'package:dplyr':
##
##     combine
```

```
## The following object is masked from 'package:ggplot2':
##
##     margin
```

```r
rforest.m = randomForest(as.factor(classification) ~ avg_phos_ug_l + secchi_depth_m, data=df_rm,
                         ntree=500, importance=TRUE)
```

```r
varImpPlot(rforest.m)
```



```r
final_test = final_test %>% ungroup(.) %>% mutate(tree_predictions =
                                        predict(tree.m, newdata = final_test, type = "class"))

# Predictions using the random forest model

final_test = final_test %>% mutate(rforest_predict =
                                        predict(rforest.m, newdata = final_test))

glimpse(final_test)
```

```
## Rows: 478
## Columns: 19
## $ lat                <int> 432844, 432955, 434641, 435649, 435755, 440050, 44101~
## $ long               <int> 803806, 803939, 802015, 792624, 804843, 774233, 81030~
## $ STN                <int> 7597, 7697, 7581, 7034, 205, 7103, 7248, 1138, 7171, ~
## $ Site.ID            <int> 1, 2, 1, 2, 1, 6, 1, 1, 1, 4, 1, 3, 1, 6, 3, 2, 1, 1,~
## $ Township           <chr> "WILMOT", "", "CENTRE WELLINGTON", "RICHMOND HILL", "~
## $ Lake.Name        <chr> "SUNFISH LAKE", "PARADISE LAKE", "BELWOOD LAKE", "WIL~
## $ Site.Description <chr> "Mid Lake, Deep Spot", "middle of lake, deep spot", "~
## $ avg_phos_ug_l    <dbl> 11.5, 11.4, 29.7, 21.3, 24.3, 12.7, 21.0, 10.2, 19.6,~
## $ phos_is_outlier  <chr> "No", "No", "No", "No", "No", "No", "No", "No", "No",~
## $ phos_date        <date> 2022-11-17, 2022-10-21, 2019-08-28, 2022-10-27, 2019~
## $ secchi_depth_m   <dbl> 3.6, 4.2, 1.0, 3.4, 4.5, 2.1, 3.0, 3.0, 1.3, 1.4, 5.2~
## $ trans_date       <date> 2018-11-11, 2022-11-02, 2019-08-28, 2022-10-27, 2017~
## $ TSI_Depth        <dbl> 41.54174, 39.32043, 60.00000, 42.36540, 38.32624, 49.~
## $ TSI_Phos         <dbl> 39.36864, 39.24270, 53.05034, 48.25656, 50.15667, 40.~
## $ TSI              <dbl> 40.45519, 39.28157, 56.52517, 45.31098, 44.24146, 45.~
## $ classification   <chr> "1", "0", "2", "1", "1", "1", "1", "1", "2", "2", "0"~
## $ group_ind        <chr> "test", "test", "test", "test", "test", "test", "test~
## $ tree_predictions <fct> 1, 0, 2, 1, 1, 1, 1, 1, 2, 1, 0, 1, 2, 2, 0, 0, 2, 2,~
## $ rforest_predict  <fct> 1, 0, 2, 1, 1, 1, 1, 1, 2, 2, 0, 2, 2, 2, 0, 0, 2, 2,~
```

```
conmat = table(final_test$classification, final_test$tree_predictions)
sum(diag(conmat))/sum(conmat)
```

```
## [1] 0.9393305
```

```
conmat = table(final_test$classification, final_test$rforest_predict)
sum(diag(conmat))/sum(conmat)
```

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