Random Forest Regression

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Modeling with Random forest

```
randomForest_training <- function(x){
  library(randomForest)

  library(parallel)
  library(doSNOW)
  cl <- makeCluster(8)
  registerDoSNOW(cl)

  R2 <- function(y, equation, ... ){
  1 - (sum((y-predict(equation))^2)/sum((y-mean(y))^2))
}
rm2 <- function(y, x, ... ){
  if ((R2(y,(lm(y ~ x)))) > R2(y,(lm(y ~ -1 + x)))) {
    return(R2(y,(lm(y ~ x)))*( 1-(sqrt(R2(y,(lm(y ~ x)))-R2(y,(lm(y ~ -1 + x)))))))
  } else {
    return(R2(y,(lm(y ~ x))))
  }
}
rm2.reverse <- function(y, x, ... ){
  return(R2(x,(lm(x ~ y)))*( 1-(sqrt(R2(x,(lm(x ~ y)))-R2(x,(lm(x ~ -1 + y)))))))
}
average.rm2 <- function(y, x, ... ){
  if ((R2(y,(lm(y ~ x)))) > R2(y,(lm(y ~ -1 + x)))) {
    return(((R2(y,(lm(y ~ x)))*( 1-(sqrt(R2(y,(lm(y ~ x)))-R2(y,(lm(y ~ -1 + x))))))+ R2(x,(lm(x ~ y)))
  } else {
    return(((R2(y,(lm(y ~ x))))  + (R2(x,(lm(x ~ y)))*( 1-(sqrt(R2(x,(lm(x ~ y)))-R2(x,(lm(x ~ -1 + y))
  }
}
delta.rm2 <- function(y, x, ... ){
  if ((R2(y,(lm(y ~ x)))) > R2(y,(lm(y ~ -1 + x)))) {
    return(abs((R2(y,(lm(y ~ x)))*( 1-(sqrt(R2(y,(lm(y ~ x)))-R2(y,(lm(y ~ -1 + x))))))  -  R2(x,(lm(x
  } else {
    return(abs((R2(y,(lm(y ~ x)))) - (R2(x,(lm(x ~ y)))*( 1-(sqrt(R2(x,(lm(x ~ y)))-R2(x,(lm(x ~ -1 + y
  }
}


  results <- list(100)
  results <- foreach(i = 1:100 ) %dopar% {



  x <- na.omit(x)
  para <- dplyr::sample_n(x, size = 2571, replace = TRUE)
    in_train_para <- sample(nrow(para),
```

```
                            size = as.integer(nrow(para) * 0.8),
                            replace = FALSE)
    Train <- para[in_train_para, ]
    Test <- para[-in_train_para, ]


    model_train <- ranger::ranger(pIC50~., data = Train, write.forest = TRUE, save.memory = TRUE)
    #actual <- train$Activity
    prediction <- predict(model_train, Train)
    prediction <- prediction$predictions

    #prediction <- predict(model, Train)
    value <- data.frame(obs = Train$pIC50, pred = prediction)
    rm(para)
    rm(Train)
    rm(Test)
    rm(model_train)
    rm(prediction)
    labeling <- c("obs", "pred")
    colnames(value) <- labeling
    result <- caret::defaultSummary(value)
    result_rm2 <- rm2(value$obs, value$pred)
    names(result_rm2) <- "rm2"
    results_reverse <- rm2.reverse(value$obs, value$pred)
    names(results_reverse) <- "reverse.rm2"
    result_average_rm2 <- average.rm2(value$obs, value$pred)
    names(result_average_rm2) <- "average.rm2"
    result_delta <- delta.rm2(value$obs, value$pred)
    names(result_delta) <- "delta.rm"

    results[[i]] <- c(result, result_rm2, results_reverse, result_average_rm2, result_delta)
  }
  return(results)
  stopCluster(cl)
}

mean_and_sd <- function(x) {
  c(round(rowMeans(x, na.rm = TRUE), digits = 2),
    round(genefilter::rowSds(x, na.rm = TRUE), digits = 2))
}

randomForest_train <- function(x) {
  ok <- randomForest_training(x)
  data <- data.frame(ok)
  result <- mean_and_sd(data)
  df <- data.frame(result)
  R2_and_RMSE <- t(df)
  label <- c("RMSE_Mean", "Rsquared_Mean", "RM2_Mean", "Reverse_RM2_Mean", "Average_RM2_Mean", "Delta_RM
             "RMSE_SD", "Rsquared_SD", "RM2_SD", "Reverse_RM2_SD", "Average_RM2_SD", "Delta_RM2_SD")
  colnames(R2_and_RMSE) <- label
  return(R2_and_RMSE)
}
```

```
rf_cross_validation <- function(x){
  library(randomForest)

  library(parallel)
  library(doSNOW)
  cl <- makeCluster(8)
  registerDoSNOW(cl)

  R2 <- function(y, equation, ... ){
  1 - (sum((y-predict(equation))^2)/sum((y-mean(y))^2))
}
rm2 <- function(y, x, ... ){
  if ((R2(y,(lm(y ~ x)))) > R2(y,(lm(y ~ -1 + x)))) {
    return(R2(y,(lm(y ~ x)))*( 1-(sqrt(R2(y,(lm(y ~ x)))-R2(y,(lm(y ~ -1 + x)))))))
  } else {
    return(R2(y,(lm(y ~ x))))
  }
}
rm2.reverse <- function(y, x, ... ){
  return(R2(x,(lm(x ~ y)))*( 1-(sqrt(R2(x,(lm(x ~ y)))-R2(x,(lm(x ~ -1 + y)))))))
}
average.rm2 <- function(y, x, ... ){
  if ((R2(y,(lm(y ~ x)))) > R2(y,(lm(y ~ -1 + x)))) {
    return(((R2(y,(lm(y ~ x)))*( 1-(sqrt(R2(y,(lm(y ~ x)))-R2(y,(lm(y ~ -1 + x))))))+ R2(x,(lm(x ~ y)))
  } else {
    return(((R2(y,(lm(y ~ x))))  + (R2(x,(lm(x ~ y)))*( 1-(sqrt(R2(x,(lm(x ~ y)))-R2(x,(lm(x ~ -1 + y))
  }
}
delta.rm2 <- function(y, x, ... ){
  if ((R2(y,(lm(y ~ x)))) > R2(y,(lm(y ~ -1 + x)))) {
    return(abs((R2(y,(lm(y ~ x)))*( 1-(sqrt(R2(y,(lm(y ~ x)))-R2(y,(lm(y ~ -1 + x))))))  -  R2(x,(lm(x
  } else {
    return(abs((R2(y,(lm(y ~ x)))) - (R2(x,(lm(x ~ y)))*( 1-(sqrt(R2(x,(lm(x ~ y)))-R2(x,(lm(x ~ -1 + y
  }
}


  results <- list(100)
  results <- foreach(i = 1:100 ) %dopar% {

    cool <- na.omit(x)
    para <- dplyr::sample_n(cool, size = 2571, replace = TRUE)
    in_train_para <- sample(nrow(para),
                            size = as.integer(nrow(para) * 0.8),
                            replace = FALSE)
    myData <- para[in_train_para, ]
    Test <- para[-in_train_para, ]
    rm(Test)
    k = 10
    index <- sample(1:k, nrow(myData), replace = TRUE)
    folds <- 1:k
    myRes <- data.frame()
    for (j in 1:k) {
```

```
      training <- subset(myData, index %in% folds[-j])
    testing <- subset(myData, index %in% c(j))
    model_train <- ranger::ranger(pIC50~., data = training, write.forest = TRUE, save.memory = TRUE)
    prediction <- predict(model_train, testing)
    prediction <- prediction$predictions

    ok <- data.frame(obs = testing$pIC50, pred = prediction)
    value <- rbind(myRes, ok)
    }
    rm(myData)
    rm(para)
    rm(in_trian_para)
    rm(training)
    rm(testing)
    rm(prediction)
    labeling <- c("obs", "pred")
    colnames(value) <- labeling
    result <- caret::defaultSummary(value)
    result_rm2 <- rm2(value$obs, value$pred)
    names(result_rm2) <- "rm2"
    results_reverse <- rm2.reverse(value$obs, value$pred)
    names(results_reverse) <- "reverse.rm2"
    result_average_rm2 <- average.rm2(value$obs, value$pred)
    names(result_average_rm2) <- "average.rm2"
    result_delta <- delta.rm2(value$obs, value$pred)
    names(result_delta) <- "delta.rm"

    results[[i]] <- c(result, result_rm2, results_reverse, result_average_rm2, result_delta)
  }
  return(results)
}

rf_10_CV <- function(x) {
  ok <- rf_cross_validation(x)
  data <- data.frame(ok)
  result <- mean_and_sd(data)
  df <- data.frame(result)
  R2_and_RMSE <- t(df)
  label <- c("RMSE_Mean", "Rsquared_Mean", "RM2_Mean", "Reverse_RM2_Mean", "Average_RM2_Mean", "Delta_RM
             "RMSE_SD", "Rsquared_SD", "RM2_SD", "Reverse_RM2_SD", "Average_RM2_SD", "Delta_RM2_SD")
  colnames(R2_and_RMSE) <- label
  return(R2_and_RMSE)
}


randomForest_testing <- function(x){
  library(parallel)
  library(doSNOW)
  cl <- makeCluster(8)
  registerDoSNOW(cl)

  R2 <- function(y, equation, ... ){
  1 - (sum((y-predict(equation))^2)/sum((y-mean(y))^2))
```

```
}
rm2 <- function(y, x, ... ){
  if ((R2(y,(lm(y ~ x)))) > R2(y,(lm(y ~ -1 + x)))) {
    return(R2(y,(lm(y ~ x)))*( 1-(sqrt(R2(y,(lm(y ~ x)))-R2(y,(lm(y ~ -1 + x)))))))
  } else {
    return(R2(y,(lm(y ~ x))))
  }
}
rm2.reverse <- function(y, x, ... ){
  return(R2(x,(lm(x ~ y)))*( 1-(sqrt(R2(x,(lm(x ~ y)))-R2(x,(lm(x ~ -1 + y)))))))
}
average.rm2 <- function(y, x, ... ){
  if ((R2(y,(lm(y ~ x)))) > R2(y,(lm(y ~ -1 + x)))) {
    return(((R2(y,(lm(y ~ x)))*( 1-(sqrt(R2(y,(lm(y ~ x)))-R2(y,(lm(y ~ -1 + x))))))+ R2(x,(lm(x ~ y)))
  } else {
    return(((R2(y,(lm(y ~ x))))  + (R2(x,(lm(x ~ y)))*( 1-(sqrt(R2(x,(lm(x ~ y)))-R2(x,(lm(x ~ -1 + y))
  }
}
delta.rm2 <- function(y, x, ... ){
  if ((R2(y,(lm(y ~ x)))) > R2(y,(lm(y ~ -1 + x)))) {
    return(abs((R2(y,(lm(y ~ x)))*( 1-(sqrt(R2(y,(lm(y ~ x)))-R2(y,(lm(y ~ -1 + x))))))  -  R2(x,(lm(x
  } else {
    return(abs((R2(y,(lm(y ~ x)))) - (R2(x,(lm(x ~ y)))*( 1-(sqrt(R2(x,(lm(x ~ y)))-R2(x,(lm(x ~ -1 + y
  }
}


  results <- list(100)
  results <- foreach(i = 1:100 ) %dopar% {

    x <- na.omit(x)
    para <- dplyr::sample_n(x, size = 2571, replace = TRUE)
    in_train_para <- sample(nrow(para),
                            size = as.integer(nrow(para) * 0.8),
                            replace = FALSE)
    Train <- para[in_train_para, ]
    Test <- para[-in_train_para, ]
    model_train <- ranger::ranger(pIC50~., data = Train, write.forest = TRUE, save.memory = TRUE)
    #actual <- train$Activity
    prediction <- predict(model_train, Test)
    prediction <- prediction$predictions
    value <- data.frame(obs = Test$pIC50, pred = prediction)
    rm(Train)
    rm(Test)
    rm(para)
    rm(in_train_para)
    rm(prediction)
    labeling <- c("obs", "pred")
    colnames(value) <- labeling
    result <- caret::defaultSummary(value)
    result_rm2 <- rm2(value$obs, value$pred)
    names(result_rm2) <- "rm2"
    results_reverse <- rm2.reverse(value$obs, value$pred)
```

```
    names(results_reverse) <- "reverse.rm2"
    result_average_rm2 <- average.rm2(value$obs, value$pred)
    names(result_average_rm2) <- "average.rm2"
    result_delta <- delta.rm2(value$obs, value$pred)
    names(result_delta) <- "delta.rm"

    results[[i]] <- c(result, result_rm2, results_reverse, result_average_rm2, result_delta)
  }
  return(results)
  stopCluster(cl)
}

randomForest_test <- function(x) {
  ok <- randomForest_testing(x)
  data <- data.frame(ok)
  result <- mean_and_sd(data)
  df <- data.frame(result)
  R2_and_RMSE <- t(df)
  label <- c("RMSE_Mean", "Rsquared_Mean", "RM2_Mean", "Reverse_RM2_Mean", "Average_RM2_Mean", "Delta_RM
             "RMSE_SD", "Rsquared_SD", "RM2_SD", "Reverse_RM2_SD", "Average_RM2_SD", "Delta_RM2_SD")
  colnames(R2_and_RMSE) <- label
  return(R2_and_RMSE)
}
```

Training results for 12 data frame with random forest

```
input <- readRDS("data.Rds")
training_results <- lapply(input, function(x) {
  results <- randomForest_train(x)
  return(results)
})
```

```
## randomForest 4.6-12
## Type rfNews() to see new features/changes/bug fixes.
## Loading required package: foreach
## Loading required package: iterators
## Loading required package: snow
##
## Attaching package: 'snow'
## The following objects are masked from 'package:parallel':
##
##     clusterApply, clusterApplyLB, clusterCall, clusterEvalQ,
##     clusterExport, clusterMap, clusterSplit, makeCluster,
##     parApply, parCapply, parLapply, parRapply, parSapply,
##     splitIndices, stopCluster
```

```
training_results
```

```
## $AtomPairs2D_fingerPrintCount
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
```

```
## result      0.45          0.93     0.84             0.76              0.8
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.08    0.01           0   0.01           0.01
##        Average_RM2_SD Delta_RM2_SD
## result           0.01            0
##
## $AtomPairs2D_fingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.84          0.75     0.65             0.39             0.52
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.26    0.04        0.02   0.02           0.03
##        Average_RM2_SD Delta_RM2_SD
## result           0.02         0.02
##
## $Substructure_fingerPrintCount
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.46          0.93     0.86             0.78             0.82
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.08    0.02        0.01   0.01           0.01
##        Average_RM2_SD Delta_RM2_SD
## result           0.01         0.01
##
## $Substructure_fingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.85          0.74     0.64             0.37              0.5
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.27    0.02        0.01   0.01           0.02
##        Average_RM2_SD Delta_RM2_SD
## result           0.02         0.01
##
## $Extended_finterPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.37          0.95      0.9             0.85             0.88
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.05    0.02        0.01   0.01           0.01
##        Average_RM2_SD Delta_RM2_SD
## result           0.01         0.01
##
## $FingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result       0.4          0.94     0.89             0.83             0.86
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.06    0.03        0.01   0.01           0.02
##        Average_RM2_SD Delta_RM2_SD
## result           0.01         0.01
##
## $Estate_FingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.99          0.66     0.55             0.18             0.36
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.37    0.03        0.02   0.02           0.03
##        Average_RM2_SD Delta_RM2_SD
## result           0.02         0.01
##
```

```
## $GraphOnly_FingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.56          0.89     0.81              0.7             0.75
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.12    0.02        0.01   0.01           0.02
##        Average_RM2_SD Delta_RM2_SD
## result           0.01         0.01
##
## $KlekotaRoth_FingerprintCount
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.48          0.92     0.84             0.75              0.8
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.09    0.02        0.01   0.01           0.01
##        Average_RM2_SD Delta_RM2_SD
## result           0.01         0.01
##
## $KlekotaRoth_FingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.54           0.9     0.81              0.7             0.75
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.11    0.01        0.01   0.01           0.01
##        Average_RM2_SD Delta_RM2_SD
## result           0.01         0.01
##
## $MACCS_FingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.53           0.9     0.83             0.72             0.77
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.11    0.02        0.01   0.01           0.02
##        Average_RM2_SD Delta_RM2_SD
## result           0.01         0.01
##
## $Pubchem_FingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.51          0.91     0.83             0.73             0.78
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result            0.1    0.02        0.01   0.01           0.01
##        Average_RM2_SD Delta_RM2_SD
## result           0.01         0.01
```

10-Fold CV results for 12 data frame with random forest

```
input <- readRDS("data.Rds")
cross_validation_results <- lapply(input, function(x) {
  results <- rf_10_CV(x)
  return(results)
})
cross_validation_results
```

```
## $AtomPairs2D_fingerPrintCount
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.85          0.74     0.65             0.38             0.51
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
```

```
## result           0.27    0.16        0.07   0.06           0.12
##        Average_RM2_SD Delta_RM2_SD
## result           0.09         0.05
##
## $AtomPairs2D_fingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      1.07          0.59     0.52             0.15             0.33
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.37    0.16        0.08   0.07           0.11
##        Average_RM2_SD Delta_RM2_SD
## result           0.09         0.05
##
## $Substructure_fingerPrintCount
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.76          0.79     0.72             0.51             0.61
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.21    0.13        0.05   0.05            0.1
##        Average_RM2_SD Delta_RM2_SD
## result           0.08         0.05
##
## $Substructure_fingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.98          0.65     0.57             0.24              0.4
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.33    0.13        0.06   0.06           0.09
##        Average_RM2_SD Delta_RM2_SD
## result           0.07         0.05
##
## $Extended_finterPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.75          0.79     0.72             0.53             0.63
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.19    0.12        0.06   0.06           0.09
##        Average_RM2_SD Delta_RM2_SD
## result           0.07         0.05
##
## $FingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.75          0.79     0.73             0.54             0.63
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.19    0.17        0.07   0.08           0.12
##        Average_RM2_SD Delta_RM2_SD
## result            0.1         0.06
##
## $Estate_FingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      1.11          0.55     0.47             0.06             0.27
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.41    0.13        0.07   0.05           0.09
##        Average_RM2_SD Delta_RM2_SD
## result           0.07         0.04
##
## $GraphOnly_FingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
```

```
## result      0.85          0.74     0.66             0.42             0.54
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.25    0.13        0.07   0.06            0.1
##        Average_RM2_SD Delta_RM2_SD
## result           0.08         0.05
##
## $KlekotaRoth_FingerprintCount
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.83          0.76     0.68             0.45             0.57
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.23    0.15        0.07   0.07           0.13
##        Average_RM2_SD Delta_RM2_SD
## result            0.1         0.06
##
## $KlekotaRoth_FingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.83          0.75     0.67             0.42             0.54
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.25    0.13        0.07   0.06            0.1
##        Average_RM2_SD Delta_RM2_SD
## result           0.08         0.04
##
## $MACCS_FingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.82          0.76     0.68             0.45             0.56
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.23    0.13        0.06   0.06            0.1
##        Average_RM2_SD Delta_RM2_SD
## result           0.08         0.06
##
## $Pubchem_FingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.79          0.77     0.69             0.46             0.58
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.23    0.13        0.06   0.06            0.1
##        Average_RM2_SD Delta_RM2_SD
## result           0.08         0.05
```

Testing results for 12 data frame with random forest

```
input <- readRDS("data.Rds")
testing_results <- lapply(input, function(x) {
  results <- randomForest_test(x)
  return(results)
})
```

```
## Warning: closing unused connection 12 (<-localhost:11305)

## Warning: closing unused connection 11 (<-localhost:11305)

## Warning: closing unused connection 10 (<-localhost:11305)

## Warning: closing unused connection 9 (<-localhost:11305)

## Warning: closing unused connection 8 (<-localhost:11305)
```

```
## Warning: closing unused connection 7 (<-localhost:11305)
## Warning: closing unused connection 6 (<-localhost:11305)
## Warning: closing unused connection 5 (<-localhost:11305)
## Warning: closing unused connection 20 (<-localhost:11305)
## Warning: closing unused connection 19 (<-localhost:11305)
## Warning: closing unused connection 18 (<-localhost:11305)
## Warning: closing unused connection 17 (<-localhost:11305)
## Warning: closing unused connection 16 (<-localhost:11305)
## Warning: closing unused connection 15 (<-localhost:11305)
## Warning: closing unused connection 14 (<-localhost:11305)
## Warning: closing unused connection 13 (<-localhost:11305)
## Warning: closing unused connection 100 (<-localhost:11305)
## Warning: closing unused connection 99 (<-localhost:11305)
## Warning: closing unused connection 98 (<-localhost:11305)
## Warning: closing unused connection 97 (<-localhost:11305)
## Warning: closing unused connection 96 (<-localhost:11305)
## Warning: closing unused connection 95 (<-localhost:11305)
## Warning: closing unused connection 94 (<-localhost:11305)
## Warning: closing unused connection 93 (<-localhost:11305)
## Warning: closing unused connection 36 (<-localhost:11305)
## Warning: closing unused connection 35 (<-localhost:11305)
## Warning: closing unused connection 34 (<-localhost:11305)
## Warning: closing unused connection 33 (<-localhost:11305)
## Warning: closing unused connection 32 (<-localhost:11305)
## Warning: closing unused connection 31 (<-localhost:11305)
## Warning: closing unused connection 30 (<-localhost:11305)
## Warning: closing unused connection 29 (<-localhost:11305)
## Warning: closing unused connection 68 (<-localhost:11305)
## Warning: closing unused connection 67 (<-localhost:11305)
## Warning: closing unused connection 66 (<-localhost:11305)
## Warning: closing unused connection 65 (<-localhost:11305)
## Warning: closing unused connection 64 (<-localhost:11305)
## Warning: closing unused connection 63 (<-localhost:11305)
## Warning: closing unused connection 62 (<-localhost:11305)
## Warning: closing unused connection 61 (<-localhost:11305)
```

```
testing_results
```

```
## $AtomPairs2D_fingerPrintCount
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.81          0.76     0.67             0.42             0.54
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.25    0.08        0.04   0.04           0.07
##        Average_RM2_SD Delta_RM2_SD
## result           0.05         0.03
##
## $AtomPairs2D_fingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      1.05           0.6     0.53             0.16             0.34
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.36    0.12        0.06   0.05           0.08
##        Average_RM2_SD Delta_RM2_SD
## result           0.06         0.03
##
## $Substructure_fingerPrintCount
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.74          0.79     0.73             0.53             0.63
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result            0.2    0.08        0.04   0.04           0.07
##        Average_RM2_SD Delta_RM2_SD
## result           0.05         0.03
##
## $Substructure_fingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.97          0.65     0.58             0.25             0.42
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.33    0.08        0.04   0.03           0.06
##        Average_RM2_SD Delta_RM2_SD
## result           0.05         0.03
##
## $Extended_finterPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.73           0.8     0.74             0.56             0.65
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.19    0.08        0.04   0.04           0.05
##        Average_RM2_SD Delta_RM2_SD
## result           0.04         0.03
##
## $FingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.71          0.81     0.75             0.57             0.66
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.18    0.08        0.04   0.04           0.06
##        Average_RM2_SD Delta_RM2_SD
## result           0.05         0.03
##
## $Estate_FingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result       1.1          0.56     0.48             0.07             0.27
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
```

```
## result           0.41    0.09        0.05   0.04           0.07
##        Average_RM2_SD Delta_RM2_SD
## result           0.05         0.03
##
## $GraphOnly_FingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.83          0.75     0.67             0.43             0.55
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.25     0.1        0.04   0.04           0.08
##        Average_RM2_SD Delta_RM2_SD
## result           0.06         0.03
##
## $KlekotaRoth_FingerprintCount
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.78          0.78     0.71              0.5             0.61
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.21     0.1        0.05   0.04           0.07
##        Average_RM2_SD Delta_RM2_SD
## result           0.05         0.03
##
## $KlekotaRoth_FingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.82          0.76     0.68             0.45             0.56
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.24     0.1        0.05   0.04           0.08
##        Average_RM2_SD Delta_RM2_SD
## result           0.06         0.03
##
## $MACCS_FingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result       0.8          0.77     0.69             0.46             0.58
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.23     0.1        0.05   0.05           0.08
##        Average_RM2_SD Delta_RM2_SD
## result           0.06         0.04
##
## $Pubchem_FingerPrinter
##        RMSE_Mean Rsquared_Mean RM2_Mean Reverse_RM2_Mean Average_RM2_Mean
## result      0.78          0.78     0.71             0.49              0.6
##        Delta_RM2_Mean RMSE_SD Rsquared_SD RM2_SD Reverse_RM2_SD
## result           0.22    0.08        0.04   0.04           0.07
##        Average_RM2_SD Delta_RM2_SD
## result           0.05         0.03
```