Final Project

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```
#import housing_data
housing_data = read.csv(file = '/Applications/MAT 342/housing_data.csv')
```

```
#load packages
pacman::p_load(tidyverse, mlr, mlr3, missForest, skimr, rpart, randomForest, data.table, dplyr, magritt
```

```
#picking certain data that does not apply in my opinion
housing_data_select = housing_data %>%
  select(approx_year_built, cats_allowed, coop_condo, dogs_allowed, dining_room_type, fuel_type,
         garage_exists, kitchen_type, maintenance_cost, num_bedrooms, num_floors_in_building,
         num_full_bathrooms, num_total_rooms, parking_charges, sale_price, sq_footage, total_taxes, wall
```

```
setDT (housing_data_select)
```

```
dim(housing_data_select)
```

```
## [1] 2230   18
```

```
str(housing_data_select)
```

```
## Classes 'data.table' and 'data.frame':   2230 obs. of  18 variables:
##  $ approx_year_built     : int  1955 1955 2004 2002 1949 1938 1950 1960 1960 2005 ...
##  $ cats_allowed          : chr  "no" "no" "no" "no" ...
##  $ coop_condo            : chr  "co-op" "co-op" "condo" "condo" ...
##  $ dogs_allowed          : chr  "no" "no" "no" "no" ...
##  $ dining_room_type      : chr  "combo" "formal" "combo" "combo" ...
##  $ fuel_type             : chr  "gas" "oil" NA "gas" ...
##  $ garage_exists         : chr  NA NA NA NA ...
##  $ kitchen_type          : chr  "eat in" "eat in" "efficiency" "eat in" ...
##  $ maintenance_cost      : chr  NA "$604 " NA NA ...
##  $ num_bedrooms          : int  2 1 1 3 2 2 1 0 1 1 ...
##  $ num_floors_in_building: int  6 7 1 NA 2 6 NA 2 NA 4 ...
##  $ num_full_bathrooms    : int  1 1 1 2 1 1 1 1 1 1 ...
##  $ num_total_rooms       : int  5 4 3 5 4 4 3 2 4 3 ...
##  $ parking_charges       : chr  NA NA NA NA ...
##  $ sale_price            : chr  "$228,000 " "$235,500 " "$137,550 " "$545,000 " ...
##  $ sq_footage            : int  NA 890 550 NA 675 1000 NA 375 NA 681 ...
##  $ total_taxes           : chr  NA NA "$5,500 " "$2,260 " ...
##  $ walk_score            : int  82 89 90 94 71 90 72 93 70 98 ...
##  - attr(*, ".internal.selfref")=<externalptr>
```

```
#removing any data with excessive NA
housing_data_drop = housing_data_select %>%
  select(-parking_charges, -sq_footage, -total_taxes, -num_floors_in_building)
```

```
#Adjusting the features so they can be used to run the algorithms
housing_data_new = housing_data_drop %>%
```

```r
  mutate(cats_allowed = ifelse(cats_allowed == "yes", 1, 0)) %>% #set data to binary
  mutate(dogs_allowed = ifelse(dogs_allowed == "yes", 1, 0)) %>% #set data to binary
  mutate(maintenance_cost = as.numeric(gsub('[$,]', '', housing_data_drop$maintenance_cost))) %>% #remo
  mutate(sale_price = as.numeric(gsub('[$,]', '', housing_data_drop$sale_price))) %>% #remove $ and , f
  mutate(coop_condo = factor(coop_condo, ordered = FALSE)) %>%
  mutate(dining_room_type = factor(dining_room_type, ordered = FALSE)) %>%
  mutate(fuel_type = factor(fuel_type, ordered = FALSE)) %>%
  mutate(kitchen_type = factor(kitchen_type, ordered = FALSE)) %>%
  mutate(garage_exists = ifelse(is.na(garage_exists), 0, 1)) #making sure NA is turned to 0
```

```r
housing_data_new %>%
  filter(!is.na(sale_price))
```

```
##      approx_year_built cats_allowed coop_condo dogs_allowed dining_room_type
##   1:              1955            0      co-op            0            combo
##   2:              1955            0      co-op            0           formal
##   3:              2004            0      condo            0            combo
##   4:              2002            0      condo            0            combo
##   5:              1949            1      co-op            1            combo
##  ---                                                                        
## 524:              1950            0      co-op            0             <NA>
## 525:              1947            0      co-op            0           formal
## 526:              2010            0      condo            0            combo
## 527:              2006            0      condo            0            combo
## 528:              1958            0      co-op            0            other
##      fuel_type garage_exists kitchen_type maintenance_cost num_bedrooms
##   1:       gas             0       eat in               NA            2
##   2:       oil             0       eat in              604            1
##   3:      <NA>             0   efficiency               NA            1
##   4:       gas             0       eat in               NA            3
##   5:       gas             0       eat in              660            2
##  ---                                                                   
## 524:       gas             0       eat in              725            2
## 525:       gas             0        Combo              680            1
## 526:       gas             0       Eat In               NA            2
## 527:  electric             0        Combo               NA            2
## 528:     other             0       eat in              659            2
##      num_full_bathrooms num_total_rooms sale_price walk_score
##   1:                  1               5     228000         82
##   2:                  1               4     235500         89
##   3:                  1               3     137550         90
##   4:                  2               5     545000         94
##   5:                  1               4     241700         71
##  ---                                                         
## 524:                  1               4     216000         83
## 525:                  1               5     232500         94
## 526:                  2               5     428000         96
## 527:                  2               4     635000         99
## 528:                  1               4     310000         96
```

```r
missing_data = tbl_df(apply(is.na(housing_data_new), 2, as.numeric))
```

```
## Warning: `tbl_df()` was deprecated in dplyr 1.0.0.
## Please use `tibble::as_tibble()` instead.
```

```r
colnames(missing_data) = paste("missing_data_", colnames(housing_data_new), sep = "")
missing_data %<>%
  select_if(function(x){sum(x) > 0})
housing_imp = missForest(data.frame(housing_data_new))$ximp
```

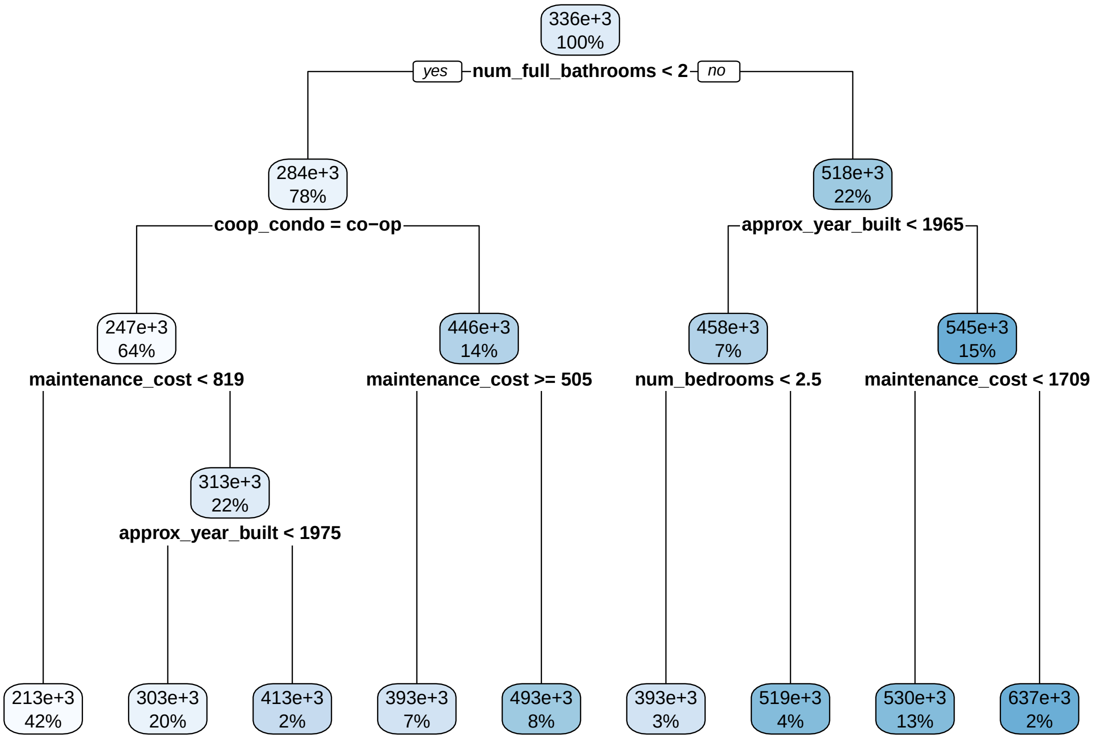
```
##   missForest iteration 1 in progress...done!
##   missForest iteration 2 in progress...done!
##   missForest iteration 3 in progress...done!
##   missForest iteration 4 in progress...done!
##   missForest iteration 5 in progress...done!
##   missForest iteration 6 in progress...done!
##   missForest iteration 7 in progress...done!
```

```r
housing = cbind(housing_imp,missing_data)
```

```r
#making train and test split
test_prop = 0.1

#test
test_indices = sample(1:nrow(housing), round((test_prop)*nrow(housing)))
housing_test = housing[test_indices,]
y_test = housing_test$sale_price
X_test = cbind(1, housing_test)
X_test$sale_price = NULL

#train
train_indices = setdiff(1:nrow(housing), test_indices)
housing_train = housing[train_indices,]
y_train = housing_train$sale_price
X_train = cbind(1, housing_train)
X_train$sale_price = NULL
n_train = nrow(X_train)
```

```r
#Create Regression tree model

#use rpart, YARF not availible for me
#In-sample Error
Reg_tree = rpart(y_train~., housing_train)
y_hat_train = predict(Reg_tree, housing_train)
e_in = y_train - y_hat_train
rsme_in = sd(e_in)
r_squared_in = (var(y_train)-var(e_in)) / var(y_train)

#OOSE
y_hat_test = predict(Reg_tree, housing_test)
e_oose = y_test - y_hat_test
rsme_oose = sd(e_oose)
rsquared_oose = (var(y_test) - var(e_oose)) / var(y_test)
```

```r
fit_model = rpart(housing_train$sale_price~., data.frame(X_train), method="anova")
rpart.plot(fit_model)
```



```
fit_model
```

```
## n= 2007
##
## node), split, n, deviance, yval
##       * denotes terminal node
##
##  1) root 2007 4.228751e+13 335821.8
##    2) num_full_bathrooms< 1.5 1560 1.860696e+13 283659.1
##      4) coop_condo=co-op 1276 7.233930e+12 247489.9
##        8) maintenance_cost< 818.5 837 2.207091e+12 213224.0 *
##        9) maintenance_cost>=818.5 439 2.170322e+12 312821.6
##         18) approx_year_built< 1974.5 400 1.629533e+12 303042.3 *
##         19) approx_year_built>=1974.5 39 1.101891e+11 413121.9 *
##      5) coop_condo=condo 284 2.203753e+12 446165.9
##       10) maintenance_cost>=505.3131 133 8.476970e+11 393480.4 *
##       11) maintenance_cost< 505.3131 151 6.617111e+11 492571.0 *
##    3) num_full_bathrooms>=1.5 447 4.622290e+12 517865.8
##      6) approx_year_built< 1964.5 141 1.704860e+12 458049.5
##       12) num_bedrooms< 2.5 68 3.817784e+11 392813.1 *
##       13) num_bedrooms>=2.5 73 7.641167e+11 518817.6 *
##      7) approx_year_built>=1964.5 306 2.180469e+12 545428.2
##       14) maintenance_cost< 1709.249 261 1.279587e+12 529642.6 *
##       15) maintenance_cost>=1709.249 45 4.586285e+11 636984.6 *
```

```
#mlr attempt
mod_task = makeRegrTask(data = data.frame(X_train), target = 'housing_data$sale_price')
algor = makeLearner("regr.rpart")
valid = makeResampleDesc("CV", iteration = 5)
resample = resample(algor, mod_task, valid, measures = list(rmse))
resample
```

```
mean(resample$measures.test$rmse)
```

```
#Random Forest
random_forest = randomForest(sale_price~.,housing_imp)
random_forest
```

```
##
## Call:
##  randomForest(formula = sale_price ~ ., data = housing_imp)
##                Type of random forest: regression
##                      Number of trees: 500
## No. of variables tried at each split: 4
##
##           Mean of squared residuals: 1531236666
##                     % Var explained: 92.7
```