House Prices Kaggle

Load all the packages needed

```
library(tidymodels)

## Registered S3 method overwritten by 'tune':
##   method                   from
##   required_pkgs.model_spec parsnip

## -- Attaching packages -------------------------------------- tidymodels
0.1.3 --

## v broom        0.7.9      v recipes      0.1.16
## v dials        0.0.10     v rsample      0.1.0
## v dplyr        1.0.7      v tibble       3.1.4
## v ggplot2      3.3.5      v tidyr        1.1.3
## v infer        1.0.0      v tune         0.1.6
## v modeldata    0.1.1      v workflows    0.2.3
## v parsnip      0.1.7      v workflowsets 0.1.0
## v purrr        0.3.4      v yardstick    0.0.8

## -- Conflicts -----------------------------------------
tidymodels_conflicts() --
## x purrr::discard() masks scales::discard()
## x dplyr::filter()  masks stats::filter()
## x dplyr::lag()     masks stats::lag()
## x recipes::step()  masks stats::step()
## * Use tidymodels_prefer() to resolve common conflicts.

library(tidyverse)

## -- Attaching packages --------------------------------------- tidyverse
1.3.1 --

## v readr   2.0.1     v forcats 0.5.1
## v stringr 1.4.0

## -- Conflicts ------------------------------------------
tidyverse_conflicts() --
## x readr::col_factor() masks scales::col_factor()
## x purrr::discard()    masks scales::discard()
## x dplyr::filter()     masks stats::filter()
## x stringr::fixed()    masks recipes::fixed()
## x dplyr::lag()        masks stats::lag()
## x readr::spec()       masks yardstick::spec()

library(skimr)
library(parsnip)
library(ranger)
```

```
library(yardstick)
library(glmnet)

## Loading required package: Matrix

##
## Attaching package: 'Matrix'

## The following objects are masked from 'package:tidyr':
##
##     expand, pack, unpack

## Loaded glmnet 4.1-2

library(earth)

## Loading required package: Formula

## Loading required package: plotmo

## Loading required package: plotrix

##
## Attaching package: 'plotrix'

## The following object is masked from 'package:scales':
##
##     rescale

## Loading required package: TeachingDemos
```

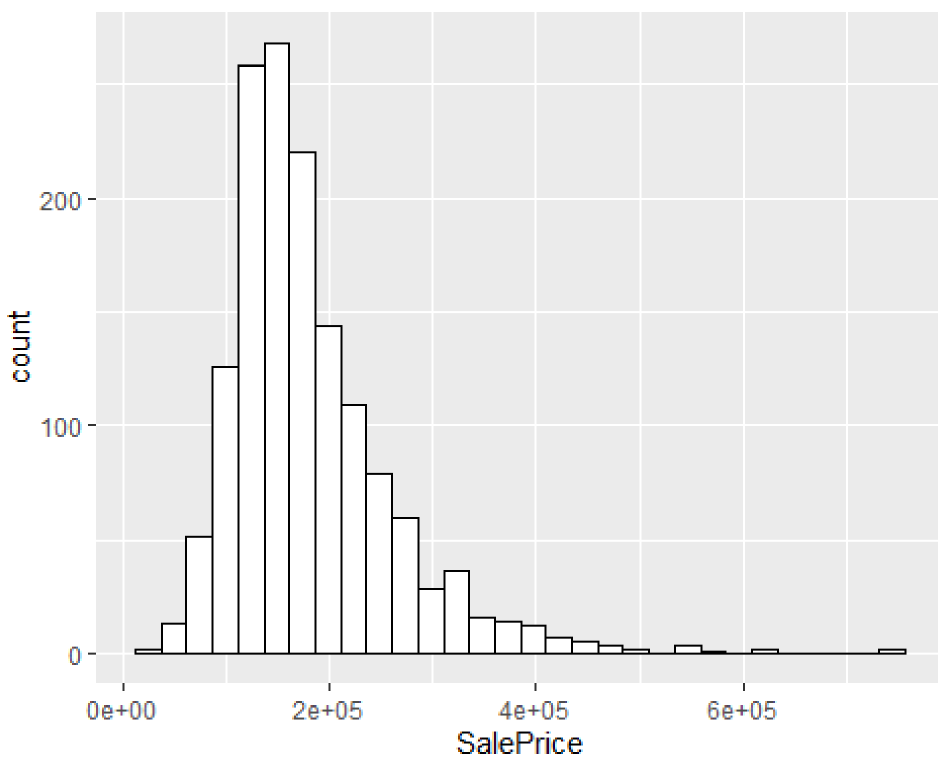
Load the data sets

```
setwd("~/R projects/House Prices")
train <- read_csv("train.csv")

## Rows: 1460 Columns: 81

## -- Column specification --------------------------------------------------
------
## Delimiter: ","
## chr (43): MSZoning, Street, Alley, LotShape, LandContour, Utilities,
LotConf...
## dbl (38): Id, MSSubClass, LotFrontage, LotArea, OverallQual, OverallCond,
Ye...

##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this
message.

test <- read_csv("test.csv")

## Rows: 1459 Columns: 80
```

```
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr (43): MSZoning, Street, Alley, LotShape, LandContour, Utilities,
LotConf...
## dbl (37): Id, MSSubClass, LotFrontage, LotArea, OverallQual, OverallCond,
Ye...

##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this
message.
```

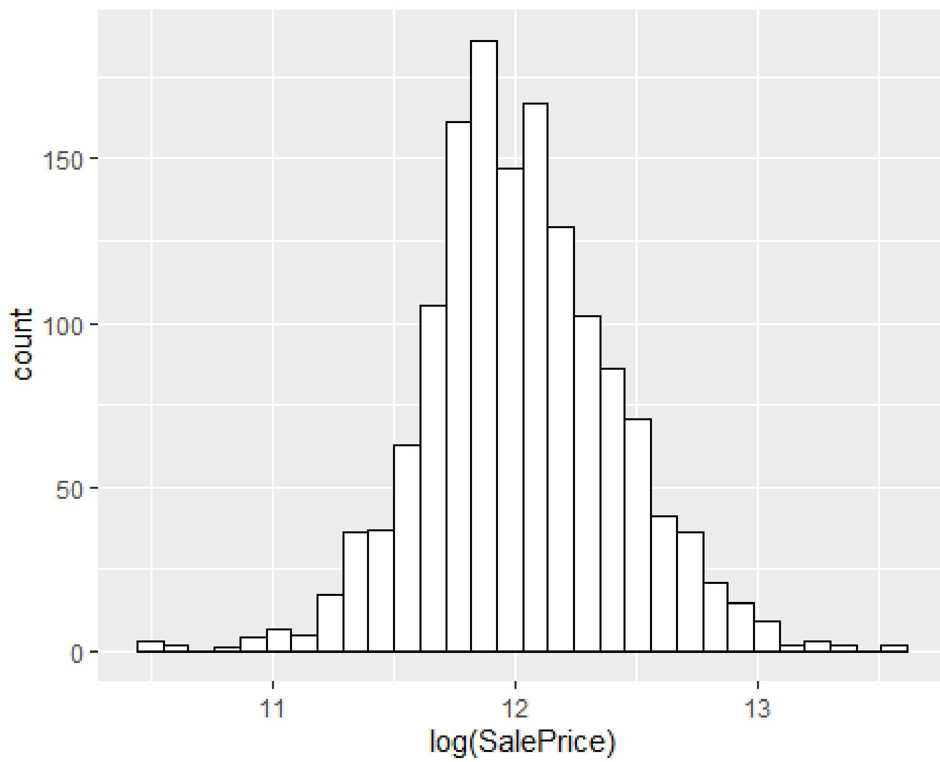
EDA Lets look at how the SalePrices are distributed

```
ggplot(train,
       aes(x = SalePrice)) +
  geom_histogram(fill = "white", color = "black")

## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



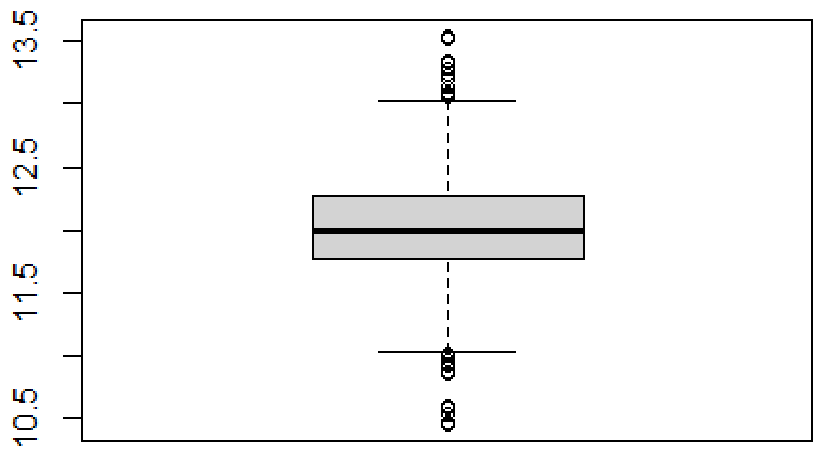
I don't like the shape of the distribution of SalePrice so lets try making it look more symmetric with a log transformation.

```
ggplot(train, aes(x = log(SalePrice))) +
  geom_histogram(fill = "white", color = "black")

## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



This is much better. We could try more kinds of transformations like inverse, power or BoxCox but I think this looks good enough. However, lets do the transformation and then remove observations that have a boxplot's definition of outlier for SalePrice.

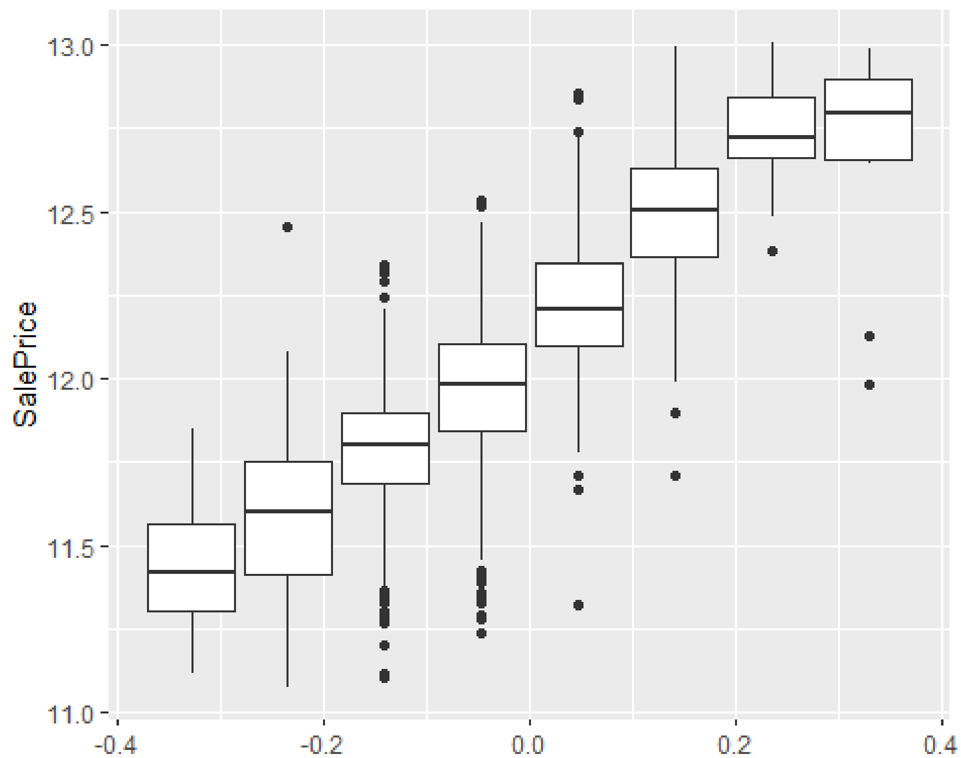
```
train$SalePrice <- log(train$SalePrice)
sale_upper <- boxplot(train$SalePrice)$stats[5]
sale_lower <- boxplot(train$SalePrice)$stats[1]
```



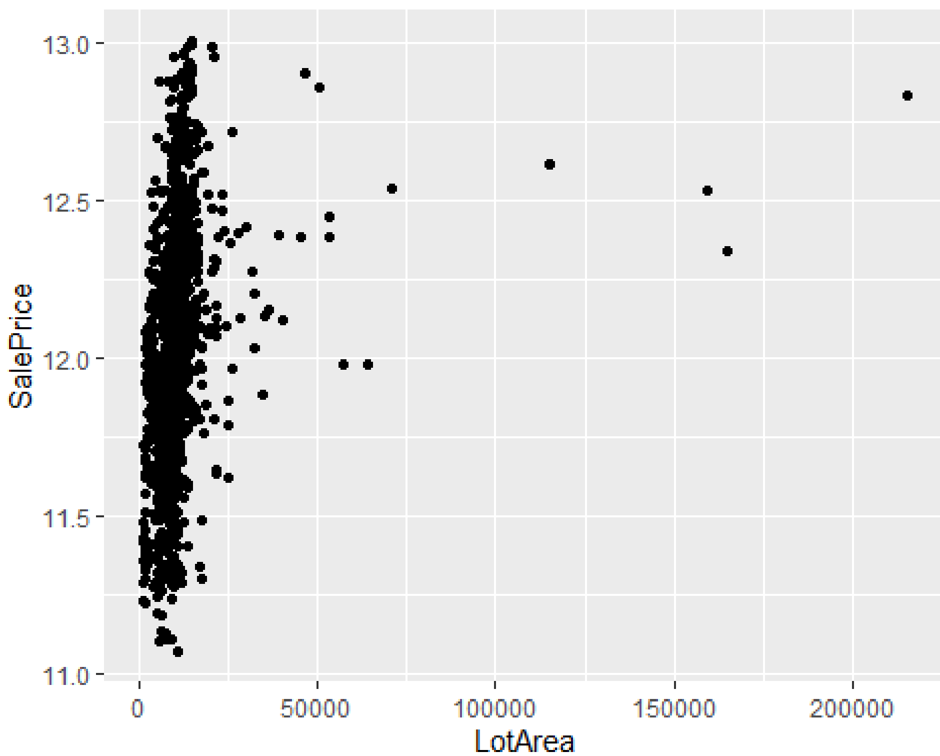

```
train <- train %>%
  filter(SalePrice < sale_upper, SalePrice > sale_lower)
```

Lets check some other features and their relationship to SalePrice

```
ggplot(train,
       aes(y = SalePrice,
           group = OverallQual)) +
  geom_boxplot()
```




```
ggplot(train,
       aes(y = SalePrice,
           x = LotArea)) +
  geom_point()
```



Data Cleaning

Now it is time to clean our datasets. For this I combine the train and test dataset. I am going to remove columns which have more that 25% missing values. Also I remove Street and Utilties because they have a very small variance.

```
test$SalePrice <- 0
full <- rbind(test, train)
skim(full)
```

Data summary

Name	full
Number of rows	2889
Number of columns	81
_______________________	
Column type frequency:	
character	43
numeric	38
________________________	
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
MSZoning	4	1.00	2	7	0	5	0
Street	0	1.00	4	4	0	2	0
Alley	2694	0.07	4	4	0	2	0
LotShape	0	1.00	3	3	0	4	0
LandContour	0	1.00	3	3	0	4	0
Utilities	2	1.00	6	6	0	2	0
LotConfig	0	1.00	3	7	0	5	0
LandSlope	0	1.00	3	3	0	3	0
Neighborhood	0	1.00	5	7	0	25	0
Condition1	0	1.00	4	6	0	9	0
Condition2	0	1.00	4	6	0	8	0
BldgType	0	1.00	4	6	0	5	0
HouseStyle	0	1.00	4	6	0	8	0
RoofStyle	0	1.00	3	7	0	6	0
RoofMatl	0	1.00	4	7	0	8	0
Exterior1st	1	1.00	5	7	0	15	0
Exterior2nd	1	1.00	5	7	0	16	0
MasVnrType	23	0.99	4	7	0	4	0
ExterQual	0	1.00	2	2	0	4	0
ExterCond	0	1.00	2	2	0	5	0
Foundation	0	1.00	4	6	0	6	0
BsmtQual	79	0.97	2	2	0	4	0
BsmtCond	80	0.97	2	2	0	4	0
BsmtExposure	80	0.97	2	2	0	4	0
BsmtFinType1	77	0.97	3	3	0	6	0
BsmtFinType2	78	0.97	3	3	0	6	0
Heating	0	1.00	4	5	0	6	0
HeatingQC	0	1.00	2	2	0	5	0
CentralAir	0	1.00	1	1	0	2	0
Electrical	1	1.00	3	5	0	5	0
KitchenQual	1	1.00	2	2	0	4	0
Functional	2	1.00	3	4	0	7	0
FireplaceQu	1406	0.51	2	2	0	5	0
GarageType	148	0.95	6	7	0	6	0
GarageFinish	150	0.95	3	3	0	3	0

GarageQual	150	0.95	2	2	0	5	0
GarageCond	150	0.95	2	2	0	5	0
PavedDrive	0	1.00	1	1	0	3	0
PoolQC	2880	0.00	2	2	0	3	0
Fence	2325	0.20	4	5	0	4	0
MiscFeature	2786	0.04	4	4	0	4	0
SaleType	1	1.00	2	5	0	9	0
SaleCondition	0	1.00	6	7	0	6	0

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
Id	0	1.00	1467.00	843.50	1	737.00	1475.0	2197.00	2919.00	
MSSubClass	0	1.00	57.28	42.58	20	20.00	50.0	70.00	190.00	
LotFrontage	484	0.83	69.19	23.21	21	59.00	68.0	80.00	313.00	
LotArea	0	1.00	10138.54	7856.52	1300	7476.00	9452.0	11520.00	215245.00	
OverallQual	0	1.00	6.09	1.38	1	5.00	6.0	7.00	10.00	
OverallCond	0	1.00	5.57	1.11	1	5.00	5.0	6.00	9.00	
YearBuilt	0	1.00	1971.40	30.18	1872	1954.00	1973.0	2001.00	2010.00	
YearRemodAdd	0	1.00	1984.33	20.82	1950	1965.00	1993.0	2004.00	2010.00	
MasVnrArea	22	0.99	100.63	175.11	0	0.00	0.0	164.00	1600.00	
BsmtFinSF1	1	1.00	439.64	451.19	0	0.00	370.0	732.25	5644.00	
BsmtFinSF2	1	1.00	49.80	169.70	0	0.00	0.0	0.00	1526.00	
BsmtUnfSF	1	1.00	560.02	438.48	0	219.75	467.0	806.00	2336.00	
TotalBsmtSF	1	1.00	1049.46	433.68	0	793.00	989.5	1299.25	6110.00	

1stFlrSF	0	1.00	1157.57	386.76	407	879.00	1082.0	1383.00	5095.00	▇▂▁▁▁
2ndFlrSF	0	1.00	335.03	425.12	0	0.00	0.0	704.00	1862.00	▇▂▂▁▁
LowQualFinSF	0	1.00	4.55	45.42	0	0.00	0.0	0.00	1064.00	▇▁▁▁▁
GrLivArea	0	1.00	1497.15	492.11	407	1128.00	1444.0	1740.00	5642.00	▇▇▁▁▁
BsmtFullBath	2	1.00	0.43	0.53	0	0.00	0.0	1.00	3.00	▇▆▁▁▁
BsmtHalfBath	2	1.00	0.06	0.25	0	0.00	0.0	0.00	2.00	▇▁▁▁▁
FullBath	0	1.00	1.57	0.55	0	1.00	2.0	2.00	4.00	▁▇▇▁▁
HalfBath	0	1.00	0.38	0.50	0	0.00	0.0	1.00	2.00	▇▁▅▁▁
BedroomAbvGr	0	1.00	2.86	0.82	0	2.00	3.0	3.00	8.00	▁▇▂▁▁
KitchenAbvGr	0	1.00	1.04	0.21	0	1.00	1.0	1.00	3.00	▁▇▁▁▁
TotRmsAbvGrd	0	1.00	6.44	1.54	3	5.00	6.0	7.00	15.00	▃▇▂▁▁
Fireplaces	0	1.00	0.60	0.64	0	0.00	1.0	1.00	4.00	▇▇▁▁▁
GarageYrBlt	150	0.95	1978.07	25.54	1895	1960.00	1979.0	2002.00	2207.00	▂▇▁▁▁
GarageCars	1	1.00	1.77	0.75	0	1.00	2.0	2.00	5.00	▃▇▂▁▁
GarageArea	1	1.00	472.92	212.98	0	322.75	480.0	576.00	1488.00	▂▇▂▁▁
WoodDeckSF	0	1.00	93.73	126.27	0	0.00	0.0	168.00	1424.00	▇▁▁▁▁
OpenPorchSF	0	1.00	47.19	66.85	0	0.00	26.0	70.00	742.00	▇▁▁▁▁
EnclosedPorch	0	1.00	23.09	64.31	0	0.00	0.0	0.00	1012.00	▇▁▁▁▁
3SsnPorch	0	1.00	2.63	25.32	0	0.00	0.0	0.00	508.00	▇▁▁▁▁

ScreenPorch	0	1.00	15.89	55.69	0	0.00	0.0	0.00	576.00	▇▁▁▁▁
PoolArea	0	1.00	2.08	34.34	0	0.00	0.0	0.00	800.00	▇▁▁▁▁
MiscVal	0	1.00	50.12	566.70	0	0.00	0.0	0.00	17000.00	▇▁▁▁▁
MoSold	0	1.00	6.22	2.71	1	4.00	6.0	8.00	12.00	▅▆▇▃▃
YrSold	0	1.00	2007.79	1.31	2006	2007.00	2008.0	2009.00	2010.00	▇▇▇▇▃
SalePrice	0	1.00	5.95	6.02	0	0.00	0.0	12.00	13.01	▇▁▁▁▇

```
remove_cols <- colnames(full)[colSums(is.na(full)) > (0.25 * nrow(full))]
full <- full %>%
  select(!remove_cols)
```

```
## Note: Using an external vector in selections is ambiguous.
## i Use `all_of(remove_cols)` instead of `remove_cols` to silence this
message.
## i See <https://tidyselect.r-lib.org/reference/faq-external-vector.html>.
## This message is displayed once per session.
```

```
full <- full %>%
  select(!c(Street, Utilities))

train <- full %>%
  filter(SalePrice != 0)
test <- full %>%
  filter(SalePrice == 0)
```

Now we split the training data

```
set.seed(135)
data_split <- initial_split(train, strata = "SalePrice", prop = 0.80)

house_test <- testing(data_split)
house_train <- training(data_split)
```

Here I am doing all the preprocessing.

```
house_rec <- recipe(SalePrice ~., data = house_train) %>%
  step_impute_mode(all_nominal_predictors()) %>%
  step_impute_mean(all_numeric_predictors()) %>%
  update_role(Id, new_role = "ID") %>%
  step_dummy(all_nominal_predictors()) %>%
  step_impute_median(all_predictors()) %>%
  step_BoxCox(all_numeric_predictors()) %>%
  step_nzv(all_predictors()) %>%
  step_normalize(all_numeric_predictors())
```

Modeling

For some of the models I will be tuning the hyperparameters and will be doing so using a 5-fold crossvalidation.

```
set.seed(123)
folds <- vfold_cv(house_train, v = 5)
```

Random Forest Model - Model

```
rf_mod <-
  rand_forest(trees = 1000, mtry = tune(), min_n = tune()) %>%
  set_mode("regression") %>%
  set_engine("ranger")
```

Random Forest - Workflow

```
rf_wf <- workflow() %>%
  add_recipe(house_rec) %>%
  add_model(rf_mod)
```

Random Forest - Grid for tuning

```
rf_grid <- grid_regular(
  mtry(range = c(10, 30)),
  min_n(range = c(2, 8)),
  levels = 5
)
```

Random Forest - Tune and update the parameters

```
set.seed(345)
tune_res <- tune_grid(
  rf_wf,
  resamples = folds,
  grid = rf_grid
)

## ! Fold1: preprocessor 1/1, model 1/25 (predictions): There are new levels
in a fa...

## ! Fold1: preprocessor 1/1, model 2/25 (predictions): There are new levels
in a fa...

## ! Fold1: preprocessor 1/1, model 3/25 (predictions): There are new levels
in a fa...

## ! Fold1: preprocessor 1/1, model 4/25 (predictions): There are new levels
in a fa...

## ! Fold1: preprocessor 1/1, model 5/25 (predictions): There are new levels
in a fa...
```

```
## ! Fold1: preprocessor 1/1, model 6/25 (predictions): There are new levels
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## ! Fold1: preprocessor 1/1, model 7/25 (predictions): There are new levels
in a fa...

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in a f...

## ! Fold1: preprocessor 1/1, model 11/25 (predictions): There are new levels
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## ! Fold2: preprocessor 1/1, model 1/25 (predictions): There are new levels
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## ! Fold2: preprocessor 1/1, model 9/25 (predictions): There are new levels
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## ! Fold2: preprocessor 1/1, model 11/25 (predictions): There are new levels
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## ! Fold2: preprocessor 1/1, model 25/25 (predictions): There are new levels
in a f...

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in a fa...

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## ! Fold3: preprocessor 1/1, model 8/25 (predictions): There are new levels
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## ! Fold3: preprocessor 1/1, model 9/25 (predictions): There are new levels
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## ! Fold3: preprocessor 1/1, model 10/25 (predictions): There are new levels
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## ! Fold3: preprocessor 1/1, model 12/25 (predictions): There are new levels
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## ! Fold3: preprocessor 1/1, model 13/25 (predictions): There are new levels
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## ! Fold3: preprocessor 1/1, model 15/25 (predictions): There are new levels
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## ! Fold3: preprocessor 1/1, model 25/25 (predictions): There are new levels
in a f...

## ! Fold4: preprocessor 1/1, model 1/25 (predictions): There are new levels
in a fa...

## ! Fold4: preprocessor 1/1, model 2/25 (predictions): There are new levels
in a fa...
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## ! Fold4: preprocessor 1/1, model 3/25 (predictions): There are new levels
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## ! Fold4: preprocessor 1/1, model 4/25 (predictions): There are new levels
in a fa...

## ! Fold4: preprocessor 1/1, model 5/25 (predictions): There are new levels
in a fa...

## ! Fold4: preprocessor 1/1, model 6/25 (predictions): There are new levels
in a fa...

## ! Fold4: preprocessor 1/1, model 7/25 (predictions): There are new levels
in a fa...

## ! Fold4: preprocessor 1/1, model 8/25 (predictions): There are new levels
in a fa...

## ! Fold4: preprocessor 1/1, model 9/25 (predictions): There are new levels
in a fa...

## ! Fold4: preprocessor 1/1, model 10/25 (predictions): There are new levels
in a f...

## ! Fold4: preprocessor 1/1, model 11/25 (predictions): There are new levels
in a f...

## ! Fold4: preprocessor 1/1, model 12/25 (predictions): There are new levels
in a f...

## ! Fold4: preprocessor 1/1, model 13/25 (predictions): There are new levels
in a f...

## ! Fold4: preprocessor 1/1, model 14/25 (predictions): There are new levels
in a f...

## ! Fold4: preprocessor 1/1, model 15/25 (predictions): There are new levels
in a f...

## ! Fold4: preprocessor 1/1, model 16/25 (predictions): There are new levels
in a f...

## ! Fold4: preprocessor 1/1, model 17/25 (predictions): There are new levels
in a f...

## ! Fold4: preprocessor 1/1, model 18/25 (predictions): There are new levels
in a f...

## ! Fold4: preprocessor 1/1, model 19/25 (predictions): There are new levels
in a f...

## ! Fold4: preprocessor 1/1, model 20/25 (predictions): There are new levels
in a f...
```

```
## ! Fold4: preprocessor 1/1, model 21/25 (predictions): There are new levels
in a f...

## ! Fold4: preprocessor 1/1, model 22/25 (predictions): There are new levels
in a f...

## ! Fold4: preprocessor 1/1, model 23/25 (predictions): There are new levels
in a f...

## ! Fold4: preprocessor 1/1, model 24/25 (predictions): There are new levels
in a f...

## ! Fold4: preprocessor 1/1, model 25/25 (predictions): There are new levels
in a f...

## ! Fold5: preprocessor 1/1, model 1/25 (predictions): There are new levels
in a fa...

## ! Fold5: preprocessor 1/1, model 2/25 (predictions): There are new levels
in a fa...

## ! Fold5: preprocessor 1/1, model 3/25 (predictions): There are new levels
in a fa...

## ! Fold5: preprocessor 1/1, model 4/25 (predictions): There are new levels
in a fa...

## ! Fold5: preprocessor 1/1, model 5/25 (predictions): There are new levels
in a fa...

## ! Fold5: preprocessor 1/1, model 6/25 (predictions): There are new levels
in a fa...

## ! Fold5: preprocessor 1/1, model 7/25 (predictions): There are new levels
in a fa...

## ! Fold5: preprocessor 1/1, model 8/25 (predictions): There are new levels
in a fa...

## ! Fold5: preprocessor 1/1, model 9/25 (predictions): There are new levels
in a fa...

## ! Fold5: preprocessor 1/1, model 10/25 (predictions): There are new levels
in a f...

## ! Fold5: preprocessor 1/1, model 11/25 (predictions): There are new levels
in a f...

## ! Fold5: preprocessor 1/1, model 12/25 (predictions): There are new levels
in a f...

## ! Fold5: preprocessor 1/1, model 13/25 (predictions): There are new levels
in a f...
```

```
## ! Fold5: preprocessor 1/1, model 14/25 (predictions): There are new levels
in a f...

## ! Fold5: preprocessor 1/1, model 15/25 (predictions): There are new levels
in a f...

## ! Fold5: preprocessor 1/1, model 16/25 (predictions): There are new levels
in a f...

## ! Fold5: preprocessor 1/1, model 17/25 (predictions): There are new levels
in a f...

## ! Fold5: preprocessor 1/1, model 18/25 (predictions): There are new levels
in a f...

## ! Fold5: preprocessor 1/1, model 19/25 (predictions): There are new levels
in a f...

## ! Fold5: preprocessor 1/1, model 20/25 (predictions): There are new levels
in a f...

## ! Fold5: preprocessor 1/1, model 21/25 (predictions): There are new levels
in a f...

## ! Fold5: preprocessor 1/1, model 22/25 (predictions): There are new levels
in a f...

## ! Fold5: preprocessor 1/1, model 23/25 (predictions): There are new levels
in a f...

## ! Fold5: preprocessor 1/1, model 24/25 (predictions): There are new levels
in a f...

## ! Fold5: preprocessor 1/1, model 25/25 (predictions): There are new levels
in a f...

best_rmse <- select_best(tune_res, "rmse")
final_rf <- finalize_model(
  rf_mod,
  best_rmse
)
rf_wf <- rf_wf %>%
  update_model(final_rf)
```

Random Forest - Fit the model

```
rf_fit <- fit(rf_wf, data = house_train)
```

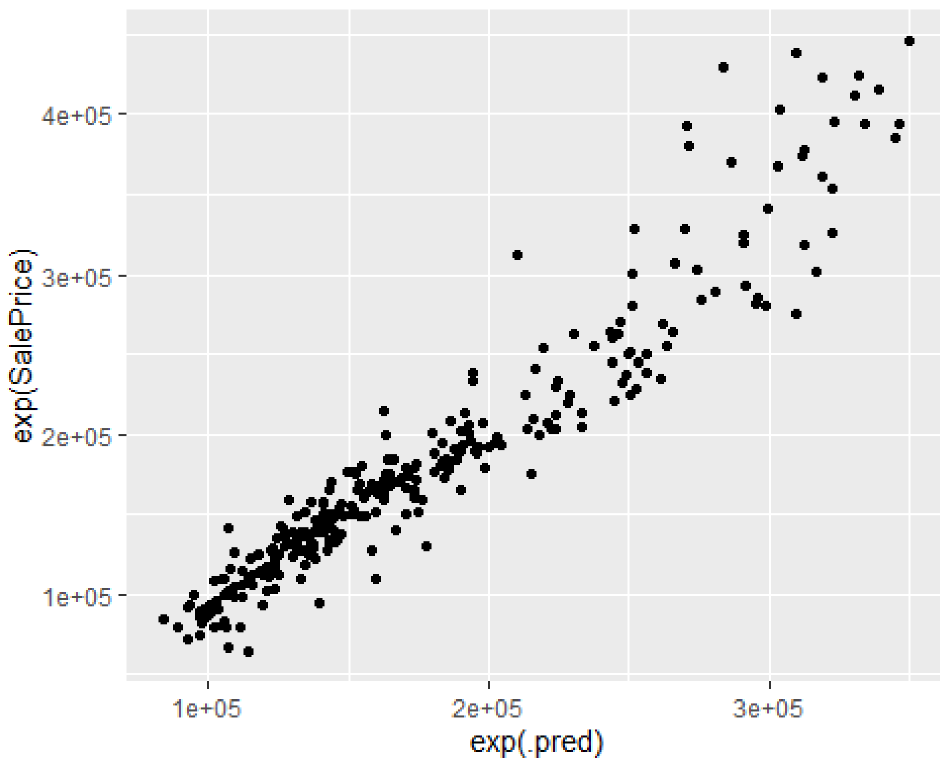
Random Forest - Predict and find the RMSE

```
rf_pred <- rf_fit %>%
  predict(new_data = house_test)

## Warning: There are new levels in a factor: Artery
```

```
## Warning: There are new levels in a factor: Other

## Warning: There are new levels in a factor: Floor

rf_pred <- bind_cols(rf_pred, house_test %>% select(SalePrice))
rf_pred

## # A tibble: 288 x 2
##    .pred SalePrice
##    <dbl>     <dbl>
##  1  12.5      12.6
##  2  11.7      11.7
##  3  11.8      11.8
##  4  11.9      11.9
##  5  11.8      11.8
##  6  12.2      12.1
##  7  12.1      12.0
##  8  11.9      11.9
##  9  11.7      11.6
## 10  12.6      13.0
## # ... with 278 more rows

rmse(rf_pred, truth = exp(SalePrice), estimate = exp(.pred))

## # A tibble: 1 x 3
##   .metric .estimator .estimate
##   <chr>   <chr>          <dbl>
## 1 rmse    standard      29029.
```

Random Forest - Plot the predictions against the actual SalePrice and see if there any postProcesses that can be done.

```
ggplot(data = rf_pred, aes(x = exp(.pred), y = exp(SalePrice))) +
  geom_point()
```



Does not look like any postProcessing is needed.

LASSO Model Same Process as with Random Forest

```
lasso_model <- linear_reg(penalty = tune(), mixture = tune()) %>%
  set_engine("glmnet")


lasso_wf <- workflow() %>%
  add_recipe(house_rec) %>%
  add_model(lasso_model)

lasso_grid <- grid_regular(
  penalty(), # The tune package has default values for penalty() and
mixture() so no need to give them any
  mixture(),
  levels = 5
)
set.seed(345)
tune_res_las <- tune_grid(
  lasso_wf,
  resamples = folds,
  grid = lasso_grid
)

## ! Fold1: preprocessor 1/1, model 1/5 (predictions): There are new levels
in a fac...
```

```
## ! Fold1: preprocessor 1/1, model 2/5 (predictions): There are new levels
in a fac...

## ! Fold1: preprocessor 1/1, model 3/5 (predictions): There are new levels
in a fac...

## ! Fold1: preprocessor 1/1, model 4/5 (predictions): There are new levels
in a fac...

## ! Fold1: preprocessor 1/1, model 5/5 (predictions): There are new levels
in a fac...

## ! Fold1: internal: A correlation computation is required, but `estimate`
is const...

## ! Fold2: preprocessor 1/1, model 1/5 (predictions): There are new levels
in a fac...

## ! Fold2: preprocessor 1/1, model 2/5 (predictions): There are new levels
in a fac...

## ! Fold2: preprocessor 1/1, model 3/5 (predictions): There are new levels
in a fac...

## ! Fold2: preprocessor 1/1, model 4/5 (predictions): There are new levels
in a fac...

## ! Fold2: preprocessor 1/1, model 5/5 (predictions): There are new levels
in a fac...

## ! Fold2: internal: A correlation computation is required, but `estimate`
is const...

## ! Fold3: preprocessor 1/1, model 1/5 (predictions): There are new levels
in a fac...

## ! Fold3: preprocessor 1/1, model 2/5 (predictions): There are new levels
in a fac...

## ! Fold3: preprocessor 1/1, model 3/5 (predictions): There are new levels
in a fac...

## ! Fold3: preprocessor 1/1, model 4/5 (predictions): There are new levels
in a fac...

## ! Fold3: preprocessor 1/1, model 5/5 (predictions): There are new levels
in a fac...

## ! Fold3: internal: A correlation computation is required, but `estimate`
is const...

## ! Fold4: preprocessor 1/1, model 1/5 (predictions): There are new levels
in a fac...
```

```
## ! Fold4: preprocessor 1/1, model 2/5 (predictions): There are new levels
in a fac...

## ! Fold4: preprocessor 1/1, model 3/5 (predictions): There are new levels
in a fac...

## ! Fold4: preprocessor 1/1, model 4/5 (predictions): There are new levels
in a fac...

## ! Fold4: preprocessor 1/1, model 5/5 (predictions): There are new levels
in a fac...

## ! Fold4: internal: A correlation computation is required, but `estimate`
is const...

## ! Fold5: preprocessor 1/1, model 1/5 (predictions): There are new levels
in a fac...

## ! Fold5: preprocessor 1/1, model 2/5 (predictions): There are new levels
in a fac...

## ! Fold5: preprocessor 1/1, model 3/5 (predictions): There are new levels
in a fac...

## ! Fold5: preprocessor 1/1, model 4/5 (predictions): There are new levels
in a fac...

## ! Fold5: preprocessor 1/1, model 5/5 (predictions): There are new levels
in a fac...

## ! Fold5: internal: A correlation computation is required, but `estimate`
is const...
```

```
best_rmse_las <- select_best(tune_res_las, "rmse")
final_las <- finalize_model(
  lasso_model,
  best_rmse_las
)
lasso_wf <- lasso_wf %>%
  update_model(final_las)
```

LASSO - Fit the model

```
lasso_fit <- fit(lasso_wf, data = house_train)
```

LASSO - Predict and evaluate using RMSE

```
lasso_pred <- lasso_fit %>%
  predict(new_data = house_test)

## Warning: There are new levels in a factor: Artery

## Warning: There are new levels in a factor: Other
```

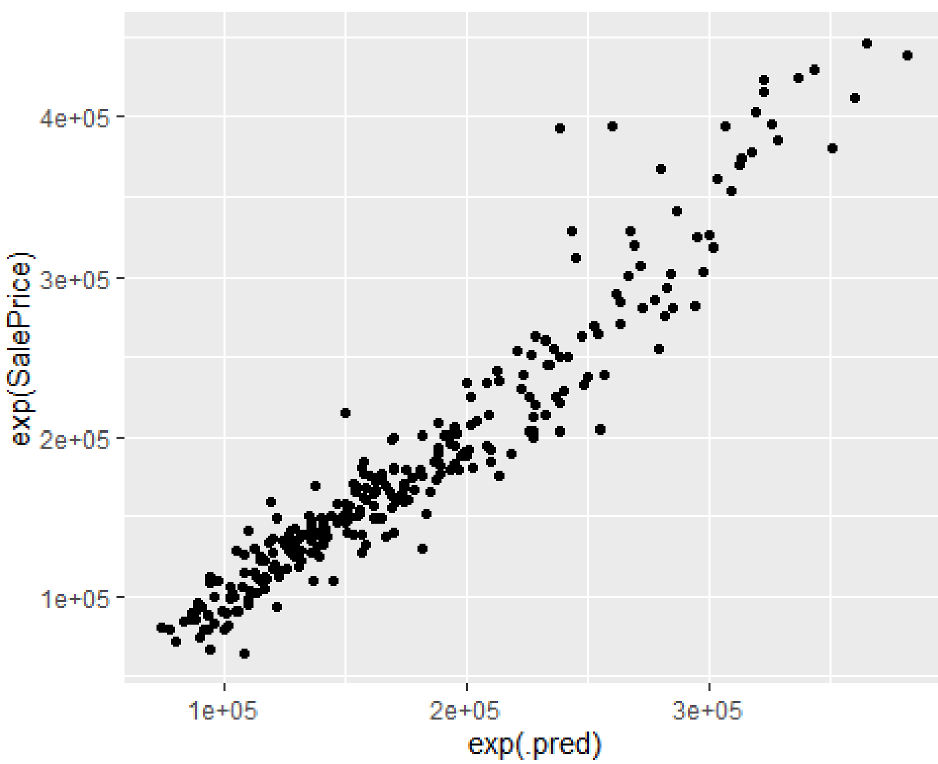
```
## Warning: There are new levels in a factor: Floor
```

```
lasso_pred <- bind_cols(lasso_pred, house_test %>% select(SalePrice))
rmse(lasso_pred, truth = exp(SalePrice), estimate = exp(.pred))
```

```
## # A tibble: 1 x 3
##   .metric .estimator .estimate
##   <chr>   <chr>          <dbl>
## 1 rmse    standard      27997.
```

LASSO - Check for any potential postProcessing

```
ggplot(data = lasso_pred, aes(x = exp(.pred), y = exp(SalePrice))) +
  geom_point()
```



Looks good, no postProcessing required

MARS Model For the MARS model I am not going to use parameter tuning

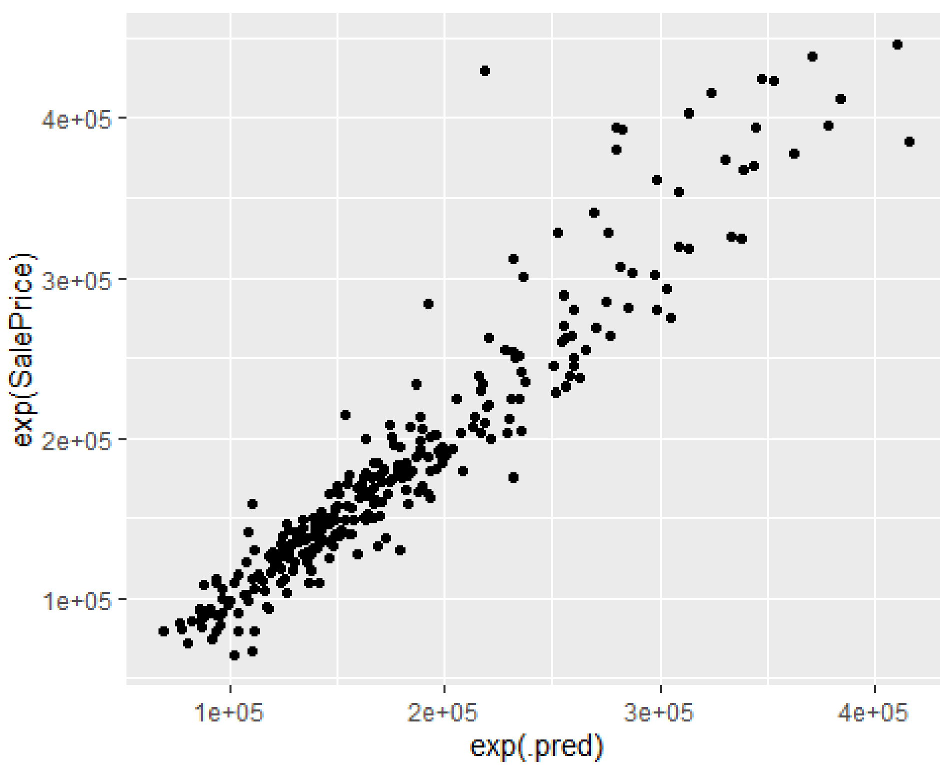
```
mars_model <- mars(mode = "regression") %>%
  set_engine("earth")

mars_wf <- workflow() %>%
  add_recipe(house_rec) %>%
  add_model(mars_model)

mars_fit <- fit(mars_wf, data = house_train)
```

MARS - Prediction and evaluate using RMSE

```
mars_pred <- mars_fit %>%
  predict(new_data = house_test)

## Warning: There are new levels in a factor: Artery

## Warning: There are new levels in a factor: Other

## Warning: There are new levels in a factor: Floor

mars_pred <- bind_cols(mars_pred, house_test %>% select(SalePrice))
rmse(mars_pred, truth = exp(SalePrice), estimate = exp(.pred))

## # A tibble: 1 x 3
##   .metric .estimator .estimate
##   <chr>   <chr>          <dbl>
## 1 rmse    standard      28164.
```

MARS - Check for any postProcessing

```
ggplot(data = mars_pred, aes(x = exp(.pred), y = exp(SalePrice))) +
  geom_point()
```



Looks good, no postProcessing required.

Submission From the RMSE scores it looks like the LASSO model worked best so that is what I am going to use for the final prediction.

```r
lasso_final_fit <- fit(lasso_wf, data = train)
lasso_final_pred <- predict(lasso_final_fit, new_data = test)
lasso_final_pred <- bind_cols(test %>% select(Id), exp(lasso_final_pred))
names(lasso_final_pred)[2] <- "SalePrice"

write_csv(lasso_final_pred, "tidymodels_pred.csv")
```

This gave me a 0.13401 score on Kaggle.