Orange Juice Sales at Wasatch Grocery Chain

Identification of Significant Predictor Variables and Predictive Modelling of Customer Preferance in Minute Maid Sales

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Introduction

Wasatch Grocery Chain (WGC) is a regional grocery chain operating in the Intermoutain West of the US. WGC sells two brands of orange juice in its stores, Citrus Hill (CH) and Minute Maid (MM) of which MM is the more profitable to the company. This report will identify what customer factors within available data contribute to purchase of MM over CH, as well as to what degree these factors influence customer choice. In addition, a predictive model is created that will allow the Sales Department to identify other customers within our customer base that are more likely to purchase Minute Maid brand orange juice, thus driving profitability across the company.

```
set.seed(1234)
df <- read.csv(url("http://data.mishra.us/files/project/OJ_data.csv"))
df[-1] <- lapply(df[-1],as.numeric)
df$Purchase <- as.factor(df$Purchase)
purchase_testtrain <- initial_split(df, prop = 0.75, strata = Purchase)
train <- training(purchase_testtrain)
test <- testing(purchase_testtrain)
```

Available Data

The data set used in this report contains 13 possible predictor variables as well as 1 outcome variable, Purchase, which records whether or not a customer purchased MM. There are a total of 1070 observations in the data set. The data set was further partitioned into a **training** data set, containing 801 observations, and a validation **testing** data set containing 269 observations.

Methods

Results

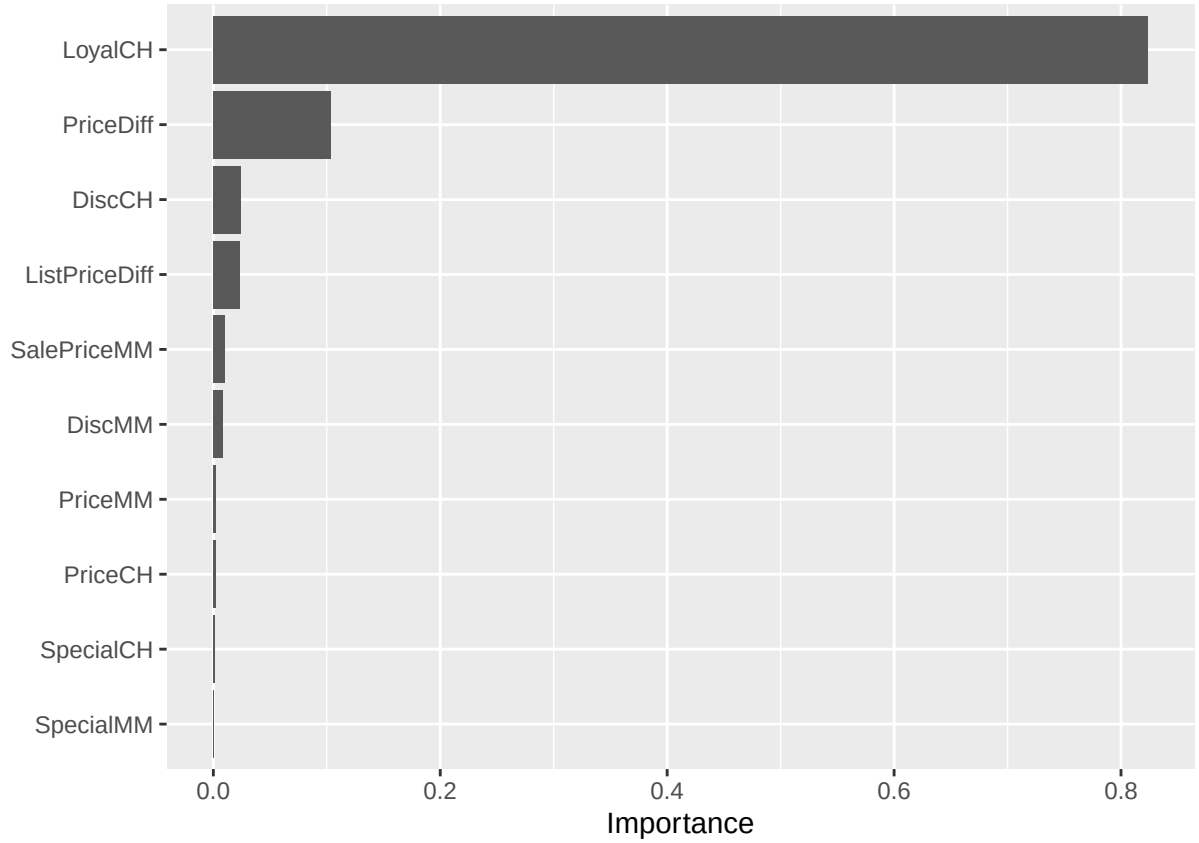
```
set.seed(1234)
recipe_oj <- recipe(Purchase ~ ., train)

model_oj_bt <- boost_tree(trees = tune(), tree_depth = tune(), learn_rate = tune()) %>%
  set_engine('xgboost', verbosity = 0) %>%
  set_mode('classification')

hyperparameter_grid <- grid_regular(trees(), tree_depth(), learn_rate(), levels = 5)

purchase_folds <- vfold_cv(train, v=4) # 4-fold Cross validation

oj_workflow <- workflow() %>% add_model(model_oj_bt) %>% add_recipe(recipe_oj) #Set Workflow

# Tune Hyper-parameters
oj_tune <- oj_workflow %>% tune_grid(resamples = purchase_folds,
                                     grid = hyperparameter_grid,
                                     metrics = metric_set(accuracy))

best_bt_model <- oj_tune %>% select_best('accuracy') #Select best Hyper-parameters from grid

best_bt_model
```

```
## # A tibble: 1 x 4
##   trees tree_depth learn_rate .config
##   <int>      <int>      <dbl> <chr>
## 1  1000          1        0.1 Preprocessor1_Model023
```

```
oj_final_workflow <- oj_workflow %>% finalize_workflow(best_bt_model) # Create Final Workflow based upo

final_fit <- oj_final_workflow %>% last_fit(split = purchase_testtrain) # Final Fit Model

final_fit %>% collect_metrics()
```

```
## # A tibble: 2 x 4
##   .metric  .estimator .estimate .config
##   <chr>    <chr>          <dbl> <chr>
## 1 accuracy binary         0.799 Preprocessor1_Model1
## 2 roc_auc  binary         0.892 Preprocessor1_Model1
```

```
oj_final_workflow %>% fit(data = train) %>% extract_fit_parsnip() %>% vip(geom = 'col') #Plot most impo
```

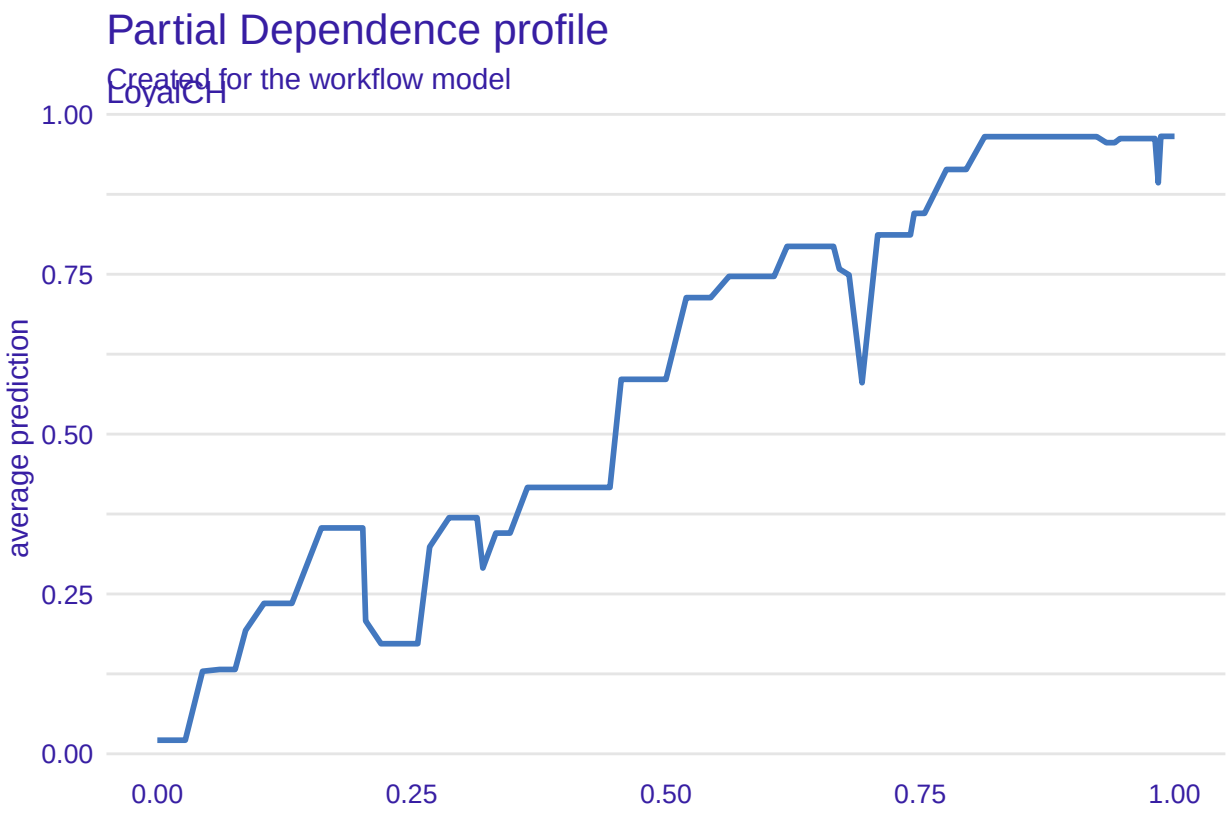



```
vi_values <- oj_final_workflow %>% fit(data = train) %>% extract_fit_parsnip() %>% vi()
vi_gt_1 <- vi_values %>% filter(Importance >= 0.01)
vi_gt_1
```

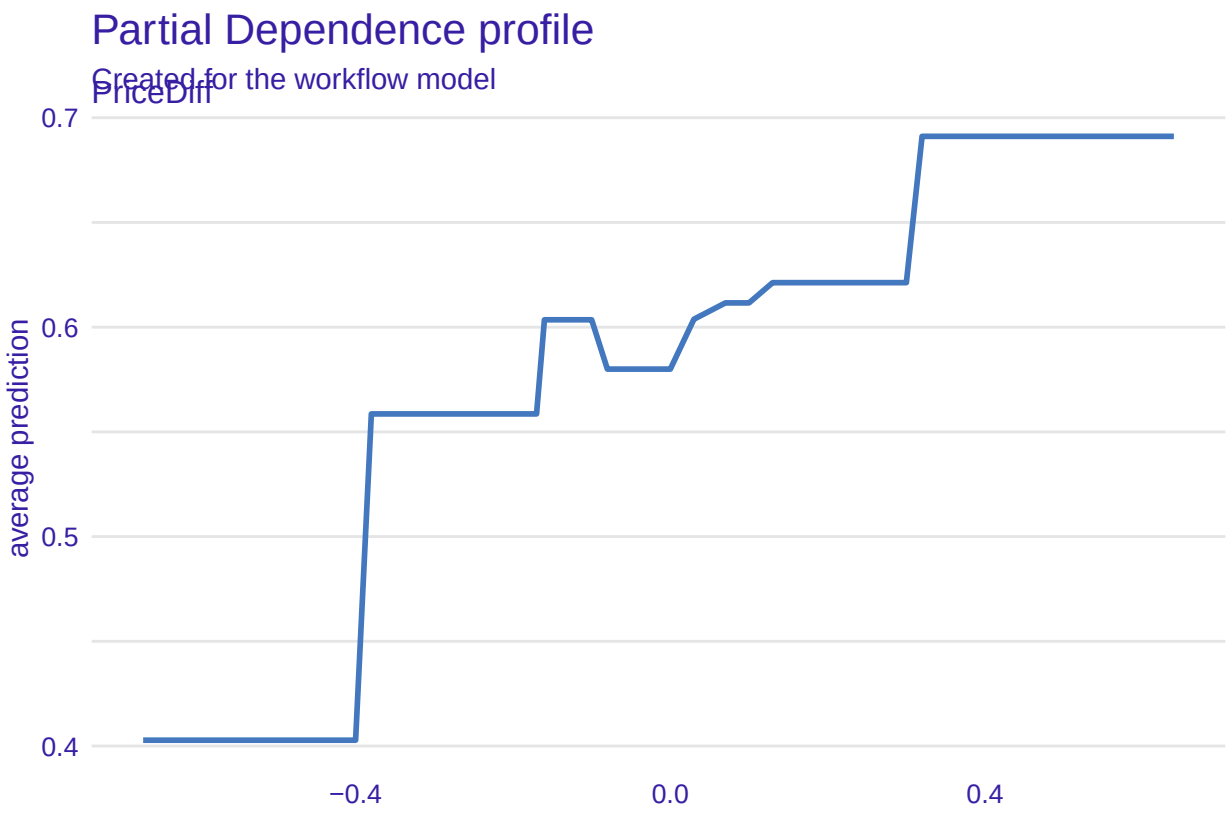
```
## # A tibble: 5 x 2
##   Variable      Importance
##   <chr>              <dbl>
## 1 LoyalCH           0.824
## 2 PriceDiff         0.104
## 3 DiscCH            0.0239
## 4 ListPriceDiff     0.0232
## 5 SalePriceMM       0.0104
```

the most important variable is LoyalCH with a 82.3503%

```
model_fitted <- oj_final_workflow %>% fit(data = train)

explainer_rf <- explain_tidymodels(model_fitted,
                                   data = train[,-1],
                                   y = train$Purchase,
                                   type = "pdp",verbose = FALSE)

pdp_LoyalCH <- model_profile(explainer_rf,
                             variables = "LoyalCH",
                             N=NULL)
pdp_PriceDiff <- model_profile(explainer_rf,
                               variables = "PriceDiff",
                               N=NULL)
pdp_DiscCH <- model_profile(explainer_rf,
                            variables = "DiscCH",
                            N=NULL)
pdp_ListPriceDiff <- model_profile(explainer_rf,
                            variables = "ListPriceDiff",
                            N=NULL)
pdp_SalePriceMM <- model_profile(explainer_rf,
                            variables = "SalePriceMM",
                            N=NULL)
pdp_DiscMM <- model_profile(explainer_rf,
                            variables = "DiscMM",
                            N=NULL)

plot(pdp_LoyalCH)
```




```
plot(pdp_PriceDiff)
```




```
#plot(pdp_DiscCH)
#plot(pdp_ListPriceDiff)
#plot(pdp_SalePriceMM)
#plot(pdp_DiscMM)
```

Conclusions and Recommendations

Brand

Sales

Appendix 1: Data Characteristics

```
summary(df)
```

```
##  Purchase    PriceCH         PriceMM         DiscCH            DiscMM
##  0:417    Min.   :1.690   Min.   :1.690   Min.   :0.00000   Min.   :0.0000
##  1:653    1st Qu.:1.790   1st Qu.:1.990   1st Qu.:0.00000   1st Qu.:0.0000
##           Median :1.860   Median :2.090   Median :0.00000   Median :0.0000
##           Mean   :1.867   Mean   :2.085   Mean   :0.05186   Mean   :0.1234
##           3rd Qu.:1.990   3rd Qu.:2.180   3rd Qu.:0.00000   3rd Qu.:0.2300
##           Max.   :2.090   Max.   :2.290   Max.   :0.50000   Max.   :0.8000
##    SpecialCH        SpecialMM         LoyalCH          SalePriceMM
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.000011   Min.   :1.190
##  1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:0.325257   1st Qu.:1.690
##  Median :0.0000   Median :0.0000   Median :0.600000   Median :2.090
##  Mean   :0.1477   Mean   :0.1617   Mean   :0.565782   Mean   :1.962
```

```
##  3rd Qu.:0.0000   3rd Qu.:0.0000   3rd Qu.:0.850873   3rd Qu.:2.130
##  Max.   :1.0000   Max.   :1.0000   Max.   :0.999947   Max.   :2.290
##   SalePriceCH      PriceDiff         PctDiscMM        PctDiscCH
##  Min.   :1.390   Min.   :-0.6700   Min.   :0.0000   Min.   :0.00000
##  1st Qu.:1.750   1st Qu.: 0.0000   1st Qu.:0.0000   1st Qu.:0.00000
##  Median :1.860   Median : 0.2300   Median :0.0000   Median :0.00000
##  Mean   :1.816   Mean   : 0.1465   Mean   :0.0593   Mean   :0.02731
##  3rd Qu.:1.890   3rd Qu.: 0.3200   3rd Qu.:0.1127   3rd Qu.:0.00000
##  Max.   :2.090   Max.   : 0.6400   Max.   :0.4020   Max.   :0.25269
##  ListPriceDiff
##  Min.   :0.000
##  1st Qu.:0.140
##  Median :0.240
##  Mean   :0.218
##  3rd Qu.:0.300
##  Max.   :0.440
```

```
summary(test)
```

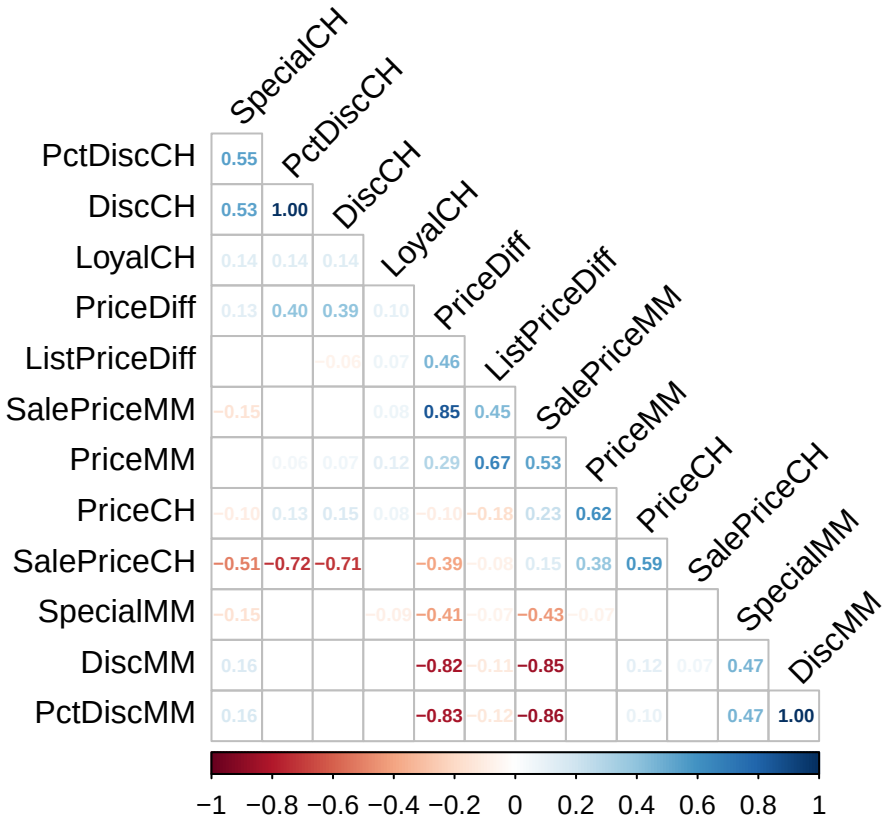
```
##  Purchase    PriceCH         PriceMM          DiscCH            DiscMM
##  0:105    Min.   :1.690   Min.   :1.690   Min.   :0.00000   Min.   :0.0000
##  1:164    1st Qu.:1.790   1st Qu.:1.990   1st Qu.:0.00000   1st Qu.:0.0000
##           Median :1.860   Median :2.090   Median :0.00000   Median :0.0000
##           Mean   :1.874   Mean   :2.079   Mean   :0.05167   Mean   :0.1094
##           3rd Qu.:1.990   3rd Qu.:2.180   3rd Qu.:0.00000   3rd Qu.:0.2000
##           Max.   :2.090   Max.   :2.290   Max.   :0.50000   Max.   :0.8000
##    SpecialCH        SpecialMM         LoyalCH          SalePriceMM
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.000011   Min.   :1.190
##  1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:0.384000   1st Qu.:1.780
##  Median :0.0000   Median :0.0000   Median :0.635200   Median :2.090
##  Mean   :0.1264   Mean   :0.1413   Mean   :0.595184   Mean   :1.969
##  3rd Qu.:0.0000   3rd Qu.:0.0000   3rd Qu.:0.875808   3rd Qu.:2.130
##  Max.   :1.0000   Max.   :1.0000   Max.   :0.999870   Max.   :2.290
##   SalePriceCH      PriceDiff         PctDiscMM         PctDiscCH
##  Min.   :1.390   Min.   :-0.6700   Min.   :0.00000   Min.   :0.00000
##  1st Qu.:1.750   1st Qu.: 0.0000   1st Qu.:0.00000   1st Qu.:0.00000
##  Median :1.860   Median : 0.2300   Median :0.00000   Median :0.00000
##  Mean   :1.823   Mean   : 0.1468   Mean   :0.05231   Mean   :0.02709
##  3rd Qu.:1.890   3rd Qu.: 0.3000   3rd Qu.:0.09569   3rd Qu.:0.00000
##  Max.   :2.090   Max.   : 0.6400   Max.   :0.40201   Max.   :0.25269
##  ListPriceDiff
##  Min.   :0.0000
##  1st Qu.:0.1000
##  Median :0.2400
##  Mean   :0.2045
##  3rd Qu.:0.2900
##  Max.   :0.4400
```

```
summary(train) #need to equalize the 0/1 split in train data set
```

```
##  Purchase    PriceCH         PriceMM          DiscCH            DiscMM
##  0:312    Min.   :1.690   Min.   :1.690   Min.   :0.00000   Min.   :0.0000
##  1:489    1st Qu.:1.790   1st Qu.:1.990   1st Qu.:0.00000   1st Qu.:0.0000
##           Median :1.860   Median :2.090   Median :0.00000   Median :0.0000
##           Mean   :1.865   Mean   :2.088   Mean   :0.05192   Mean   :0.1281
```

```
##           3rd Qu.:1.990   3rd Qu.:2.180   3rd Qu.:0.00000   3rd Qu.:0.2400
##           Max.   :2.090   Max.   :2.290   Max.   :0.50000   Max.   :0.8000
##    SpecialCH        SpecialMM         LoyalCH          SalePriceMM
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.000014   Min.   :1.19
##  1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:0.320000   1st Qu.:1.69
##  Median :0.0000   Median :0.0000   Median :0.585435   Median :2.09
##  Mean   :0.1548   Mean   :0.1685   Mean   :0.555908   Mean   :1.96
##  3rd Qu.:0.0000   3rd Qu.:0.0000   3rd Qu.:0.836160   3rd Qu.:2.18
##  Max.   :1.0000   Max.   :1.0000   Max.   :0.999947   Max.   :2.29
##   SalePriceCH      PriceDiff         PctDiscMM         PctDiscCH
##  Min.   :1.390   Min.   :-0.6700   Min.   :0.00000   Min.   :0.00000
##  1st Qu.:1.750   1st Qu.: 0.0000   1st Qu.:0.00000   1st Qu.:0.00000
##  Median :1.860   Median : 0.2400   Median :0.00000   Median :0.00000
##  Mean   :1.813   Mean   : 0.1464   Mean   :0.06164   Mean   :0.02739
##  3rd Qu.:1.890   3rd Qu.: 0.3200   3rd Qu.:0.11834   3rd Qu.:0.00000
##  Max.   :2.090   Max.   : 0.6400   Max.   :0.40201   Max.   :0.25269
##  ListPriceDiff
##  Min.   :0.0000
##  1st Qu.:0.1400
##  Median :0.2400
##  Mean   :0.2225
##  3rd Qu.:0.3000
##  Max.   :0.4400
```

```
corr <- cor(df[-1]) #correlogram of numeric variables, excluding outcome variable
testDf <- cor.mtest(df[-1], conf.level = 0.95) #compute significance of correlation
# Plot correlogram
corrplot(corr, p.mat = testDf$p, method = 'number', type = 'lower', insig='blank',
         addCoef.col ='black', number.cex = 0.6, order = 'AOE', diag=FALSE, tl.srt = 45, tl.col = 'blac
```




```
# TEST TEST TEST Chris gearheart's test
```