Space Titantic: Kaggle Prediction Model

```
library(tidyverse)
library(knitr)
library(lubridate)
library(rpart)
library(pROC)
library(rattle)
library(randomForest)
library(ggplot2)
library(simputation)
library(naniar)
```

Pre-Processing

```
train = read.csv("train.csv")
```

```
test = read.csv("test.csv")
```

```
miss_var_summary(train)
```

```
## # A tibble: 14 x 3
##    variable     n_miss pct_miss
##    <chr>         <int>    <num>
##  1 ShoppingMall    208     2.39
##  2 VRDeck          188     2.16
##  3 FoodCourt       183     2.11
##  4 Spa             183     2.11
##  5 RoomService     181     2.08
##  6 Age             179     2.06
##  7 PassengerId       0     0
##  8 HomePlanet        0     0
##  9 CryoSleep         0     0
## 10 Cabin             0     0
## 11 Destination       0     0
## 12 VIP               0     0
## 13 Name              0     0
## 14 Transported       0     0
```

Imputing all NA Values in Missing Variables

```r
imp_age = lm(Age~ShoppingMall+VRDeck+FoodCourt+Spa+RoomService+HomePlanet+
               CryoSleep+Destination+VIP, data=train)
summary(imp_age)
```

```
##
## Call:
## lm(formula = Age ~ ShoppingMall + VRDeck + FoodCourt + Spa +
##     RoomService + HomePlanet + CryoSleep + Destination + VIP,
##     data = train)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -34.527  -8.737  -2.495   8.505  55.140
##
## Coefficients:
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)               28.8169087  2.0822319  13.839  < 2e-16 ***
## ShoppingMall               0.0002736  0.0002701   1.013 0.311221
## VRDeck                     0.0002456  0.0001555   1.580 0.114175
## FoodCourt                  0.0002309  0.0001098   2.103 0.035534 *
## Spa                        0.0005768  0.0001484   3.886 0.000103 ***
## RoomService                0.0009596  0.0002538   3.782 0.000157 ***
## HomePlanetEarth           -2.8511257  1.0590858  -2.692 0.007117 **
## HomePlanetEuropa           5.3846105  1.1045482   4.875 1.11e-06 ***
## HomePlanetMars             0.2977731  1.0993682   0.271 0.786507
## CryoSleepFalse             1.0911023  1.0302207   1.059 0.289590
## CryoSleepTrue             -0.9412191  1.0494040  -0.897 0.369796
## Destination55 Cancri e    -2.8014595  1.1607616  -2.413 0.015825 *
## DestinationPSO J318.5-22   0.1583797  1.2283327   0.129 0.897410
## DestinationTRAPPIST-1e    -1.4021401  1.1161152  -1.256 0.209057
## VIPFalse                   0.6368065  1.0467319   0.608 0.542956
## VIPTrue                    4.4543859  1.4911027   2.987 0.002823 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 13.94 on 7604 degrees of freedom
##   (1073 observations deleted due to missingness)
## Multiple R-squared:  0.07847,    Adjusted R-squared:  0.07665
## F-statistic: 43.17 on 15 and 7604 DF,  p-value: < 2.2e-16
```

```r
train2 = train %>% mutate(Age_pred = predict(imp_age,newdata=train))
```

```r
train2=train2 %>%mutate(NewAge = case_when(is.na(Age) ~ round(Age_pred, digits = 0),
                                           TRUE ~ Age))
```

```r
train2 = train2 %>% mutate(NewAge_Final = case_when(is.na(NewAge) ~
                                                      round(mean(NewAge, na.rm=T), digits=0)
                                                    , TRUE ~ NewAge))
```

```r
imp_spa = lm(Spa~ShoppingMall+VRDeck+FoodCourt+Age+RoomService+HomePlanet+
               CryoSleep+Destination+VIP, data=train)
summary(imp_spa)
```

```
##
## Call:
## lm(formula = Spa ~ ShoppingMall + VRDeck + FoodCourt + Age +
##     RoomService + HomePlanet + CryoSleep + Destination + VIP,
##     data = train)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2486.0  -360.8  -229.5   200.5 20538.7
##
## Coefficients:
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)                1.711e+02  1.627e+02   1.052 0.292889
## ShoppingMall              -4.654e-02  2.084e-02  -2.233 0.025564 *
## VRDeck                     1.031e-02  1.200e-02   0.859 0.390335
## FoodCourt                  5.475e-02  8.455e-03   6.476 1.00e-10 ***
## Age                        3.436e+00  8.842e-01   3.886 0.000103 ***
## RoomService               -4.517e-02  1.960e-02  -2.305 0.021180 *
## HomePlanetEarth           -1.096e+02  8.177e+01  -1.340 0.180290
## HomePlanetEuropa           5.585e+02  8.514e+01   6.560 5.75e-11 ***
## HomePlanetMars            -6.986e+01  8.484e+01  -0.823 0.410292
## CryoSleepFalse             2.122e+02  7.948e+01   2.670 0.007597 **
## CryoSleepTrue             -3.159e+02  8.091e+01  -3.905 9.52e-05 ***
## Destination55 Cancri e    -4.123e+01  8.962e+01  -0.460 0.645457
## DestinationPSO J318.5-22  -1.401e+01  9.480e+01  -0.148 0.882509
## DestinationTRAPPIST-1e    -7.317e+01  8.614e+01  -0.849 0.395679
## VIPFalse                   4.868e+00  8.079e+01   0.060 0.951948
## VIPTrue                   -4.867e+01  1.151e+02  -0.423 0.672563
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1076 on 7604 degrees of freedom
##   (1073 observations deleted due to missingness)
## Multiple R-squared:  0.1321, Adjusted R-squared:  0.1304
## F-statistic: 77.17 on 15 and 7604 DF,  p-value: < 2.2e-16
```

```
train2 = train2 %>% mutate(Spa_pred = predict(imp_spa,newdata=train2))
```

```
train2=train2 %>%mutate(NewSpa = case_when(is.na(Spa) ~ round(Spa_pred, digits = 0),
                                           TRUE ~ Spa))
```

```
train2 = train2 %>% mutate(NewSpa_Final = case_when(is.na(NewSpa) ~
                                                      round(mean(NewSpa, na.rm=T), digits=0)
                                                    , TRUE ~ NewSpa))
```

```
imp_foodcourt = lm(FoodCourt~ShoppingMall+VRDeck+Age+Spa+RoomService+HomePlanet+
               CryoSleep+Destination+VIP, data=train)
summary(imp_foodcourt)
```

```
##
## Call:
## lm(formula = FoodCourt ~ ShoppingMall + VRDeck + Age + Spa +
```

```
##     RoomService + HomePlanet + CryoSleep + Destination + VIP,
##     data = train)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3405.1  -475.2  -235.7   377.4 27241.4
##
## Coefficients:
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)                144.99316  220.09389   0.659  0.51006
## ShoppingMall                -0.15087    0.02815  -5.360 8.57e-08 ***
## VRDeck                       0.08653    0.01620   5.341 9.54e-08 ***
## Age                          2.51651    1.19686   2.103  0.03553 *
## Spa                          0.10018    0.01547   6.476 1.00e-10 ***
## RoomService                 -0.13211    0.02647  -4.990 6.16e-07 ***
## HomePlanetEarth           -144.78427  110.60598  -1.309  0.19057
## HomePlanetEuropa          1163.61866  114.71849  10.143  < 2e-16 ***
## HomePlanetMars             -76.91869  114.76830  -0.670  0.50275
## CryoSleepFalse             288.77551  107.50926   2.686  0.00725 **
## CryoSleepTrue             -547.06014  109.38103  -5.001 5.82e-07 ***
## Destination55 Cancri e     247.06941  121.19374   2.039  0.04152 *
## DestinationPSO J318.5-22   209.40525  128.21234   1.633  0.10245
## DestinationTRAPPIST-1e      85.18204  116.52748   0.731  0.46480
## VIPFalse                   -79.93184  109.27487  -0.731  0.46451
## VIPTrue                    497.54903  155.65396   3.197  0.00140 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1455 on 7604 degrees of freedom
##   (1073 observations deleted due to missingness)
## Multiple R-squared:  0.221,  Adjusted R-squared:  0.2194
## F-statistic: 143.8 on 15 and 7604 DF,  p-value: < 2.2e-16
```

```
train2 = train2 %>% mutate(foodcourt_pred = predict(imp_foodcourt,newdata=train2))
```

```
train2=train2 %>%mutate(NewFoodCourt = case_when(is.na(FoodCourt) ~
                                                   round(foodcourt_pred, digits = 0),
                                                 TRUE ~ FoodCourt))
```

```
train2 = train2 %>% mutate(NewFoodCourt_final = case_when(is.na(NewFoodCourt) ~
                                                            round(mean(NewFoodCourt, na.rm=T)
                                                                  , digits=0)
                                                          , TRUE ~ NewFoodCourt))
```

```
imp_VR = lm(VRDeck~ShoppingMall+Spa+FoodCourt+Age+RoomService+HomePlanet+
              CryoSleep+Destination+VIP, data=train)
summary(imp_VR)
```

```
##
## Call:
## lm(formula = VRDeck ~ ShoppingMall + Spa + FoodCourt + Age +
##     RoomService + HomePlanet + CryoSleep + Destination + VIP,
```

```
##     data = train)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2751.8  -339.7  -196.7   212.8 19071.3
##
## Coefficients:
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)                1.389e+02  1.555e+02   0.893 0.371817
## ShoppingMall              -7.713e-02  1.990e-02  -3.875 0.000107 ***
## Spa                        9.413e-03  1.096e-02   0.859 0.390335
## FoodCourt                  4.318e-02  8.086e-03   5.341 9.54e-08 ***
## Age                        1.336e+00  8.456e-01   1.580 0.114175
## RoomService               -9.314e-02  1.870e-02  -4.981 6.48e-07 ***
## HomePlanetEarth           -1.821e+02  7.811e+01  -2.331 0.019778 *
## HomePlanetEuropa           4.980e+02  8.138e+01   6.120 9.85e-10 ***
## HomePlanetMars            -1.796e+02  8.105e+01  -2.216 0.026690 *
## CryoSleepFalse             2.941e+02  7.591e+01   3.875 0.000108 ***
## CryoSleepTrue             -2.406e+02  7.735e+01  -3.110 0.001876 **
## Destination55 Cancri e     1.063e+02  8.563e+01   1.241 0.214617
## DestinationPSO J318.5-22   1.433e+02  9.057e+01   1.582 0.113594
## DestinationTRAPPIST-1e     6.771e+01  8.232e+01   0.823 0.410808
## VIPFalse                  -5.256e+01  7.719e+01  -0.681 0.495988
## VIPTrue                    3.665e+02  1.099e+02   3.333 0.000862 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1028 on 7604 degrees of freedom
##   (1073 observations deleted due to missingness)
## Multiple R-squared:  0.1466, Adjusted R-squared:  0.1449
## F-statistic: 87.08 on 15 and 7604 DF,  p-value: < 2.2e-16
```

```
train2 = train2 %>% mutate(vr_pred = predict(imp_VR,newdata=train2))
```

```
train2=train2 %>%mutate(NewVR = case_when(is.na(VRDeck) ~
                                            round(vr_pred, digits = 0),
                                          TRUE ~ VRDeck))
```

```
train2 = train2 %>% mutate(VRDeck_final = case_when(is.na(NewVR) ~
                                                      round(mean(NewVR, na.rm=T)
                                                            , digits=0)
                                                    , TRUE ~ NewVR))
```

```
imp_RS = lm(RoomService~ShoppingMall+VRDeck+FoodCourt+Age+Spa+HomePlanet+
              CryoSleep+Destination+VIP, data=train)
summary(imp_RS)
```

```
##
## Call:
## lm(formula = RoomService ~ ShoppingMall + VRDeck + FoodCourt +
##     Age + Spa + HomePlanet + CryoSleep + Destination + VIP, data = train)
##
```

```
## Residuals:
##     Min      1Q  Median      3Q     Max
##  -836.7  -274.1  -154.3   126.9 13984.6
##
## Coefficients:
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)                1.596e+02  9.517e+01   1.677 0.093634 .
## ShoppingMall              -4.038e-02  1.219e-02  -3.313 0.000926 ***
## VRDeck                    -3.491e-02  7.009e-03  -4.981 6.48e-07 ***
## FoodCourt                 -2.471e-02  4.951e-03  -4.990 6.16e-07 ***
## Age                        1.956e+00  5.173e-01   3.782 0.000157 ***
## Spa                       -1.546e-02  6.706e-03  -2.305 0.021180 *
## HomePlanetEarth           -9.903e+01  4.783e+01  -2.071 0.038423 *
## HomePlanetEuropa           9.454e-01  4.995e+01   0.019 0.984898
## HomePlanetMars             3.435e+02  4.948e+01   6.943 4.15e-12 ***
## CryoSleepFalse             1.793e+02  4.647e+01   3.857 0.000116 ***
## CryoSleepTrue             -2.411e+02  4.730e+01  -5.097 3.54e-07 ***
## Destination55 Cancri e     9.141e+01  5.242e+01   1.744 0.081231 .
## DestinationPSO J318.5-22   5.461e+01  5.545e+01   0.985 0.324729
## DestinationTRAPPIST-1e     5.489e+01  5.039e+01   1.089 0.276047
## VIPFalse                  -6.832e+01  4.725e+01  -1.446 0.148288
## VIPTrue                    3.679e+01  6.736e+01   0.546 0.584955
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 629.3 on 7604 degrees of freedom
##   (1073 observations deleted due to missingness)
## Multiple R-squared:  0.1353, Adjusted R-squared:  0.1336
## F-statistic: 79.31 on 15 and 7604 DF,  p-value: < 2.2e-16
```

```
train2 = train2 %>% mutate(rs_pred = predict(imp_RS,newdata=train2))
```

```
train2=train2 %>%mutate(Newrs = case_when(is.na(RoomService) ~
                                            round(rs_pred, digits = 0),
                                          TRUE ~ RoomService))
```

```
train2 = train2 %>% mutate(RoomService_final = case_when(is.na(Newrs) ~
                                                   round(mean(Newrs, na.rm=T)
                                                         , digits=0)
                                                 , TRUE ~ Newrs))
```

```
imp_sm = lm(ShoppingMall~RoomService+VRDeck+FoodCourt+Age+Spa+HomePlanet+
              CryoSleep+Destination+VIP, data=train)
summary(imp_sm)
```

```
##
## Call:
## lm(formula = ShoppingMall ~ RoomService + VRDeck + FoodCourt +
##     Age + Spa + HomePlanet + CryoSleep + Destination + VIP, data = train)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
```

```
##  -486.3  -231.9  -126.9    75.8 23142.8
##
## Coefficients:
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)               -4.504e+01  8.950e+01  -0.503 0.614785
## RoomService               -3.570e-02  1.077e-02  -3.313 0.000926 ***
## VRDeck                    -2.556e-02  6.595e-03  -3.875 0.000107 ***
## FoodCourt                 -2.495e-02  4.654e-03  -5.360 8.57e-08 ***
## Age                        4.930e-01  4.868e-01   1.013 0.311221
## Spa                       -1.408e-02  6.306e-03  -2.233 0.025564 *
## HomePlanetEarth           -4.751e+00  4.498e+01  -0.106 0.915885
## HomePlanetEuropa           1.152e+02  4.695e+01   2.454 0.014169 *
## HomePlanetMars             2.165e+02  4.660e+01   4.646 3.45e-06 ***
## CryoSleepFalse             1.503e+02  4.370e+01   3.439 0.000587 ***
## CryoSleepTrue             -1.886e+02  4.450e+01  -4.239 2.27e-05 ***
## Destination55 Cancri e     7.380e+01  4.929e+01   1.497 0.134331
## DestinationPSO J318.5-22   8.159e+01  5.214e+01   1.565 0.117661
## DestinationTRAPPIST-1e     5.357e+01  4.738e+01   1.131 0.258243
## VIPFalse                   8.103e+01  4.443e+01   1.824 0.068208 .
## VIPTrue                    4.415e+01  6.334e+01   0.697 0.485728
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 591.7 on 7604 degrees of freedom
##   (1073 observations deleted due to missingness)
## Multiple R-squared:  0.06807,    Adjusted R-squared:  0.06623
## F-statistic: 37.03 on 15 and 7604 DF,  p-value: < 2.2e-16
```

```
train2 = train2 %>% mutate(sm_pred = predict(imp_sm,newdata=train2))
```

```
train2=train2 %>%mutate(Newsm = case_when(is.na(ShoppingMall) ~
                                            round(sm_pred, digits = 0),
                                          TRUE ~ ShoppingMall))
```

```
train2 = train2 %>% mutate(ShoppingMall_final = case_when(is.na(Newsm) ~
                                                    round(mean(Newsm, na.rm=T)
                                                          , digits=0)
                                                  , TRUE ~ Newsm))
```

```
train2 = train2 %>% mutate(NewTransported = ifelse(Transported == "True", 1, 0))
```

```
train_f = subset(train2, select = -c(Age,RoomService,FoodCourt,
                                     ShoppingMall,Spa,VRDeck,
                                     Age_pred,NewAge,Spa_pred,NewSpa,
                                     foodcourt_pred,NewFoodCourt,
                                     vr_pred,NewVR,rs_pred,Newrs,
                                     sm_pred,Newsm, Transported))
```

Creating Logistic Regression Model using Imputed Data

```
logit = glm(NewTransported ~ HomePlanet+CryoSleep+Destination+VIP+
              NewAge_Final+NewSpa_Final+NewFoodCourt_final+VRDeck_final+
              RoomService_final+ShoppingMall_final, family = binomial,
            data = train_f)
```

```
## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred
```

```
summary(logit)
```

```
##
## Call:
## glm(formula = NewTransported ~ HomePlanet + CryoSleep + Destination +
##     VIP + NewAge_Final + NewSpa_Final + NewFoodCourt_final +
##     VRDeck_final + RoomService_final + ShoppingMall_final, family = binomial,
##     data = train_f)
##
## Coefficients:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                 1.136e+00  3.593e-01   3.161 0.001573 **
## HomePlanetEarth            -5.912e-01  1.792e-01  -3.300 0.000968 ***
## HomePlanetEuropa            1.629e+00  2.067e-01   7.884 3.16e-15 ***
## HomePlanetMars              1.179e-01  1.871e-01   0.630 0.528663
## CryoSleepFalse             -2.549e-01  1.697e-01  -1.502 0.133193
## CryoSleepTrue               9.797e-01  1.735e-01   5.645 1.65e-08 ***
## Destination55 Cancri e      7.407e-02  2.035e-01   0.364 0.715925
## DestinationPSO J318.5-22 -3.543e-01  2.089e-01  -1.696 0.089870 .
## DestinationTRAPPIST-1e     -4.107e-01  1.936e-01  -2.121 0.033904 *
## VIPFalse                   -8.097e-02  1.862e-01  -0.435 0.663706
## VIPTrue                    -5.384e-01  3.004e-01  -1.792 0.073101 .
## NewAge_Final               -7.914e-03  1.999e-03  -3.959 7.52e-05 ***
## NewSpa_Final               -1.921e-03  1.022e-04 -18.798  < 2e-16 ***
## NewFoodCourt_final          5.048e-04  3.865e-05  13.058  < 2e-16 ***
## VRDeck_final               -1.782e-03  9.683e-05 -18.400  < 2e-16 ***
## RoomService_final          -1.474e-03  8.999e-05 -16.378  < 2e-16 ***
## ShoppingMall_final          5.310e-04  6.615e-05   8.028 9.92e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 12050.6  on 8692  degrees of freedom
## Residual deviance:  7749.2  on 8676  degrees of freedom
## AIC: 7783.2
##
## Number of Fisher Scoring iterations: 7
```

```
p = predict(logit, type = "response")
roc_logit = roc(train_f$NewTransported ~ p)
```

```
## Setting levels: control = 0, case = 1
```

```
## Setting direction: controls < cases
```

```
auc(roc_logit)
```

```
## Area under the curve: 0.8717
```

Processing Test Data

```
imp_age = lm(Age~ShoppingMall+VRDeck+FoodCourt+Spa+RoomService+HomePlanet+
               CryoSleep+Destination+VIP, data=test)
summary(imp_age)
```

```
##
## Call:
## lm(formula = Age ~ ShoppingMall + VRDeck + FoodCourt + Spa +
##     RoomService + HomePlanet + CryoSleep + Destination + VIP,
##     data = test)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -34.149  -8.485  -2.706   8.140  52.561
##
## Coefficients:
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)                3.077e+01  3.067e+00  10.034  < 2e-16 ***
## ShoppingMall               5.619e-04  4.192e-04   1.340  0.18017
## VRDeck                     2.968e-04  2.064e-04   1.438  0.15056
## FoodCourt                  9.706e-05  1.687e-04   0.575  0.56506
## Spa                        5.159e-04  2.169e-04   2.379  0.01741 *
## RoomService                1.114e-03  4.107e-04   2.714  0.00669 **
## HomePlanetEarth           -2.772e+00  1.653e+00  -1.677  0.09359 .
## HomePlanetEuropa           5.410e+00  1.703e+00   3.177  0.00150 **
## HomePlanetMars             8.199e-01  1.700e+00   0.482  0.62958
## CryoSleepFalse            -1.677e+00  1.519e+00  -1.104  0.26953
## CryoSleepTrue             -3.120e+00  1.549e+00  -2.014  0.04408 *
## Destination55 Cancri e     1.330e-01  1.674e+00   0.079  0.93668
## DestinationPSO J318.5-22   2.594e+00  1.764e+00   1.470  0.14163
## DestinationTRAPPIST-1e     1.632e+00  1.606e+00   1.016  0.30949
## VIPFalse                  -1.988e+00  1.534e+00  -1.296  0.19507
## VIPTrue                   -1.983e+00  2.290e+00  -0.866  0.38646
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 13.71 on 3724 degrees of freedom
##   (537 observations deleted due to missingness)
## Multiple R-squared:  0.06931,    Adjusted R-squared:  0.06556
## F-statistic: 18.49 on 15 and 3724 DF,  p-value: < 2.2e-16
```

```
test2 = test %>% mutate(Age_pred = predict(imp_age,newdata=test))
```

```
test2=test2 %>%mutate(NewAge = case_when(is.na(Age) ~ round(Age_pred, digits = 0),
                                         TRUE ~ Age))
```

```
test2 = test2 %>% mutate(NewAge_Final = case_when(is.na(NewAge) ~
                                                    round(mean(NewAge, na.rm=T), digits=0)
                                                  , TRUE ~ NewAge))
```

```r
imp_spa = lm(Spa~ShoppingMall+VRDeck+FoodCourt+Age+RoomService+HomePlanet+
               CryoSleep+Destination+VIP, data=test)
summary(imp_spa)
```

```
##
## Call:
## lm(formula = Spa ~ ShoppingMall + VRDeck + FoodCourt + Age +
##     RoomService + HomePlanet + CryoSleep + Destination + VIP,
##     data = test)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3324.3  -354.4  -193.1   198.8 18777.7
##
## Coefficients:
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)                4.367e+02  2.346e+02   1.862 0.062740 .
## ShoppingMall              -8.434e-02  3.163e-02  -2.666 0.007701 **
## VRDeck                     4.297e-03  1.559e-02   0.276 0.782891
## FoodCourt                  8.302e-02  1.266e-02   6.555 6.32e-11 ***
## Age                        2.941e+00  1.236e+00   2.379 0.017412 *
## RoomService               -9.795e-02  3.100e-02  -3.160 0.001591 **
## HomePlanetEarth           -1.429e+02  1.248e+02  -1.144 0.252492
## HomePlanetEuropa           4.701e+02  1.285e+02   3.658 0.000258 ***
## HomePlanetMars            -8.275e+01  1.283e+02  -0.645 0.519116
## CryoSleepFalse             6.729e+01  1.147e+02   0.587 0.557445
## CryoSleepTrue             -4.708e+02  1.168e+02  -4.032 5.64e-05 ***
## Destination55 Cancri e     1.430e+02  1.264e+02   1.132 0.257762
## DestinationPSO J318.5-22   9.964e+01  1.333e+02   0.748 0.454669
## DestinationTRAPPIST-1e     1.327e+01  1.213e+02   0.109 0.912884
## VIPFalse                  -1.655e+02  1.158e+02  -1.429 0.153105
## VIPTrue                    4.691e+02  1.727e+02   2.716 0.006644 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1035 on 3724 degrees of freedom
##   (537 observations deleted due to missingness)
## Multiple R-squared:  0.1573, Adjusted R-squared:  0.1539
## F-statistic: 46.33 on 15 and 3724 DF,  p-value: < 2.2e-16
```

```r
test2 = test2 %>% mutate(Spa_pred = predict(imp_spa,newdata=test2))
```

```r
test2=test2 %>%mutate(NewSpa = case_when(is.na(Spa) ~ round(Spa_pred, digits = 0),
                                         TRUE ~ Spa))
```

```r
test2 = test2 %>% mutate(NewSpa_Final = case_when(is.na(NewSpa) ~
                                                    round(mean(NewSpa, na.rm=T), digits=0)
                                                  , TRUE ~ NewSpa))
```

```r
imp_foodcourt = lm(FoodCourt~ShoppingMall+VRDeck+Age+Spa+RoomService+HomePlanet+
                     CryoSleep+Destination+VIP, data=test)
summary(imp_foodcourt)
```

```
##
## Call:
## lm(formula = FoodCourt ~ ShoppingMall + VRDeck + Age + Spa +
##     RoomService + HomePlanet + CryoSleep + Destination + VIP,
##     data = test)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4114.4  -478.7  -214.9   342.2 23454.9
##
## Coefficients:
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)                 48.26029  301.92365   0.160  0.87301
## ShoppingMall                -0.03255    0.04073  -0.799  0.42428
## VRDeck                       0.15536    0.01990   7.808 7.49e-15 ***
## Age                          0.91594    1.59183   0.575  0.56506
## Spa                          0.13741    0.02096   6.555 6.32e-11 ***
## RoomService                 -0.17386    0.03983  -4.365 1.31e-05 ***
## HomePlanetEarth           -225.11735  160.60373  -1.402  0.16109
## HomePlanetEuropa           914.51576  164.98951   5.543 3.18e-08 ***
## HomePlanetMars            -176.59456  165.09911  -1.070  0.28486
## CryoSleepFalse             441.62517  147.38827   2.996  0.00275 **
## CryoSleepTrue             -297.24193  150.47580  -1.975  0.04830 *
## Destination55 Cancri e     109.88104  162.60075   0.676  0.49923
## DestinationPSO J318.5-22   215.93313  171.40673   1.260  0.20783
## DestinationTRAPPIST-1e      77.65553  156.03898   0.498  0.61875
## VIPFalse                   -13.46613  149.06071  -0.090  0.92802
## VIPTrue                    525.76236  222.27676   2.365  0.01806 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1332 on 3724 degrees of freedom
##   (537 observations deleted due to missingness)
## Multiple R-squared:  0.233,  Adjusted R-squared:  0.2299
## F-statistic: 75.43 on 15 and 3724 DF,  p-value: < 2.2e-16
```

```
test2 = test2 %>% mutate(foodcourt_pred = predict(imp_foodcourt,newdata=test2))
```

```
test2=test2 %>%mutate(NewFoodCourt = case_when(is.na(FoodCourt) ~
                                                 round(foodcourt_pred, digits = 0),
                                               TRUE ~ FoodCourt))
```

```
test2 = test2 %>% mutate(NewFoodCourt_final = case_when(is.na(NewFoodCourt) ~
                                                          round(mean(NewFoodCourt, na.rm=T)
                                                                , digits=0)
                                                        , TRUE ~ NewFoodCourt))
```

```
imp_VR = lm(VRDeck~ShoppingMall+Spa+FoodCourt+Age+RoomService+HomePlanet+
              CryoSleep+Destination+VIP, data=test)
summary(imp_VR)
```

```
##
```

```
## Call:
## lm(formula = VRDeck ~ ShoppingMall + Spa + FoodCourt + Age +
##     RoomService + HomePlanet + CryoSleep + Destination + VIP,
##     data = test)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2328.2  -369.5  -185.4   204.8 17023.2
##
## Coefficients:
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)                6.189e+02  2.464e+02   2.512  0.01206 *
## ShoppingMall              -1.255e-02  3.327e-02  -0.377  0.70601
## Spa                        4.746e-03  1.722e-02   0.276  0.78289
## FoodCourt                  1.037e-01  1.328e-02   7.808 7.49e-15 ***
## Age                        1.869e+00  1.300e+00   1.438  0.15056
## RoomService               -1.318e-01  3.255e-02  -4.050 5.22e-05 ***
## HomePlanetEarth           -3.844e+02  1.311e+02  -2.933  0.00338 **
## HomePlanetEuropa           2.763e+02  1.353e+02   2.043  0.04112 *
## HomePlanetMars            -3.707e+02  1.348e+02  -2.751  0.00597 **
## CryoSleepFalse             2.151e+02  1.205e+02   1.785  0.07429 .
## CryoSleepTrue             -2.960e+02  1.229e+02  -2.408  0.01608 *
## Destination55 Cancri e    -6.741e+01  1.328e+02  -0.508  0.61182
## DestinationPSO J318.5-22   5.416e+01  1.400e+02   0.387  0.69900
## DestinationTRAPPIST-1e    -4.808e+01  1.275e+02  -0.377  0.70605
## VIPFalse                  -1.644e+02  1.217e+02  -1.351  0.17690
## VIPTrue                    2.426e+02  1.817e+02   1.335  0.18180
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1088 on 3724 degrees of freedom
##   (537 observations deleted due to missingness)
## Multiple R-squared:  0.1513, Adjusted R-squared:  0.1478
## F-statistic: 44.25 on 15 and 3724 DF,  p-value: < 2.2e-16
```

```
test2 = test2 %>% mutate(vr_pred = predict(imp_VR,newdata=test2))
```

```
test2=test2 %>%mutate(NewVR = case_when(is.na(VRDeck) ~
                                          round(vr_pred, digits = 0),
                                        TRUE ~ VRDeck))
```

```
test2 = test2 %>% mutate(VRDeck_final = case_when(is.na(NewVR) ~
                                                    round(mean(NewVR, na.rm=T)
                                                          , digits=0)
                                                  , TRUE ~ NewVR))
```

```
imp_RS = lm(RoomService~ShoppingMall+VRDeck+FoodCourt+Age+Spa+HomePlanet+
              CryoSleep+Destination+VIP, data=test)
summary(imp_RS)
```

```
##
## Call:
```

```
## lm(formula = RoomService ~ ShoppingMall + VRDeck + FoodCourt +
##     Age + Spa + HomePlanet + CryoSleep + Destination + VIP, data = test)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
##  -808.4  -272.3  -123.2   124.2 11339.8
##
## Coefficients:
##                              Estimate Std. Error t value Pr(>|t|)
## (Intercept)                 9.999e+01  1.239e+02   0.807 0.419636
## ShoppingMall               -6.374e-02  1.668e-02  -3.821 0.000135 ***
## VRDeck                     -3.327e-02  8.213e-03  -4.050 5.22e-05 ***
## FoodCourt                  -2.927e-02  6.707e-03  -4.365 1.31e-05 ***
## Age                         1.771e+00  6.526e-01   2.714 0.006685 **
## Spa                        -2.730e-02  8.639e-03  -3.160 0.001591 **
## HomePlanetEarth            -1.159e+02  6.589e+01  -1.759 0.078656 .
## HomePlanetEuropa           -2.932e+01  6.798e+01  -0.431 0.666268
## HomePlanetMars              3.198e+02  6.755e+01   4.734 2.28e-06 ***
## CryoSleepFalse              1.055e+02  6.053e+01   1.743 0.081433 .
## CryoSleepTrue              -3.227e+02  6.155e+01  -5.243 1.66e-07 ***
## Destination55 Cancri e      9.354e+01  6.671e+01   1.402 0.160913
## DestinationPSO J318.5-22    9.156e+01  7.033e+01   1.302 0.193088
## DestinationTRAPPIST-1e      5.029e+01  6.403e+01   0.785 0.432222
## VIPFalse                    9.601e+01  6.114e+01   1.570 0.116466
## VIPTrue                     2.351e+02  9.120e+01   2.578 0.009971 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 546.4 on 3724 degrees of freedom
##   (537 observations deleted due to missingness)
## Multiple R-squared:  0.1749, Adjusted R-squared:  0.1716
## F-statistic: 52.63 on 15 and 3724 DF,  p-value: < 2.2e-16
```

```
test2 = test2 %>% mutate(rs_pred = predict(imp_RS,newdata=test2))
```

```
test2=test2 %>%mutate(Newrs = case_when(is.na(RoomService) ~
                                          round(rs_pred, digits = 0),
                                        TRUE ~ RoomService))
```

```
test2 = test2 %>% mutate(RoomService_final = case_when(is.na(Newrs) ~
                                                         round(mean(Newrs, na.rm=T)
                                                               , digits=0)
                                                       , TRUE ~ Newrs))
```

```
imp_sm = lm(ShoppingMall~RoomService+VRDeck+FoodCourt+Age+Spa+HomePlanet+
              CryoSleep+Destination+VIP, data=test)
summary(imp_sm)
```

```
##
## Call:
## lm(formula = ShoppingMall ~ RoomService + VRDeck + FoodCourt +
##     Age + Spa + HomePlanet + CryoSleep + Destination + VIP, data = test)
```

```
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -516.9 -226.2 -149.2   70.1 7997.8
##
## Coefficients:
##                              Estimate Std. Error t value Pr(>|t|)
## (Intercept)                 2.935e+02  1.214e+02   2.418 0.015647 *
## RoomService                -6.127e-02  1.603e-02  -3.821 0.000135 ***
## VRDeck                     -3.044e-03  8.070e-03  -0.377 0.706007
## FoodCourt                  -5.267e-03  6.592e-03  -0.799 0.424277
## Age                         8.582e-01  6.402e-01   1.340 0.180172
## Spa                        -2.259e-02  8.473e-03  -2.666 0.007701 **
## HomePlanetEarth            -1.893e+02  6.455e+01  -2.932 0.003388 **
## HomePlanetEuropa           -1.281e+02  6.661e+01  -1.923 0.054528 .
## HomePlanetMars              6.902e+01  6.642e+01   1.039 0.298814
## CryoSleepFalse              1.245e+02  5.933e+01   2.099 0.035928 *
## CryoSleepTrue              -2.078e+02  6.047e+01  -3.437 0.000594 ***
## Destination55 Cancri e      7.535e+00  6.542e+01   0.115 0.908309
## DestinationPSO J318.5-22    1.541e+01  6.897e+01   0.223 0.823242
## DestinationTRAPPIST-1e     -2.354e+01  6.277e+01  -0.375 0.707648
## VIPFalse                    8.689e+00  5.996e+01   0.145 0.884793
## VIPTrue                     9.259e+01  8.947e+01   1.035 0.300808
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 535.7 on 3724 degrees of freedom
##   (537 observations deleted due to missingness)
## Multiple R-squared:  0.09125,    Adjusted R-squared:  0.08759
## F-statistic: 24.93 on 15 and 3724 DF,  p-value: < 2.2e-16
```

```
test2 = test2 %>% mutate(sm_pred = predict(imp_sm,newdata=test2))
```

```
test2=test2 %>%mutate(Newsm = case_when(is.na(ShoppingMall) ~
                                          round(sm_pred, digits = 0),
                                        TRUE ~ ShoppingMall))
```

```
test2 = test2 %>% mutate(ShoppingMall_final = case_when(is.na(Newsm) ~
                                                          round(mean(Newsm, na.rm=T)
                                                                , digits=0)
                                                        , TRUE ~ Newsm))
```

```
test_f = subset(test2, select = -c(Age,RoomService,FoodCourt,
                                   ShoppingMall,Spa,VRDeck,
                                   Age_pred,NewAge,Spa_pred,NewSpa,
                                   foodcourt_pred,NewFoodCourt,
                                   vr_pred,NewVR,rs_pred,Newrs,
                                   sm_pred,Newsm))
```

Predicting Test Data

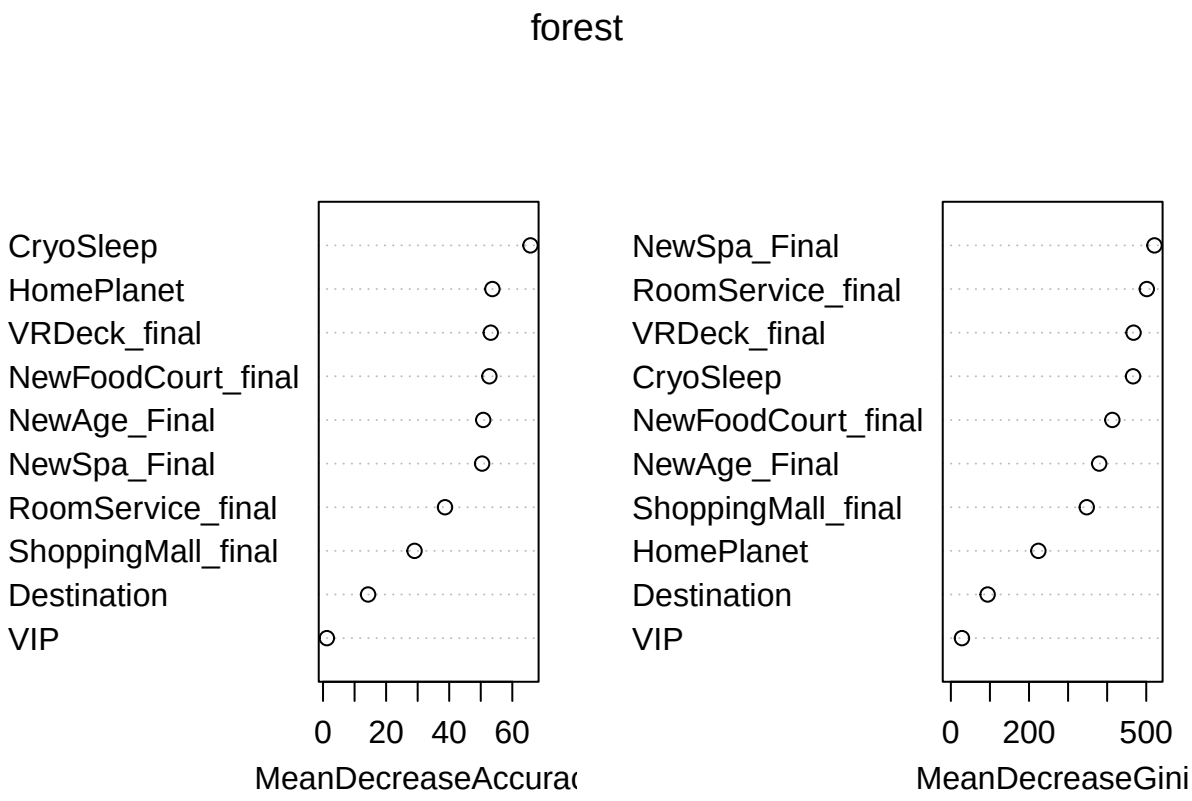
```
test_f = test_f %>% mutate(prediction =
                                predict(logit, type = "response", newdata = test_f)) %>%
  mutate(Transported = case_when(prediction>0.5~"True",
                                 TRUE ~"False") )
```

```
submission = test_f %>% select(PassengerId, Transported)
```

```
#write.csv(submission, file="submission.csv", row.names=FALSE)
```

Test using Random Forest Model

```
forest = randomForest(as.factor(NewTransported) ~ HomePlanet+CryoSleep+Destination+VIP+
              NewAge_Final+NewSpa_Final+NewFoodCourt_final+VRDeck_final+
              RoomService_final+ShoppingMall_final, ntree=500, importance=TRUE,
            data = train_f)
varImpPlot(forest)
```




```
test_f2 = test_f %>% mutate(prediction_forest = predict(forest, newdata = test_f))
```

```
test_f2 = test_f2 %>% mutate(Transported = ifelse(prediction_forest == 1,
                                                  "True", "False"))
```

```
submission_forest = test_f2 %>% select(PassengerId, Transported)
```

```
#write.csv(submission_forest, file = "submission2.csv", row.names = FALSE)
```

Our Random Forest Model had ~0.3% higher accuracy than our logistic regression model.