Random Forest Modeling

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INSTALL AND LOAD PACKAGES

```
# Install pacman ("package manager") if needed
if (!require("pacman")) install.packages("pacman")
```

```
# pacman must already be installed; then load contributed
# packages (including pacman) with pacman
pacman::p_load(caret, magrittr, pacman, parallel,
  randomForest, rio, tidyverse)
# caret: for decision trees
# magrittr: for pipes
# pacman: for loading/unloading packages
# parallel: for parallel processing
# randomForest: for random forests (obviously)
# rio: for importing data
# tidyverse: for so many reasons
```

LOAD AND PREPARE DATA

```
# Set random seed
set.seed(313)
# Import data, select random sample
df <- import("../data/b5_df.rds") %>%
  select(gender, Extrav:Open) %>%
  sample_n(500) %>%                # Sample 500 cases
  print()
```

```
## # A tibble: 500 x 6
##    gender Extrav Neurot Agree Consc  Open
##    <fct>   <dbl>  <dbl> <dbl> <dbl> <dbl>
##  1 Female    3.7    2.8   4     3.4   3.5
##  2 Female    2.6    4     3.6   4.7   4.1
##  3 Male      3.6    2.3   4.4   3     3.6
##  4 Female    4      3.6   4.1   2.9   3.5
##  5 Male      2.8    2.6   3.6   3.5   4.4
##  6 Male      2.3    3.3   3.3   3.4   3
##  7 Female    2.1    4.2   4.1   4.2   2.9
##  8 Female    3.5    2.4   4.5   4     3.5
```

```
##  9 Female    3.3    3.3   3.8   4.4   4.3
## 10 Female    2.5    4     4.3   4.1   4.6
## # ... with 490 more rows
```

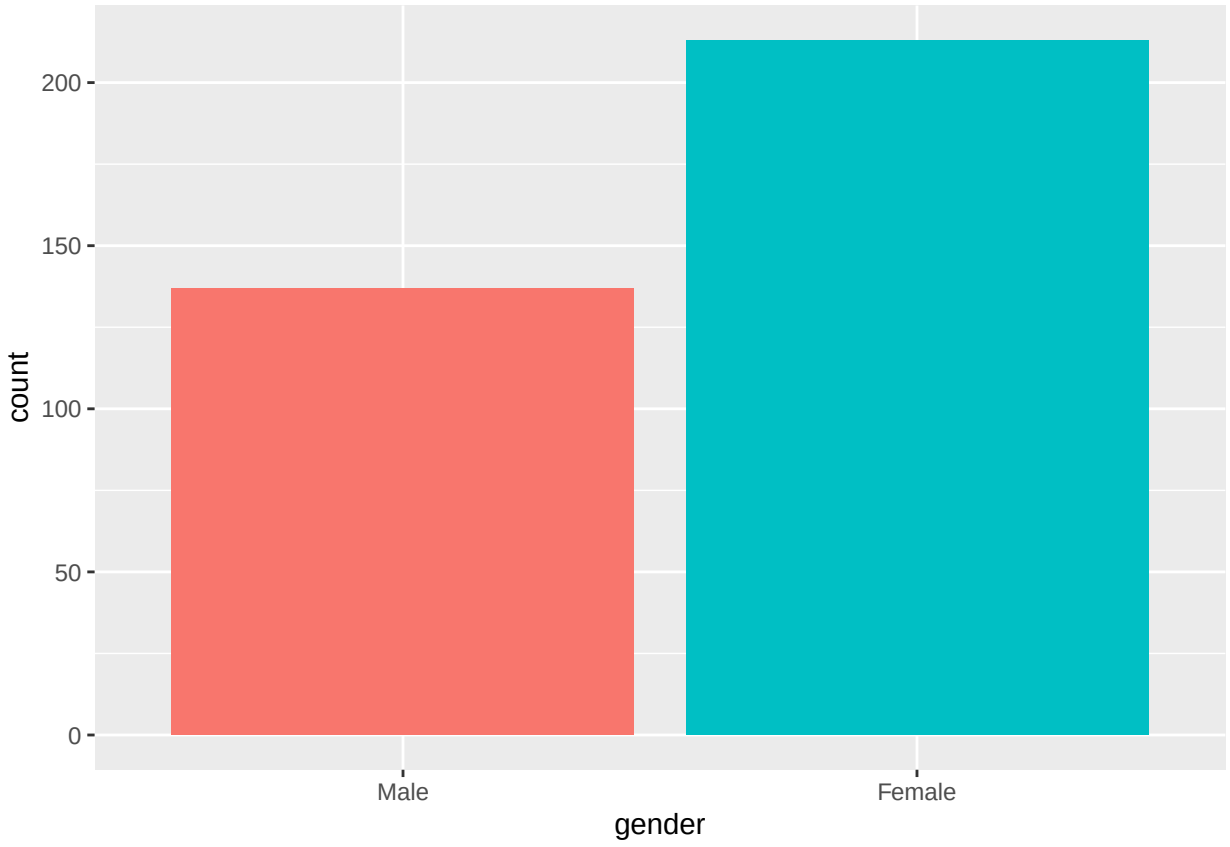
SPLIT DATA

```
# Split data into train and test sets
train <- df %>% sample_frac(.70)
test <- df %>% anti_join(train)
```

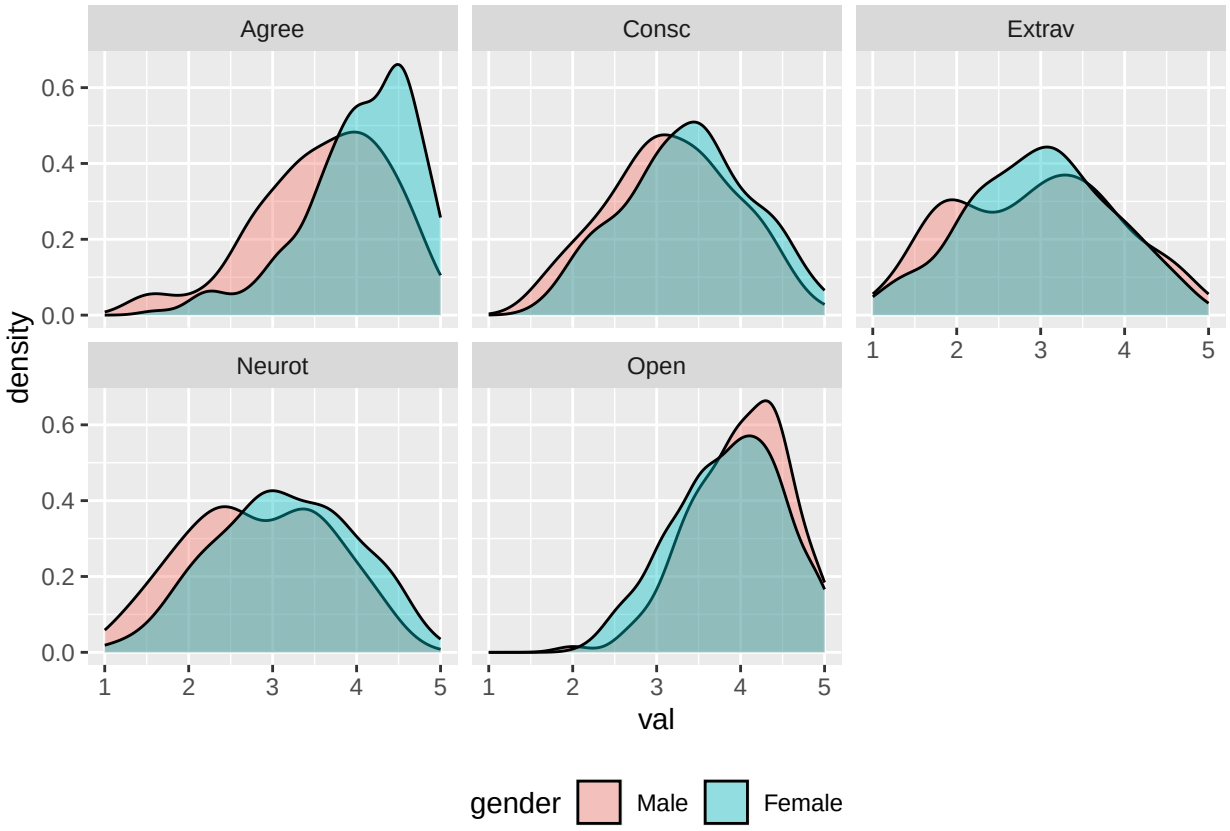
```
## Joining with `by = join_by(gender, Extrav, Neurot, Agree, Consc, Open)`
```

EXPLORE TRAINING DATA

```
# Bar chart of "gender"
train %>%
  ggplot() +
  geom_bar(aes(x = gender, fill = gender)) +
  theme(legend.position = "none")
```



```r
# Density plots of Big 5 variables
train %>%
  gather(var, val, Extrav:Open) %>%
  ggplot(aes(val, group = gender, fill = gender)) +
  geom_density(alpha = 0.4) +
  facet_wrap(~var) +
  theme(legend.position = 'bottom')
```



MODEL TRAINING DATA

```r
# Define parameters for the train function
control <- trainControl(
  method  = "repeatedcv",  # Repeated cross-validation
  number  = 10,            # Number of folds
  repeats = 3,             # Number of sets of folds
  search  = "random",      # Max number of tuning parameters
  allowParallel = TRUE     # Allow parallel processing
)
```

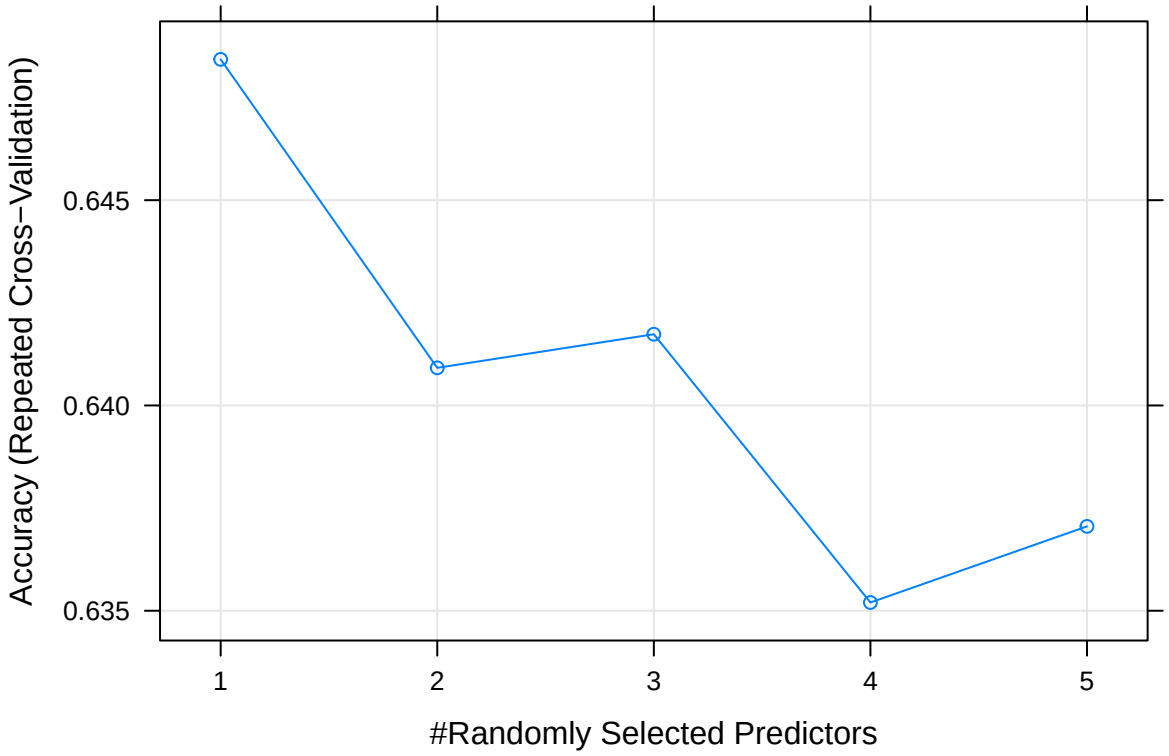
```r
# Train decision tree on training data (can take a while)
rf <- train(
  gender ~ . ,          # Predict gender from all other vars
```

```
  data = train,          # Use training data
  method = "rf",         # Use random forests
  metric = "Accuracy",   # Use accuracy as criterion
  tuneLength = 15,       # Number of levels for parameters
  ntree = 800,           # Number of trees
  trControl = control    # Link to parameters
)
```

```
# Show processing summary
rf
```

```
## Random Forest
##
## 350 samples
##   5 predictor
##   2 classes: 'Male', 'Female'
##
## No pre-processing
## Resampling: Cross-Validated (10 fold, repeated 3 times)
## Summary of sample sizes: 315, 314, 315, 316, 315, 315, ...
## Resampling results across tuning parameters:
##
##   mtry  Accuracy   Kappa
##   1     0.6484298  0.2205045
##   2     0.6409166  0.2155382
##   3     0.6417351  0.2279157
##   4     0.6352007  0.2147962
##   5     0.6370542  0.2192244
##
## Accuracy was used to select the optimal model using the largest value.
## The final value used for the model was mtry = 1.
```

```
# Plot accuracy by number of predictors
rf %>% plot()
```

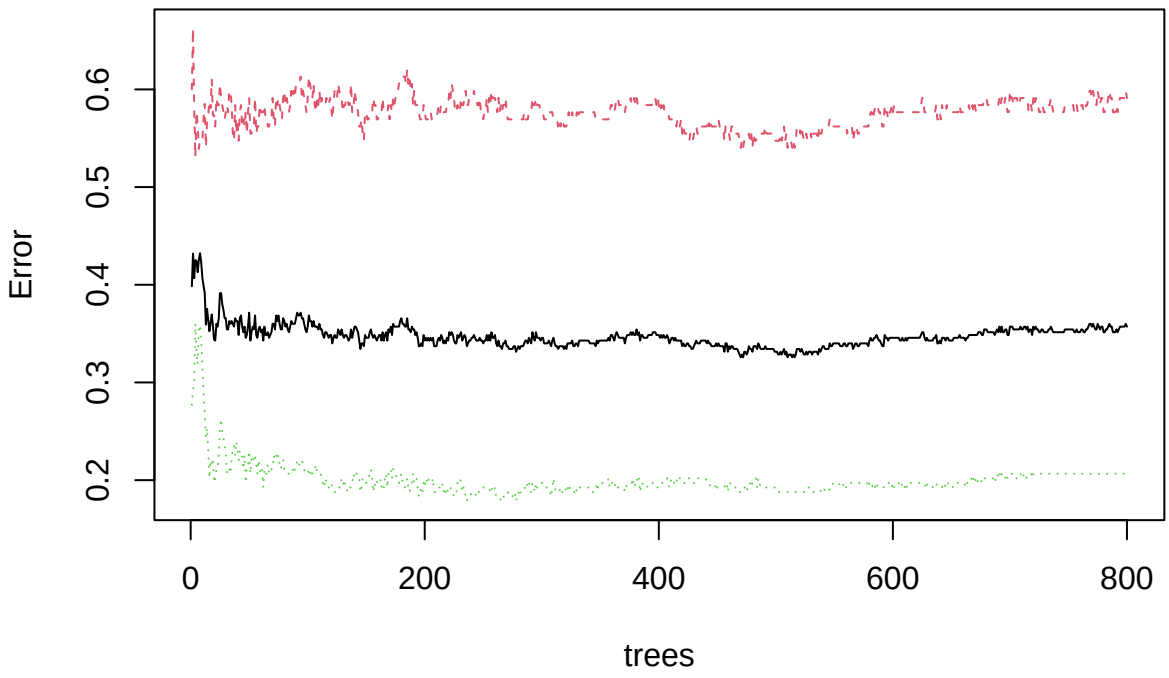



```
# Accuracy of model with training data
rf$finalModel
```

```
##
## Call:
##  randomForest(x = x, y = y, ntree = 800, mtry = param$mtry)
##                Type of random forest: classification
##                      Number of trees: 800
## No. of variables tried at each split: 1
##
##         OOB estimate of  error rate: 35.71%
## Confusion matrix:
##        Male Female class.error
## Male     56     81   0.5912409
## Female   44    169   0.2065728
```

```
# Plot error by number of trees; Red is error for "Male,"
# green is error for "Female," and black is error or "OOB,"
# or "out of bag" (i.e., the probability that any given
# prediction is not correct within the test data, or the
# overall accuracy)
rf$finalModel %>% plot()
```

.



APPLY MODEL TO TEST DATA

```
# Predict test set
gender_p <- rf %>%          # "predicted"
  predict(newdata = test)   # Use test data
```

```
# Accuracy of model on test data
table(
  actualclass = test$gender,
  predictedclass = gender_p
) %>%
confusionMatrix() %>%
print()
```

```
## Confusion Matrix and Statistics
##
##             predictedclass
## actualclass Male Female
##      Male     22     33
##      Female   24     71
##
##                Accuracy : 0.62
```

```
##                  95% CI : (0.5372, 0.6979)
##     No Information Rate : 0.6933
##     P-Value [Acc > NIR] : 0.9776
##
##                   Kappa : 0.1526
##
##  Mcnemar's Test P-Value : 0.2893
##
##             Sensitivity : 0.4783
##             Specificity : 0.6827
##          Pos Pred Value : 0.4000
##          Neg Pred Value : 0.7474
##              Prevalence : 0.3067
##          Detection Rate : 0.1467
##    Detection Prevalence : 0.3667
##       Balanced Accuracy : 0.5805
##
##        'Positive' Class : Male
##
```

The End!