Final Project

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(We don't have to polish this RMD in terms of labels or descriptions. Final presentation will be in powerpoint. We'll still submit this as the source code though so we should still be commenting what we're doing with code) Jon

Load Data

```r
# Read csv
gold <- read.csv("gold.csv", sep = ",", header = TRUE)

# Omit all rows that have NA vals
gold <- na.omit(gold)

# Add Binary Classifier Variable
gold$Binary.PercChange <- ifelse(gold$PercChangeForc > 0.1, 1, 0)

# Hurdle rate for Binary CLassifier is set at 0.1%, so that edge cases that are
# very close to 0% (0%:0.0999%) are classified as non-investment opportunities
```

Variable Selection

```r
# Run Boruta  algorithm on clean data
library(Boruta)
library(randomForest)
```

```
## randomForest 4.7-1.1
```

```
## Type rfNews() to see new features/changes/bug fixes.
```

```r
boruta.gold <- Boruta(PercChangeForc~.-Date -Average.Price -Oil -PPIJewelry -Binary.PercChange, data = g
                      randomForest = TRUE)
```

```
##  1. run of importance source...
```

```
## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest
```

```
##  2. run of importance source...
```

```
## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest
```

```
##  3. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  4. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  5. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  6. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  7. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  8. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  9. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  10. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  11. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  12. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest
```

```
## After 12 iterations, +9 secs:

##  confirmed 2 attributes: FedFundsRate, PercChangeLag1;

##  rejected 7 attributes: Inf.L2, Inf.L3, Inf.L4, Inf.Rate.MoM, Nasdaq.Change.MoM and 2 more;

##  still have 13 attributes left.

##  13. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  14. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  15. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  16. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

## After 16 iterations, +11 secs:

##  rejected 3 attributes: Inf.L1, PercChangeLag3, PercChangeLag5;

##  still have 10 attributes left.

##  17. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  18. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  19. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest
```

```
## After 19 iterations, +12 secs:

##  rejected 1 attribute: UM.Con.Sent;

##  still have 9 attributes left.

##  20. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  21. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  22. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

## After 22 iterations, +14 secs:

##  confirmed 1 attribute: Indus.Prod.Ind;

##  still have 8 attributes left.

##  23. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  24. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  25. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  26. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

## After 26 iterations, +15 secs:
```

```
##  confirmed 1 attribute: FedFundsRateL1;

##  still have 7 attributes left.

##  27. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  28. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  29. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

## After 29 iterations, +16 secs:

##  confirmed 2 attributes: X2MA, X3MA;

##  still have 5 attributes left.

##  30. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  31. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

## After 31 iterations, +17 secs:

##  confirmed 1 attribute: PercChangeLag2;

##  still have 4 attributes left.

##  32. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  33. run of importance source...
```

```
## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  34. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  35. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  36. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  37. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  38. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  39. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  40. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  41. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  42. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  43. run of importance source...
```

```
## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  44. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  45. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


## After 45 iterations, +23 secs:


##  confirmed 1 attribute: NFCI;


##  still have 3 attributes left.


##  46. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  47. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  48. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  49. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  50. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  51. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest
```

```
##  52. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  53. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  54. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  55. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  56. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  57. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  58. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  59. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  60. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  61. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest
```

```
##  62. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  63. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  64. run of importance source...

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## "shadow.Boruta.decision", : Unused arguments: randomForest


##  65. run of importance source...

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##  66. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
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##  67. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
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##  68. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  69. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

## After 69 iterations, +34 secs:

##  confirmed 1 attribute: UM.Infl.Exp;

##  still have 2 attributes left.

##  70. run of importance source...
```

```
## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  71. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  72. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  73. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  74. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  75. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  76. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  77. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  78. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  79. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  80. run of importance source...
```

```
## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  81. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


## After 81 iterations, +38 secs:


##  confirmed 1 attribute: PercChange.PPI;


##  still have 1 attribute left.


##  82. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  83. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  84. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  85. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest


##  86. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
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##  87. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
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##  88. run of importance source...


## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest
```

```
##  89. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  90. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  91. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
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##  92. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
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##  93. run of importance source...

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##  94. run of importance source...

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##  95. run of importance source...

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##  96. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  97. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  98. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest

##  99. run of importance source...

## Warning in ranger::ranger(data = x, dependent.variable.name =
## "shadow.Boruta.decision", : Unused arguments: randomForest
```
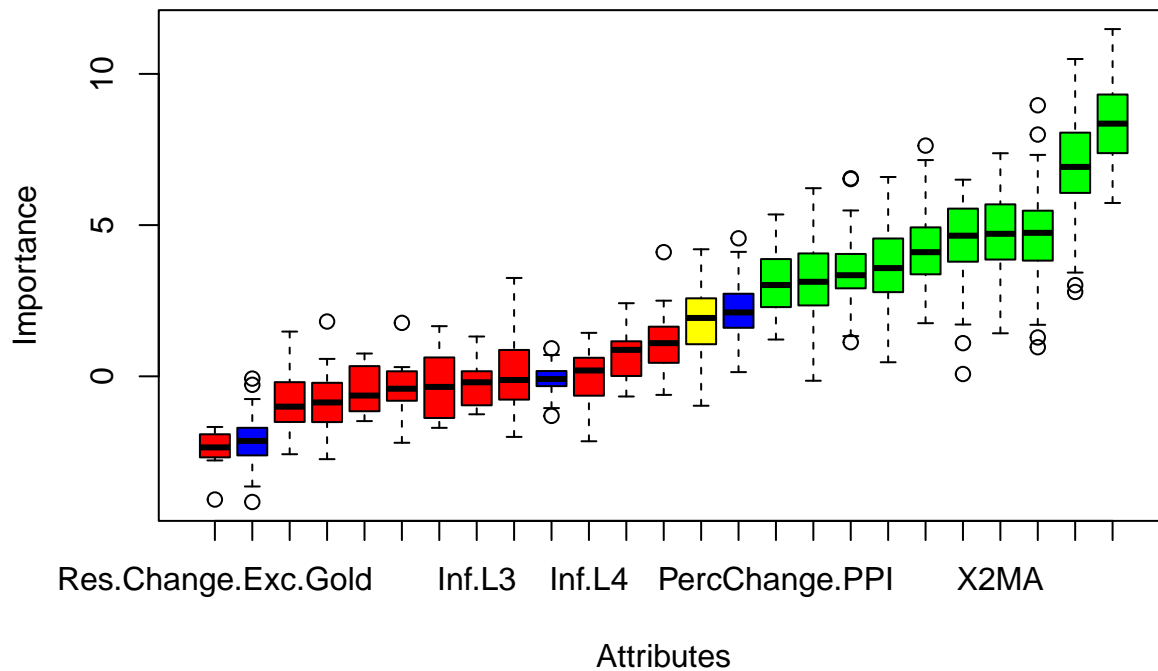
```
plot(boruta.gold)
```


Create Cross Validation Folds (Regression)

```
library(caret)
```

```
## Loading required package: ggplot2
```

```
##
## Attaching package: 'ggplot2'
```

```
## The following object is masked from 'package:randomForest':
##
##     margin
```

```
## Loading required package: lattice
```

```
set.seed(123)
folds <- createFolds(gold$PercChangeForc, k = 5, returnTrain = TRUE)
```

Regression

OLS

Random Forest + Bagging

Boosting

Neural Network

Classification

Support Vector Machine

Neural Network