INTA 4803 Homework 2

Madi Wickett

```r
library(caret)
```

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

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

```r
library(ROCR)
library(doMC)
```

```
## Loading required package: foreach
```

```
## Loading required package: iterators
```

```
## Loading required package: parallel
```

```r
library(tidyverse)
```

```
## ── Attaching packages ────────────────────────────────────────────────────────────
─────────────────────────── tidyverse 1.3.0 ──
```

```
## ✓ tibble  3.0.3     ✓ dplyr   1.0.2
## ✓ tidyr   1.1.2     ✓ stringr 1.4.0
## ✓ readr   1.3.1     ✓ forcats 0.5.0
## ✓ purrr   0.3.4
```

```
## ── Conflicts ─────────────────────────────────────────────────────────────────────
───────────────────── tidyverse_conflicts() ──
## x purrr::accumulate() masks foreach::accumulate()
## x dplyr::filter()     masks stats::filter()
## x dplyr::lag()        masks stats::lag()
## x purrr::lift()       masks caret::lift()
## x purrr::when()       masks foreach::when()
```

```r
library(corrr)
library(e1071)
```

```
training<-subset(fl_dataset, year <= 1980)
testing<-subset(fl_dataset, year > 1980)

training<-na.omit(training)
testing<-na.omit(testing)
```

```
training$warstds<-factor(
  training$warstds,
  level = c(0, 1),
  labels = c("None", "CivilWar")
)

testing$warstds<-factor(
  testing$warstds,
  level = c(0, 1),
  labels = c("None", "CivilWar")
)
```

Question I

Fearon & Laitin (2003) Replication

```
fitControl<-trainControl(method = "cv",
                         number = 10,
                         summaryFunction = twoClassSummary,
                         classProbs = TRUE,
                         savePredictions = TRUE)
```

```
mod.logit<-train(as.factor(warstds) ~ ln_gdpen+lpopns+lmtnest+ncontig+oil+nwstate+ins
t3+pol4+ef+relfrac,
                 method = "glm",
                 trControl=fitControl,
                 family = "binomial",
                 metric = "ROC",
                 data = training[c(-1, -2)])
mod.logit
```

```
## Generalized Linear Model
##
## 3940 samples
##   10 predictor
##    2 classes: 'None', 'CivilWar'
##
## No pre-processing
## Resampling: Cross-Validated (10 fold)
## Summary of sample sizes: 3546, 3546, 3546, 3546, 3546, 3546, ...
## Resampling results:
##
##   ROC        Sens  Spec
##   0.7418471  1     0
```

As seen below, no onsets were correctly predicted by Fearon and Laitin’s model

```
pred.mod.logit<-predict(mod.logit, newdata = testing, type = "raw")
confusionMatrix(pred.mod.logit, testing$warstds, positive = "CivilWar", mode = "every
thing")
```

```
## Confusion Matrix and Statistics
## 
##           Reference
## Prediction None CivilWar
##   None     3153       47
##   CivilWar    0        0
##                                           
##                Accuracy : 0.9853          
##                  95% CI : (0.9805, 0.9892)
##     No Information Rate : 0.9853          
##     P-Value [Acc > NIR] : 0.5387          
##                                           
##                   Kappa : 0               
##                                           
##  Mcnemar's Test P-Value : 1.949e-11       
##                                           
##             Sensitivity : 0.00000         
##             Specificity : 1.00000         
##          Pos Pred Value :     NaN         
##          Neg Pred Value : 0.98531         
##               Precision :      NA         
##                  Recall : 0.00000         
##                      F1 :      NA         
##              Prevalence : 0.01469         
##          Detection Rate : 0.00000         
##    Detection Prevalence : 0.00000         
##       Balanced Accuracy : 0.50000         
##                                           
##        'Positive' Class : CivilWar        
## 
```

Elastic Net Model w/ F&L Features

An elastic net model using the same features as Fearon & Laitin’s study produces 0 correct onsets.

```
set.seed(38745)
mod.enet<-train(as.factor(warstds) ~ warhist+ln_gdpen+lpopns+lmtnest+ncontig+oil+nwst
ate+inst3+pol4+ef+relfrac,
                 method = "glmnet",
                 trControl=fitControl,
                 metric = "ROC",
                 data = training[c(-1, -2)])
mod.enet
```

```
## glmnet
##
## 3940 samples
##   11 predictor
##    2 classes: 'None', 'CivilWar'
##
## No pre-processing
## Resampling: Cross-Validated (10 fold)
## Summary of sample sizes: 3546, 3546, 3546, 3547, 3546, 3546, ...
## Resampling results across tuning parameters:
##
##   alpha  lambda        ROC        Sens  Spec
##   0.10   2.566529e-05  0.7503702  1     0
##   0.10   2.566529e-04  0.7503702  1     0
##   0.10   2.566529e-03  0.7520253  1     0
##   0.55   2.566529e-05  0.7500505  1     0
##   0.55   2.566529e-04  0.7498474  1     0
##   0.55   2.566529e-03  0.7494564  1     0
##   1.00   2.566529e-05  0.7498166  1     0
##   1.00   2.566529e-04  0.7503884  1     0
##   1.00   2.566529e-03  0.7461270  1     0
##
## ROC was used to select the optimal model using the largest value.
## The final values used for the model were alpha = 0.1 and lambda = 0.002566529.
```

```
pred.mod.enet<-predict(mod.enet, newdata = testing, type = "raw")
confusionMatrix(pred.mod.enet, testing$warstds, positive = "CivilWar", mode = "everyt
hing")
```

```
## Confusion Matrix and Statistics
## 
##           Reference
## Prediction None CivilWar
##   None     3153       47
##   CivilWar    0        0
##                                           
##                Accuracy : 0.9853          
##                  95% CI : (0.9805, 0.9892)
##     No Information Rate : 0.9853          
##     P-Value [Acc > NIR] : 0.5387          
##                                           
##                   Kappa : 0               
##                                           
##  Mcnemar's Test P-Value : 1.949e-11       
##                                           
##             Sensitivity : 0.00000         
##             Specificity : 1.00000         
##          Pos Pred Value :     NaN         
##          Neg Pred Value : 0.98531         
##               Precision :      NA         
##                  Recall : 0.00000         
##                      F1 :      NA         
##              Prevalence : 0.01469         
##          Detection Rate : 0.00000         
##    Detection Prevalence : 0.00000         
##       Balanced Accuracy : 0.50000         
##                                           
##        'Positive' Class : CivilWar        
## 
```

Non-zero factors for the Fearon and Laitin Model

```
coef_fl<-coef(mod.enet$finalModel, mod.enet$bestTune$lambda)
as.table(as.matrix(coef_fl))
```

```
##                         1
## (Intercept) -8.1649034786
## warhist      0.1005524902
## ln_gdpen    -0.3486909955
## lpopns       0.1930874206
## lmtnest      0.1504734315
## ncontig     -0.0002598242
## oil          0.5434854802
## nwstate      1.5581104051
## inst3        1.2297247497
## pol4        -0.0055687639
## ef           0.1998205562
## relfrac      0.6019453750
```

Elastic Net with All Features

An elastic net model with all features correctly predicts two civil war onsets.

```
set.seed(38745)
mod.enet2<-train(as.factor(warstds) ~.,
                 method = "glmnet",
                 trControl=fitControl,
                 metric = "ROC",
                 data = training[c(-1, -2)])
mod.enet2
```

```
## glmnet
##
## 3940 samples
##   90 predictor
##    2 classes: 'None', 'CivilWar'
##
## No pre-processing
## Resampling: Cross-Validated (10 fold)
## Summary of sample sizes: 3546, 3546, 3546, 3547, 3546, 3546, ...
## Resampling results across tuning parameters:
##
##   alpha  lambda        ROC        Sens       Spec
##   0.10   2.566529e-05  0.8250547  0.9958676  0.10000000
##   0.10   2.566529e-04  0.8333068  0.9968999  0.07142857
##   0.10   2.566529e-03  0.8467432  0.9994832  0.00000000
##   0.55   2.566529e-05  0.8263904  0.9958676  0.10000000
##   0.55   2.566529e-04  0.8370133  0.9974167  0.07142857
##   0.55   2.566529e-03  0.8493812  1.0000000  0.00000000
##   1.00   2.566529e-05  0.8252782  0.9956099  0.10000000
##   1.00   2.566529e-04  0.8379240  0.9976751  0.04285714
##   1.00   2.566529e-03  0.8489355  1.0000000  0.00000000
##
## ROC was used to select the optimal model using the largest value.
## The final values used for the model were alpha = 0.55 and lambda = 0.002566529.
```

```
pred.mod.enet2<-predict(mod.enet2, newdata = testing, type = "raw")
confusionMatrix(pred.mod.enet2, testing$warstds, positive = "CivilWar", mode = "every
thing")
```

```
## Confusion Matrix and Statistics
## 
##           Reference
## Prediction None CivilWar
##   None     3151       45
##   CivilWar    2        2
##                                           
##                Accuracy : 0.9853          
##                  95% CI : (0.9805, 0.9892)
##     No Information Rate : 0.9853          
##     P-Value [Acc > NIR] : 0.5387          
##                                           
##                   Kappa : 0.0763          
##                                           
##  Mcnemar's Test P-Value : 8.993e-10       
##                                           
##             Sensitivity : 0.042553        
##             Specificity : 0.999366        
##          Pos Pred Value : 0.500000        
##          Neg Pred Value : 0.985920        
##               Precision : 0.500000        
##                  Recall : 0.042553        
##                      F1 : 0.078431        
##              Prevalence : 0.014687        
##          Detection Rate : 0.000625        
##    Detection Prevalence : 0.001250        
##       Balanced Accuracy : 0.520959        
##                                           
##        'Positive' Class : CivilWar        
## 
```

Non-zero factors for all possible predictors

```
coef_all<-coef(mod.enet2$finalModel, mod.enet2$bestTune$lambda)
coef_df<-as.data.frame(as.matrix(coef_all))
colnames(coef_df)<-c("value")
coef_nz<-subset(coef_df, value != 0)
as.table(as.matrix(coef_nz))
```

```
##                     value
## (Intercept) -3.8306137491
## autonomy    -0.0083787589
## centpol3     0.0004713508
## decade2     -0.1547610406
## decade3     -0.5202372171
## demch98      0.0943290676
## drel         0.0011014642
## elfo2        0.0001193801
## etdo4590     0.8092082832
## expgdp      -0.0183870369
## fuelexp      0.0015478205
## gdpgrowth   -6.8268654692
## geo2        -0.6034274673
## geo34        0.2678743892
## geo69        0.0086495633
## geo8        -0.1020923393
## illiteracy   0.0155668483
## incumb       0.7098884996
## inst3        0.8924023621
## lmtnest      0.1408117911
## ln_gdpen    -0.0249174356
## lpopns       0.0115565645
## major       -0.1681120932
## manuexp     -0.0044806141
## mirps0       0.7262678635
## mirps1      -0.1383317590
## nat_war      0.3643654586
## nwstate      1.3577796225
## oil          0.1576773182
## p4mchg      -0.0484538026
## parreg      -0.2475663105
## partfree     0.1019828174
## presi       -0.5898436987
## proxregc    -0.3389797382
## ptime       -0.0002428726
## relfrac      0.3314195187
## second      -1.0821828364
## semipol3    -0.6068236909
## sxpnew      -1.5182240200
## sxpsq       -1.8667147378
## trade       -0.0083625661
## xconst      -0.0228946063
```

Explanation of results

The logistic regression model and the elastic net model with just Fearon and Laitin’s variables did not show any predictive power because they were overfit based on incorrect theory. While theory can be helpful for finding which correlations are spurious or which variables are just a translation of another variable, if the theory is incorrect, you may be excluding important predictors.

This is why the elastic net with all possible predictors performed the best out of the three. Without any bias from the researchers or the theory, we can see the influence of all possible variables

Question II

```
set.seed(38745)
train.rf<-train(as.factor(warstds)~.,
                method = "rf",
                trControl = fitControl,
                ntrees = 1000,
                metric = "ROC",
                sampsize=c(140, 50),
                data = training[c(-1, -2)]
                )
train.rf
```

```
## Random Forest
##
## 3940 samples
##   90 predictor
##    2 classes: 'None', 'CivilWar'
##
## No pre-processing
## Resampling: Cross-Validated (10 fold)
## Summary of sample sizes: 3546, 3546, 3546, 3547, 3546, 3546, ...
## Resampling results across tuning parameters:
##
##   mtry  ROC        Sens       Spec
##    2    0.9283000  0.9612496  0.4166667
##   46    0.9402448  0.9511794  0.6523810
##   90    0.9315591  0.9457551  0.6523810
##
## ROC was used to select the optimal model using the largest value.
## The final value used for the model was mtry = 46.
```

```
pred.rf<-predict(train.rf, newdata = testing, type = "raw")
confusionMatrix(pred.rf, testing$warstds, positive = "CivilWar", mode = "everything")
```

```
## Confusion Matrix and Statistics
##
##           Reference
## Prediction None CivilWar
##   None     2968       23
##   CivilWar  185       24
##
##                Accuracy : 0.935
##                  95% CI : (0.9259, 0.9433)
##     No Information Rate : 0.9853
##     P-Value [Acc > NIR] : 1
##
##                   Kappa : 0.1675
##
##  Mcnemar's Test P-Value : <2e-16
##
##             Sensitivity : 0.51064
##             Specificity : 0.94133
##          Pos Pred Value : 0.11483
##          Neg Pred Value : 0.99231
##               Precision : 0.11483
##                  Recall : 0.51064
##                      F1 : 0.18750
##              Prevalence : 0.01469
##          Detection Rate : 0.00750
##    Detection Prevalence : 0.06531
##       Balanced Accuracy : 0.72598
##
##        'Positive' Class : CivilWar
##
```

Random forests correctly predicts 24 civil war onsets. It performs better than the elastic net because random forests randomly selects predictors, meaning that a single strong predictor won't guide the entire model. Additionally, random forests internally cross-validates as it is training, so it's out-of-bag predictions tend to be more accurate.

Question III

Predictive Accuracy

Precision

Elastic Net (F&L variables) - NA Elastic Net (All variables) - 0.500 Random Forests - 0.115

According to the precision measure, the Elastic Net with all variables makes the most accurate predictions. This measure is based on the number of true positives out of the number of predicted positives. The elastic net only predicted a few positives, but half of the ones predicted were true positives so it has relatively good precision. While random forests predicted more true positives, it also predicted many false positives.

Recall

Elastic Net (F&L) - 0.000 Elastic Net (All) - 0.043 Random Forests - 0.511

According to the recall measure, random forests has the most accurate predictions because it predicted over half of the total onsets.. This looks at the number of true positives out of the total positives. The reasoning is flipped from precision. For recall, we care more about the total number of true positives predicted rather than how many false positives were predicted.

F1 Statistic

Elastic Net (F&L) - NA Elastic Net (All) - 0.078 Random Forests - 0.187

According to the F1 statistic, random forests is the most accurate (though objectively not incredibly accurate). This is a combination of the previous two statistics that tries to balance precision and recall.

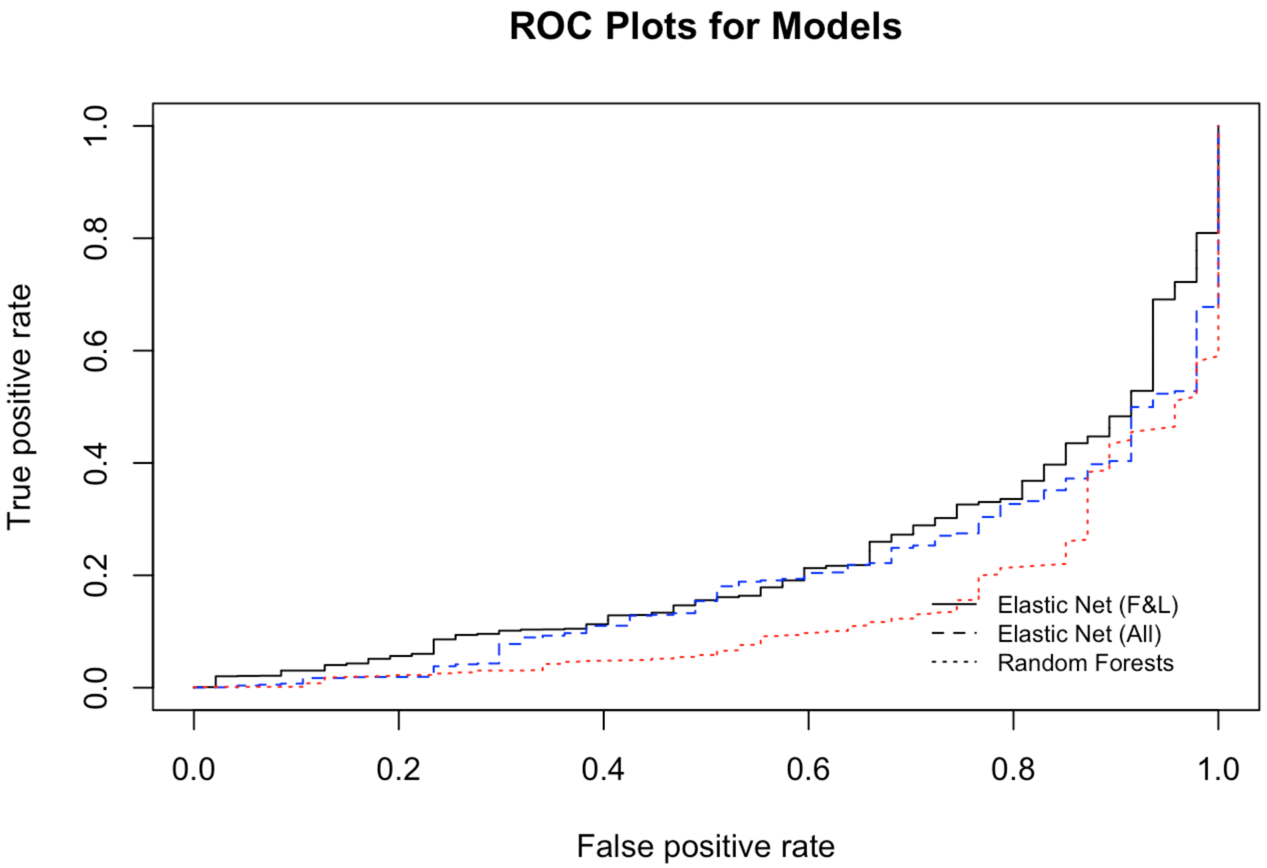
ROC Plots

```
pred.enet<-predict(mod.enet, newdata = testing, type = "prob")
enet.pred<-prediction(pred.enet$CivilWar, testing$warstds)
perf.enet<-performance(enet.pred, "tpr", "fpr")

pred.enet2<-predict(mod.enet2, newdata = testing, type = "prob")
enet2.pred<-prediction(pred.enet2$CivilWar, testing$warstds)
perf.enet2<-performance(enet2.pred, "tpr", "fpr")

predict.rf<-predict(train.rf, newdata = testing, type = "prob")
rf.pred<-prediction(predict.rf$CivilWar, testing$warstds)
perf.rf<-performance(rf.pred, "tpr", "fpr")
```

```
plot(perf.enet, main="ROC Plots for Models")
plot(perf.enet2, add=T, lty=2, col="blue")
plot(perf.rf, add=T, lty=3, col="red")
legend(0.7, 0.2, c("Elastic Net (F&L)", "Elastic Net (All)", "Random Forests"), lty=c(1,2,3), bty="n", cex=0.75)
```



According to the ROC plots, the elastic net model with Fearon and Laitin's variables is more accurate

Area under Precision-Recall Curve

```
pr.enet<-performance(enet.pred, "prec", "rec")
pr.enet2<-performance(enet2.pred, "prec", "rec")
pr.rf<-performance(rf.pred, "prec", "rec")
```

```
as.numeric(performance(enet.pred, "aucpr")@y.values)
```

```
## [1] 0.9710677
```

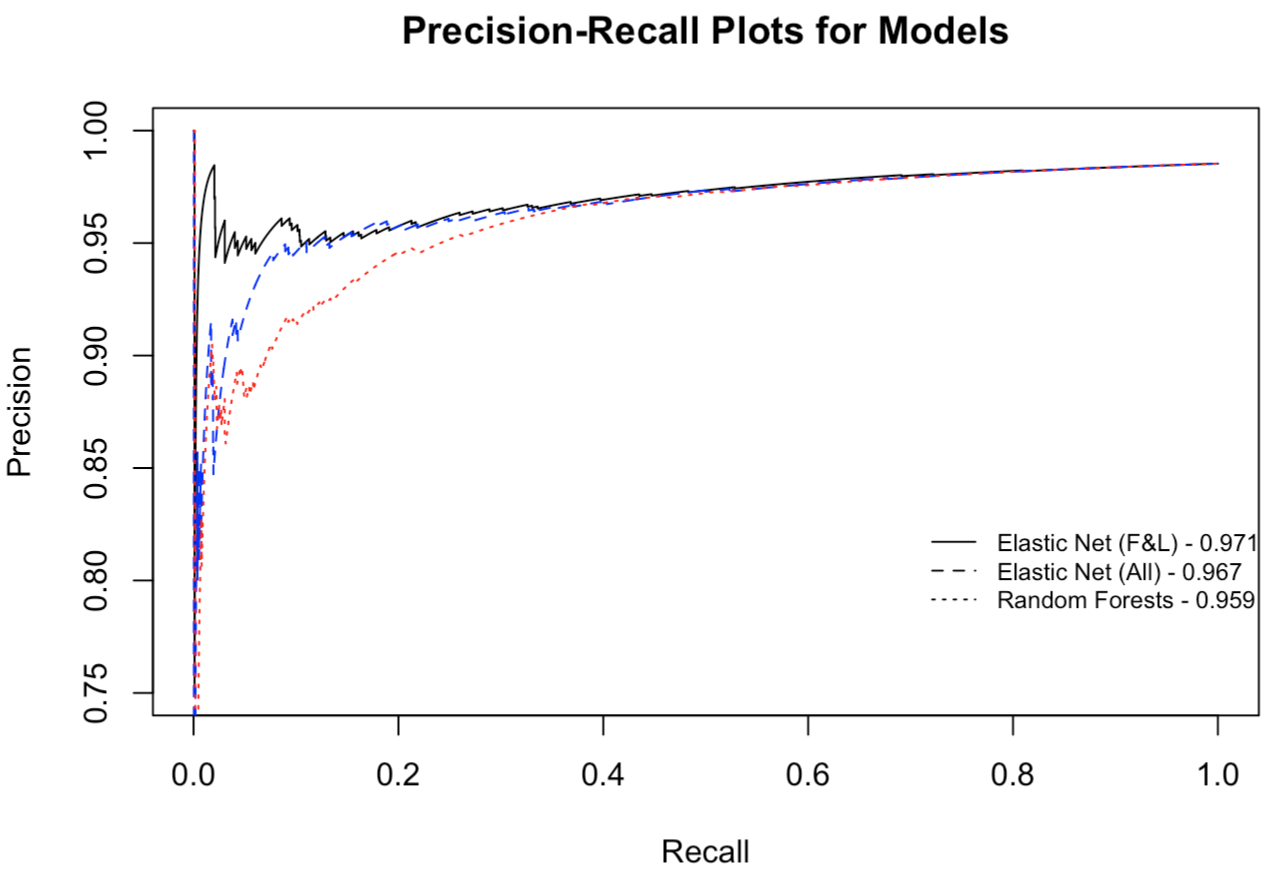
```
as.numeric(performance(enet2.pred, "aucpr")@y.values)
```

```
## [1] 0.9659323
```

```
as.numeric(performance(rf.pred, "aucpr")@y.values)
```

```
## [1] 0.9597818
```

```
plot(pr.enet, main="Precision-Recall Plots for Models")
plot(pr.enet2, add=T, lty=2, col="blue")
plot(pr.rf, add=T, lty=3, col="red")
legend(0.7, 0.83, c("Elastic Net (F&L) - 0.971", "Elastic Net (All) - 0.967", "Random
Forests - 0.959"), lty=c(1,2,3), bty="n", cex=0.75)
```



According to the precision-recall plots, the elastic net model with Fearon and Laitin's variables is more accurate.

Conclusion

These different metrics show the many ways that accuracy can be measured, as well as the drawbacks of both the metrics and the models themselves. With data that has very few positive cases, it is hard for standard models to make accurate predictions and for the measures to show the entire picture. The elastic net models have very high accuracy because they are identifying most, if not all, of the cases and negatives. Because of the small number of civil wars comparatively, they are only incorrectly classifying 40 out of 4000 cases, which looks like a small rate of failure. However, only accurate predicting when there is no civil war does not have a lot of value for preventing violence.

Precision, recall, and the F1 statistic care more about positive predictions, but they still have their drawbacks. Would a policymaker rather know two definite onsets of civil war and not know anything about the other 40 that are going to happen, or have a model that narrows it down to ~200 civil wars that might happen, even if 80% are wrong?

Model fit depends on the rarity of the event you are trying to predict as well as how you wish to use the model to make decisions. For events in international affairs, it’s clear that simple accuracy is not a sufficient measure, and policymakers want to decide whether a few, definite “yeses” are better than many realistic “maybes.”

Question IV

Gradient Boosted Trees

```
set.seed(38745)
train.gbm<-train(as.factor(warstds)~.,
                 method = "gbm",
                 trControl = fitControl,
                 metric = "ROC",
                 data = training[c(-1, -2)])
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1686             nan     0.1000    0.0034
##      2        0.1590             nan     0.1000    0.0039
##      3        0.1540             nan     0.1000    0.0025
##      4        0.1494             nan     0.1000    0.0018
##      5        0.1452             nan     0.1000    0.0016
##      6        0.1428             nan     0.1000    0.0012
##      7        0.1407             nan     0.1000    0.0010
##      8        0.1380             nan     0.1000    0.0011
##      9        0.1358             nan     0.1000    0.0010
##     10        0.1342             nan     0.1000    0.0006
##     20        0.1217             nan     0.1000    0.0003
##     40        0.1068             nan     0.1000    0.0002
##     60        0.0982             nan     0.1000   -0.0001
##     80        0.0908             nan     0.1000   -0.0001
##    100        0.0860             nan     0.1000   -0.0001
##    120        0.0824             nan     0.1000   -0.0001
##    140        0.0792             nan     0.1000   -0.0001
##    150        0.0779             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1580             nan     0.1000    0.0088
##      2        0.1477             nan     0.1000    0.0025
##      3        0.1416             nan     0.1000    0.0023
##      4        0.1354             nan     0.1000    0.0024
##      5        0.1279             nan     0.1000    0.0032
##      6        0.1238             nan     0.1000    0.0012
##      7        0.1184             nan     0.1000    0.0016
##      8        0.1146             nan     0.1000    0.0009
##      9        0.1115             nan     0.1000    0.0014
##     10        0.1096             nan     0.1000    0.0005
##     20        0.0890             nan     0.1000   -0.0002
##     40        0.0755             nan     0.1000   -0.0002
##     60        0.0694             nan     0.1000   -0.0002
##     80        0.0630             nan     0.1000    0.0000
##    100        0.0580             nan     0.1000   -0.0001
##    120        0.0541             nan     0.1000   -0.0001
##    140        0.0500             nan     0.1000   -0.0001
##    150        0.0474             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1608             nan     0.1000    0.0064
##      2        0.1429             nan     0.1000    0.0057
##      3        0.1293             nan     0.1000    0.0031
##      4        0.1214             nan     0.1000    0.0024
##      5        0.1151             nan     0.1000    0.0016
##      6        0.1111             nan     0.1000    0.0016
##      7        0.1076             nan     0.1000    0.0013
##      8        0.1048             nan     0.1000    0.0008
##      9        0.1023             nan     0.1000    0.0005
##     10        0.1004             nan     0.1000    0.0005
##     20        0.0842             nan     0.1000    0.0000
##     40        0.0668             nan     0.1000   -0.0002
##     60        0.0572             nan     0.1000   -0.0001
##     80        0.0514             nan     0.1000   -0.0003
##    100        0.0458             nan     0.1000   -0.0002
##    120        0.0399             nan     0.1000   -0.0002
##    140        0.0356             nan     0.1000   -0.0001
##    150        0.0340             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1674             nan     0.1000    0.0050
##      2        0.1596             nan     0.1000    0.0030
##      3        0.1553             nan     0.1000    0.0022
##      4        0.1514             nan     0.1000    0.0017
##      5        0.1478             nan     0.1000    0.0017
##      6        0.1448             nan     0.1000    0.0007
##      7        0.1421             nan     0.1000    0.0010
##      8        0.1395             nan     0.1000    0.0004
##      9        0.1372             nan     0.1000    0.0010
##     10        0.1354             nan     0.1000    0.0007
##     20        0.1243             nan     0.1000    0.0008
##     40        0.1089             nan     0.1000   -0.0002
##     60        0.1004             nan     0.1000   -0.0002
##     80        0.0931             nan     0.1000    0.0002
##    100        0.0878             nan     0.1000   -0.0001
##    120        0.0835             nan     0.1000   -0.0002
##    140        0.0800             nan     0.1000   -0.0000
##    150        0.0788             nan     0.1000   -0.0000
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1543             nan     0.1000    0.0076
##      2        0.1461             nan     0.1000    0.0029
##      3        0.1370             nan     0.1000    0.0042
##      4        0.1325             nan     0.1000    0.0012
##      5        0.1292             nan     0.1000    0.0002
##      6        0.1266             nan     0.1000    0.0011
##      7        0.1208             nan     0.1000    0.0028
##      8        0.1177             nan     0.1000    0.0007
##      9        0.1159             nan     0.1000    0.0003
##     10        0.1123             nan     0.1000    0.0012
##     20        0.0941             nan     0.1000    0.0008
##     40        0.0798             nan     0.1000   -0.0000
##     60        0.0707             nan     0.1000   -0.0002
##     80        0.0624             nan     0.1000    0.0000
##    100        0.0567             nan     0.1000   -0.0001
##    120        0.0535             nan     0.1000   -0.0002
##    140        0.0494             nan     0.1000   -0.0001
##    150        0.0467             nan     0.1000   -0.0001
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1486             nan     0.1000    0.0115
##      2        0.1325             nan     0.1000    0.0059
##      3        0.1258             nan     0.1000    0.0018
##      4        0.1200             nan     0.1000    0.0012
##      5        0.1164             nan     0.1000    0.0014
##      6        0.1128             nan     0.1000    0.0014
##      7        0.1100             nan     0.1000    0.0003
##      8        0.1088             nan     0.1000   -0.0000
##      9        0.1054             nan     0.1000    0.0007
##     10        0.1042             nan     0.1000    0.0001
##     20        0.0878             nan     0.1000   -0.0002
##     40        0.0715             nan     0.1000    0.0002
##     60        0.0598             nan     0.1000   -0.0002
##     80        0.0517             nan     0.1000   -0.0003
##    100        0.0472             nan     0.1000   -0.0001
##    120        0.0427             nan     0.1000   -0.0002
##    140        0.0373             nan     0.1000   -0.0002
##    150        0.0356             nan     0.1000   -0.0002
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1666             nan     0.1000    0.0043
##      2        0.1593             nan     0.1000    0.0024
##      3        0.1543             nan     0.1000    0.0020
##      4        0.1506             nan     0.1000    0.0015
##      5        0.1466             nan     0.1000    0.0015
##      6        0.1438             nan     0.1000    0.0012
##      7        0.1422             nan     0.1000    0.0006
##      8        0.1399             nan     0.1000    0.0010
##      9        0.1375             nan     0.1000    0.0008
##     10        0.1356             nan     0.1000    0.0006
##     20        0.1222             nan     0.1000    0.0002
##     40        0.1091             nan     0.1000    0.0001
##     60        0.1011             nan     0.1000   -0.0000
##     80        0.0949             nan     0.1000    0.0001
##    100        0.0886             nan     0.1000   -0.0003
##    120        0.0847             nan     0.1000   -0.0001
##    140        0.0819             nan     0.1000   -0.0001
##    150        0.0806             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1554             nan     0.1000    0.0086
##      2        0.1458             nan     0.1000    0.0043
##      3        0.1412             nan     0.1000    0.0021
##      4        0.1345             nan     0.1000    0.0025
##      5        0.1309             nan     0.1000    0.0009
##      6        0.1270             nan     0.1000    0.0010
##      7        0.1255             nan     0.1000   -0.0004
##      8        0.1200             nan     0.1000    0.0030
##      9        0.1171             nan     0.1000    0.0009
##     10        0.1154             nan     0.1000    0.0005
##     20        0.0975             nan     0.1000    0.0003
##     40        0.0788             nan     0.1000   -0.0002
##     60        0.0704             nan     0.1000   -0.0002
##     80        0.0630             nan     0.1000   -0.0002
##    100        0.0558             nan     0.1000   -0.0001
##    120        0.0521             nan     0.1000   -0.0002
##    140        0.0482             nan     0.1000   -0.0002
##    150        0.0463             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1488             nan     0.1000    0.0120
##      2        0.1370             nan     0.1000    0.0050
##      3        0.1311             nan     0.1000    0.0016
##      4        0.1261             nan     0.1000    0.0019
##      5        0.1211             nan     0.1000    0.0018
##      6        0.1170             nan     0.1000    0.0014
##      7        0.1146             nan     0.1000    0.0008
##      8        0.1099             nan     0.1000    0.0014
##      9        0.1075             nan     0.1000    0.0007
##     10        0.1041             nan     0.1000    0.0005
##     20        0.0849             nan     0.1000    0.0003
##     40        0.0669             nan     0.1000   -0.0002
##     60        0.0567             nan     0.1000   -0.0002
##     80        0.0490             nan     0.1000   -0.0003
##    100        0.0417             nan     0.1000   -0.0001
##    120        0.0376             nan     0.1000   -0.0001
##    140        0.0332             nan     0.1000   -0.0001
##    150        0.0316             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1707             nan     0.1000    0.0046
##      2        0.1633             nan     0.1000    0.0034
##      3        0.1589             nan     0.1000    0.0024
##      4        0.1536             nan     0.1000    0.0024
##      5        0.1489             nan     0.1000    0.0020
##      6        0.1460             nan     0.1000    0.0013
##      7        0.1431             nan     0.1000    0.0009
##      8        0.1406             nan     0.1000    0.0006
##      9        0.1381             nan     0.1000    0.0011
##     10        0.1362             nan     0.1000    0.0009
##     20        0.1222             nan     0.1000    0.0004
##     40        0.1085             nan     0.1000   -0.0004
##     60        0.1007             nan     0.1000   -0.0001
##     80        0.0944             nan     0.1000   -0.0001
##    100        0.0905             nan     0.1000   -0.0002
##    120        0.0867             nan     0.1000   -0.0001
##    140        0.0830             nan     0.1000   -0.0000
##    150        0.0808             nan     0.1000   -0.0001
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1540             nan     0.1000    0.0112
##      2        0.1383             nan     0.1000    0.0066
##      3        0.1331             nan     0.1000    0.0021
##      4        0.1281             nan     0.1000    0.0022
##      5        0.1233             nan     0.1000    0.0017
##      6        0.1216             nan     0.1000   -0.0004
##      7        0.1183             nan     0.1000    0.0012
##      8        0.1138             nan     0.1000    0.0014
##      9        0.1114             nan     0.1000    0.0009
##     10        0.1075             nan     0.1000    0.0016
##     20        0.0915             nan     0.1000    0.0007
##     40        0.0775             nan     0.1000   -0.0001
##     60        0.0667             nan     0.1000   -0.0001
##     80        0.0612             nan     0.1000   -0.0003
##    100        0.0569             nan     0.1000   -0.0005
##    120        0.0520             nan     0.1000   -0.0002
##    140        0.0483             nan     0.1000   -0.0000
##    150        0.0472             nan     0.1000   -0.0000
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1423             nan     0.1000    0.0152
##      2        0.1340             nan     0.1000    0.0036
##      3        0.1280             nan     0.1000    0.0012
##      4        0.1231             nan     0.1000    0.0013
##      5        0.1181             nan     0.1000    0.0007
##      6        0.1132             nan     0.1000    0.0011
##      7        0.1093             nan     0.1000    0.0016
##      8        0.1068             nan     0.1000    0.0011
##      9        0.1038             nan     0.1000    0.0008
##     10        0.1015             nan     0.1000    0.0001
##     20        0.0844             nan     0.1000   -0.0001
##     40        0.0702             nan     0.1000   -0.0001
##     60        0.0603             nan     0.1000   -0.0003
##     80        0.0519             nan     0.1000   -0.0001
##    100        0.0449             nan     0.1000   -0.0003
##    120        0.0405             nan     0.1000   -0.0000
##    140        0.0356             nan     0.1000   -0.0001
##    150        0.0340             nan     0.1000   -0.0002
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1678             nan     0.1000    0.0049
##      2        0.1614             nan     0.1000    0.0037
##      3        0.1565             nan     0.1000    0.0024
##      4        0.1520             nan     0.1000    0.0019
##      5        0.1477             nan     0.1000    0.0016
##      6        0.1435             nan     0.1000    0.0014
##      7        0.1409             nan     0.1000    0.0013
##      8        0.1384             nan     0.1000    0.0010
##      9        0.1369             nan     0.1000    0.0005
##     10        0.1352             nan     0.1000    0.0004
##     20        0.1231             nan     0.1000    0.0004
##     40        0.1086             nan     0.1000   -0.0000
##     60        0.0997             nan     0.1000   -0.0001
##     80        0.0924             nan     0.1000    0.0000
##    100        0.0883             nan     0.1000   -0.0002
##    120        0.0844             nan     0.1000   -0.0003
##    140        0.0806             nan     0.1000   -0.0001
##    150        0.0792             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1549             nan     0.1000    0.0069
##      2        0.1434             nan     0.1000    0.0049
##      3        0.1319             nan     0.1000    0.0053
##      4        0.1279             nan     0.1000    0.0010
##      5        0.1228             nan     0.1000    0.0018
##      6        0.1199             nan     0.1000    0.0005
##      7        0.1170             nan     0.1000    0.0006
##      8        0.1144             nan     0.1000    0.0009
##      9        0.1115             nan     0.1000    0.0008
##     10        0.1093             nan     0.1000    0.0008
##     20        0.0918             nan     0.1000   -0.0000
##     40        0.0789             nan     0.1000   -0.0002
##     60        0.0698             nan     0.1000   -0.0001
##     80        0.0622             nan     0.1000   -0.0000
##    100        0.0567             nan     0.1000   -0.0001
##    120        0.0500             nan     0.1000   -0.0003
##    140        0.0448             nan     0.1000   -0.0001
##    150        0.0435             nan     0.1000   -0.0002
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1485             nan     0.1000    0.0101
##      2        0.1383             nan     0.1000    0.0045
##      3        0.1311             nan     0.1000    0.0025
##      4        0.1254             nan     0.1000    0.0017
##      5        0.1212             nan     0.1000    0.0014
##      6        0.1156             nan     0.1000    0.0006
##      7        0.1112             nan     0.1000    0.0015
##      8        0.1078             nan     0.1000    0.0008
##      9        0.1056             nan     0.1000    0.0007
##     10        0.1039             nan     0.1000    0.0004
##     20        0.0886             nan     0.1000    0.0000
##     40        0.0666             nan     0.1000    0.0000
##     60        0.0557             nan     0.1000   -0.0002
##     80        0.0457             nan     0.1000   -0.0002
##    100        0.0393             nan     0.1000   -0.0000
##    120        0.0348             nan     0.1000   -0.0003
##    140        0.0309             nan     0.1000   -0.0002
##    150        0.0287             nan     0.1000   -0.0000
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1647             nan     0.1000    0.0042
##      2        0.1578             nan     0.1000    0.0027
##      3        0.1537             nan     0.1000    0.0020
##      4        0.1499             nan     0.1000    0.0019
##      5        0.1459             nan     0.1000    0.0017
##      6        0.1425             nan     0.1000    0.0012
##      7        0.1398             nan     0.1000    0.0012
##      8        0.1375             nan     0.1000    0.0010
##      9        0.1358             nan     0.1000    0.0005
##     10        0.1343             nan     0.1000    0.0003
##     20        0.1226             nan     0.1000    0.0001
##     40        0.1066             nan     0.1000    0.0002
##     60        0.0981             nan     0.1000   -0.0001
##     80        0.0916             nan     0.1000   -0.0001
##    100        0.0855             nan     0.1000    0.0001
##    120        0.0807             nan     0.1000   -0.0002
##    140        0.0776             nan     0.1000   -0.0002
##    150        0.0763             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1590             nan     0.1000    0.0026
##      2        0.1502             nan     0.1000    0.0033
##      3        0.1437             nan     0.1000    0.0013
##      4        0.1377             nan     0.1000    0.0021
##      5        0.1339             nan     0.1000    0.0014
##      6        0.1282             nan     0.1000    0.0017
##      7        0.1242             nan     0.1000    0.0011
##      8        0.1196             nan     0.1000    0.0022
##      9        0.1162             nan     0.1000    0.0015
##     10        0.1144             nan     0.1000   -0.0001
##     20        0.1005             nan     0.1000   -0.0002
##     40        0.0817             nan     0.1000   -0.0000
##     60        0.0723             nan     0.1000    0.0001
##     80        0.0631             nan     0.1000   -0.0002
##    100        0.0571             nan     0.1000   -0.0003
##    120        0.0518             nan     0.1000   -0.0003
##    140        0.0464             nan     0.1000   -0.0001
##    150        0.0450             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1439             nan     0.1000    0.0096
##      2        0.1301             nan     0.1000    0.0048
##      3        0.1227             nan     0.1000    0.0034
##      4        0.1182             nan     0.1000    0.0022
##      5        0.1140             nan     0.1000    0.0013
##      6        0.1101             nan     0.1000    0.0010
##      7        0.1058             nan     0.1000    0.0020
##      8        0.1046             nan     0.1000   -0.0003
##      9        0.1022             nan     0.1000    0.0009
##     10        0.0997             nan     0.1000    0.0007
##     20        0.0844             nan     0.1000   -0.0001
##     40        0.0659             nan     0.1000   -0.0003
##     60        0.0547             nan     0.1000   -0.0002
##     80        0.0477             nan     0.1000   -0.0003
##    100        0.0420             nan     0.1000   -0.0002
##    120        0.0377             nan     0.1000   -0.0001
##    140        0.0335             nan     0.1000   -0.0002
##    150        0.0315             nan     0.1000   -0.0002
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1653             nan     0.1000    0.0048
##      2        0.1605             nan     0.1000    0.0025
##      3        0.1558             nan     0.1000    0.0019
##      4        0.1520             nan     0.1000    0.0010
##      5        0.1480             nan     0.1000    0.0018
##      6        0.1446             nan     0.1000    0.0014
##      7        0.1414             nan     0.1000    0.0011
##      8        0.1386             nan     0.1000    0.0013
##      9        0.1367             nan     0.1000    0.0007
##     10        0.1350             nan     0.1000    0.0007
##     20        0.1210             nan     0.1000   -0.0000
##     40        0.1065             nan     0.1000   -0.0000
##     60        0.0965             nan     0.1000    0.0001
##     80        0.0893             nan     0.1000    0.0001
##    100        0.0829             nan     0.1000   -0.0000
##    120        0.0787             nan     0.1000   -0.0001
##    140        0.0758             nan     0.1000   -0.0001
##    150        0.0743             nan     0.1000   -0.0003
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1517             nan     0.1000    0.0068
##      2        0.1435             nan     0.1000    0.0027
##      3        0.1384             nan     0.1000    0.0023
##      4        0.1322             nan     0.1000    0.0018
##      5        0.1248             nan     0.1000    0.0034
##      6        0.1225             nan     0.1000    0.0002
##      7        0.1194             nan     0.1000    0.0016
##      8        0.1168             nan     0.1000    0.0011
##      9        0.1160             nan     0.1000   -0.0001
##     10        0.1134             nan     0.1000    0.0006
##     20        0.0969             nan     0.1000   -0.0001
##     40        0.0759             nan     0.1000    0.0003
##     60        0.0663             nan     0.1000   -0.0000
##     80        0.0594             nan     0.1000   -0.0003
##    100        0.0551             nan     0.1000   -0.0001
##    120        0.0513             nan     0.1000   -0.0002
##    140        0.0469             nan     0.1000   -0.0003
##    150        0.0453             nan     0.1000   -0.0001
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1458             nan     0.1000    0.0128
##      2        0.1355             nan     0.1000    0.0039
##      3        0.1277             nan     0.1000    0.0034
##      4        0.1229             nan     0.1000    0.0018
##      5        0.1187             nan     0.1000    0.0013
##      6        0.1149             nan     0.1000    0.0015
##      7        0.1098             nan     0.1000   -0.0005
##      8        0.1074             nan     0.1000    0.0007
##      9        0.1056             nan     0.1000    0.0000
##     10        0.1029             nan     0.1000    0.0005
##     20        0.0891             nan     0.1000   -0.0003
##     40        0.0688             nan     0.1000    0.0000
##     60        0.0562             nan     0.1000   -0.0002
##     80        0.0463             nan     0.1000   -0.0003
##    100        0.0395             nan     0.1000   -0.0001
##    120        0.0338             nan     0.1000    0.0001
##    140        0.0301             nan     0.1000   -0.0001
##    150        0.0282             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1671             nan     0.1000    0.0048
##      2        0.1616             nan     0.1000    0.0029
##      3        0.1553             nan     0.1000    0.0030
##      4        0.1515             nan     0.1000    0.0021
##      5        0.1482             nan     0.1000    0.0016
##      6        0.1447             nan     0.1000    0.0012
##      7        0.1432             nan     0.1000    0.0003
##      8        0.1390             nan     0.1000    0.0015
##      9        0.1370             nan     0.1000    0.0010
##     10        0.1344             nan     0.1000    0.0010
##     20        0.1212             nan     0.1000    0.0003
##     40        0.1073             nan     0.1000    0.0002
##     60        0.0979             nan     0.1000    0.0002
##     80        0.0926             nan     0.1000   -0.0000
##    100        0.0865             nan     0.1000   -0.0002
##    120        0.0828             nan     0.1000   -0.0001
##    140        0.0793             nan     0.1000   -0.0000
##    150        0.0781             nan     0.1000   -0.0003
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1537             nan     0.1000    0.0063
##      2        0.1484             nan     0.1000    0.0019
##      3        0.1432             nan     0.1000    0.0020
##      4        0.1313             nan     0.1000    0.0054
##      5        0.1278             nan     0.1000    0.0012
##      6        0.1245             nan     0.1000    0.0013
##      7        0.1222             nan     0.1000    0.0005
##      8        0.1190             nan     0.1000    0.0009
##      9        0.1154             nan     0.1000    0.0016
##     10        0.1120             nan     0.1000    0.0015
##     20        0.0970             nan     0.1000   -0.0002
##     40        0.0773             nan     0.1000    0.0000
##     60        0.0692             nan     0.1000   -0.0001
##     80        0.0632             nan     0.1000   -0.0001
##    100        0.0566             nan     0.1000   -0.0001
##    120        0.0524             nan     0.1000   -0.0001
##    140        0.0474             nan     0.1000   -0.0000
##    150        0.0464             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1556             nan     0.1000    0.0083
##      2        0.1406             nan     0.1000    0.0025
##      3        0.1311             nan     0.1000    0.0021
##      4        0.1231             nan     0.1000    0.0016
##      5        0.1182             nan     0.1000    0.0020
##      6        0.1149             nan     0.1000    0.0009
##      7        0.1110             nan     0.1000    0.0018
##      8        0.1074             nan     0.1000    0.0014
##      9        0.1043             nan     0.1000    0.0008
##     10        0.1020             nan     0.1000    0.0002
##     20        0.0866             nan     0.1000    0.0001
##     40        0.0689             nan     0.1000   -0.0002
##     60        0.0570             nan     0.1000   -0.0001
##     80        0.0460             nan     0.1000   -0.0000
##    100        0.0405             nan     0.1000   -0.0001
##    120        0.0360             nan     0.1000   -0.0002
##    140        0.0328             nan     0.1000   -0.0003
##    150        0.0310             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1657             nan     0.1000    0.0049
##      2        0.1598             nan     0.1000    0.0028
##      3        0.1550             nan     0.1000    0.0018
##      4        0.1523             nan     0.1000    0.0010
##      5        0.1479             nan     0.1000    0.0020
##      6        0.1448             nan     0.1000    0.0015
##      7        0.1412             nan     0.1000    0.0010
##      8        0.1388             nan     0.1000    0.0009
##      9        0.1367             nan     0.1000    0.0007
##     10        0.1349             nan     0.1000    0.0003
##     20        0.1229             nan     0.1000   -0.0001
##     40        0.1118             nan     0.1000    0.0002
##     60        0.1031             nan     0.1000   -0.0004
##     80        0.0943             nan     0.1000    0.0000
##    100        0.0895             nan     0.1000   -0.0001
##    120        0.0849             nan     0.1000   -0.0000
##    140        0.0811             nan     0.1000   -0.0001
##    150        0.0799             nan     0.1000   -0.0000
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1536             nan     0.1000    0.0107
##      2        0.1477             nan     0.1000    0.0020
##      3        0.1402             nan     0.1000    0.0022
##      4        0.1345             nan     0.1000    0.0016
##      5        0.1300             nan     0.1000    0.0017
##      6        0.1268             nan     0.1000    0.0010
##      7        0.1233             nan     0.1000    0.0014
##      8        0.1206             nan     0.1000    0.0008
##      9        0.1166             nan     0.1000    0.0012
##     10        0.1137             nan     0.1000    0.0010
##     20        0.0974             nan     0.1000    0.0004
##     40        0.0830             nan     0.1000   -0.0001
##     60        0.0720             nan     0.1000   -0.0001
##     80        0.0654             nan     0.1000   -0.0001
##    100        0.0608             nan     0.1000   -0.0001
##    120        0.0567             nan     0.1000   -0.0001
##    140        0.0533             nan     0.1000    0.0000
##    150        0.0508             nan     0.1000    0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1467             nan     0.1000    0.0117
##      2        0.1384             nan     0.1000    0.0035
##      3        0.1338             nan     0.1000    0.0010
##      4        0.1261             nan     0.1000    0.0028
##      5        0.1205             nan     0.1000    0.0016
##      6        0.1162             nan     0.1000    0.0013
##      7        0.1130             nan     0.1000    0.0009
##      8        0.1107             nan     0.1000    0.0002
##      9        0.1077             nan     0.1000    0.0010
##     10        0.1049             nan     0.1000    0.0010
##     20        0.0901             nan     0.1000   -0.0003
##     40        0.0703             nan     0.1000   -0.0002
##     60        0.0577             nan     0.1000   -0.0001
##     80        0.0493             nan     0.1000   -0.0000
##    100        0.0438             nan     0.1000   -0.0002
##    120        0.0391             nan     0.1000   -0.0002
##    140        0.0347             nan     0.1000   -0.0001
##    150        0.0325             nan     0.1000   -0.0002
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1684             nan     0.1000    0.0025
##      2        0.1615             nan     0.1000    0.0040
##      3        0.1557             nan     0.1000    0.0028
##      4        0.1540             nan     0.1000   -0.0006
##      5        0.1495             nan     0.1000    0.0019
##      6        0.1481             nan     0.1000    0.0002
##      7        0.1452             nan     0.1000    0.0011
##      8        0.1423             nan     0.1000    0.0014
##      9        0.1417             nan     0.1000   -0.0003
##     10        0.1396             nan     0.1000    0.0006
##     20        0.1267             nan     0.1000   -0.0004
##     40        0.1134             nan     0.1000   -0.0002
##     60        0.1048             nan     0.1000   -0.0000
##     80        0.0970             nan     0.1000   -0.0001
##    100        0.0917             nan     0.1000   -0.0001
##    120        0.0883             nan     0.1000   -0.0001
##    140        0.0850             nan     0.1000   -0.0003
##    150        0.0825             nan     0.1000   -0.0003
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1635             nan     0.1000    0.0042
##      2        0.1520             nan     0.1000    0.0049
##      3        0.1433             nan     0.1000    0.0024
##      4        0.1331             nan     0.1000    0.0049
##      5        0.1270             nan     0.1000    0.0013
##      6        0.1199             nan     0.1000    0.0021
##      7        0.1172             nan     0.1000    0.0004
##      8        0.1149             nan     0.1000    0.0006
##      9        0.1124             nan     0.1000    0.0004
##     10        0.1095             nan     0.1000    0.0009
##     20        0.0988             nan     0.1000   -0.0007
##     40        0.0834             nan     0.1000   -0.0003
##     60        0.0751             nan     0.1000   -0.0000
##     80        0.0702             nan     0.1000   -0.0001
##    100        0.0633             nan     0.1000   -0.0001
##    120        0.0570             nan     0.1000    0.0000
##    140        0.0526             nan     0.1000   -0.0001
##    150        0.0514             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1637             nan     0.1000    0.0016
##      2        0.1492             nan     0.1000    0.0048
##      3        0.1317             nan     0.1000    0.0051
##      4        0.1262             nan     0.1000    0.0019
##      5        0.1225             nan     0.1000    0.0013
##      6        0.1177             nan     0.1000    0.0006
##      7        0.1145             nan     0.1000    0.0007
##      8        0.1107             nan     0.1000    0.0011
##      9        0.1072             nan     0.1000    0.0006
##     10        0.1052             nan     0.1000    0.0004
##     20        0.0844             nan     0.1000    0.0001
##     40        0.0658             nan     0.1000   -0.0001
##     60        0.0555             nan     0.1000   -0.0001
##     80        0.0468             nan     0.1000   -0.0001
##    100        0.0405             nan     0.1000   -0.0000
##    120        0.0369             nan     0.1000   -0.0002
##    140        0.0324             nan     0.1000   -0.0001
##    150        0.0310             nan     0.1000   -0.0000
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 10: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 14: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1657             nan     0.1000    0.0044
##      2        0.1593             nan     0.1000    0.0025
##      3        0.1538             nan     0.1000    0.0025
##      4        0.1504             nan     0.1000    0.0015
##      5        0.1470             nan     0.1000    0.0017
##      6        0.1434             nan     0.1000    0.0016
##      7        0.1406             nan     0.1000    0.0009
##      8        0.1387             nan     0.1000    0.0008
##      9        0.1366             nan     0.1000    0.0007
##     10        0.1351             nan     0.1000    0.0005
##     20        0.1230             nan     0.1000   -0.0000
##     40        0.1103             nan     0.1000    0.0003
##     60        0.0997             nan     0.1000    0.0002
##     80        0.0954             nan     0.1000   -0.0002
##    100        0.0896             nan     0.1000    0.0001
##    120        0.0855             nan     0.1000   -0.0003
##    140        0.0825             nan     0.1000   -0.0001
##    150        0.0811             nan     0.1000   -0.0001
```

```
train.gbm
```

```
## Stochastic Gradient Boosting
##
## 3940 samples
##   90 predictor
##    2 classes: 'None', 'CivilWar'
##
## No pre-processing
## Resampling: Cross-Validated (10 fold)
## Summary of sample sizes: 3546, 3546, 3546, 3547, 3546, 3546, ...
## Resampling results across tuning parameters:
##
##   interaction.depth  n.trees  ROC        Sens       Spec
##   1                   50      0.9282049  0.9997416  0.00000000
##   1                  100      0.9378211  0.9992248  0.04285714
##   1                  150      0.9442238  0.9987080  0.14523810
##   2                   50      0.9392708  0.9992248  0.21666667
##   2                  100      0.9432928  0.9989664  0.23095238
##   2                  150      0.9415643  0.9981919  0.23095238
##   3                   50      0.9393141  0.9974180  0.23095238
##   3                  100      0.9375460  0.9958683  0.25952381
##   3                  150      0.9380001  0.9963858  0.25952381
##
## Tuning parameter 'shrinkage' was held constant at a value of 0.1
##
## Tuning parameter 'n.minobsinnode' was held constant at a value of 10
## ROC was used to select the optimal model using the largest value.
## The final values used for the model were n.trees = 150, interaction.depth =
##  1, shrinkage = 0.1 and n.minobsinnode = 10.
```

```
pred.gbm<-predict(train.gbm, newdata = testing, type = "raw")
confusionMatrix(pred.gbm, testing$warstds, positive = "CivilWar", mode = "everythin
g")
```

```
## Confusion Matrix and Statistics
## 
##           Reference
## Prediction None CivilWar
##   None     3141       43
##   CivilWar   12        4
##                                          
##                Accuracy : 0.9828         
##                  95% CI : (0.9777, 0.987)
##     No Information Rate : 0.9853         
##     P-Value [Acc > NIR] : 0.8921         
##                                          
##                   Kappa : 0.1204         
##                                          
##  Mcnemar's Test P-Value : 5.228e-05      
##                                          
##             Sensitivity : 0.08511        
##             Specificity : 0.99619        
##          Pos Pred Value : 0.25000        
##          Neg Pred Value : 0.98649        
##               Precision : 0.25000        
##                  Recall : 0.08511        
##                      F1 : 0.12698        
##              Prevalence : 0.01469        
##          Detection Rate : 0.00125        
##    Detection Prevalence : 0.00500        
##       Balanced Accuracy : 0.54065        
##                                          
##        'Positive' Class : CivilWar       
## 
```

Ensemble Modeling

```
library(caretEnsemble)
```

```
## 
## Attaching package: 'caretEnsemble'
```

```
## The following object is masked from 'package:ggplot2':
## 
##     autoplot
```

```
algList<-c("glmnet", "rf", "gbm")

set.seed(38745)
models<-caretList(warstds~.,
                  data=training,
                  trControl = fitControl,
                  methodList = algList)
```

```
## Warning in trControlCheck(x = trControl, y = target): x$savePredictions == TRUE
## is depreciated. Setting to 'final' instead.
```

```
## Warning in trControlCheck(x = trControl, y = target): indexes not defined in
## trControl. Attempting to set them ourselves, so each model in the ensemble will
## have the same resampling indexes.
```

```
## Warning in train.default(x, y, weights = w, ...): The metric "Accuracy" was not
## in the result set. ROC will be used instead.

## Warning in train.default(x, y, weights = w, ...): The metric "Accuracy" was not
## in the result set. ROC will be used instead.

## Warning in train.default(x, y, weights = w, ...): The metric "Accuracy" was not
## in the result set. ROC will be used instead.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1703             nan     0.1000    0.0036
##      2        0.1605             nan     0.1000    0.0037
##      3        0.1545             nan     0.1000    0.0024
##      4        0.1506             nan     0.1000    0.0017
##      5        0.1475             nan     0.1000    0.0014
##      6        0.1451             nan     0.1000    0.0008
##      7        0.1427             nan     0.1000    0.0012
##      8        0.1407             nan     0.1000    0.0009
##      9        0.1383             nan     0.1000    0.0012
##     10        0.1376             nan     0.1000   -0.0001
##     20        0.1235             nan     0.1000    0.0005
##     40        0.1079             nan     0.1000   -0.0002
##     60        0.0992             nan     0.1000   -0.0002
##     80        0.0899             nan     0.1000   -0.0001
##    100        0.0845             nan     0.1000   -0.0001
##    120        0.0808             nan     0.1000    0.0002
##    140        0.0768             nan     0.1000   -0.0001
##    150        0.0761             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1418             nan     0.1000    0.0170
##      2        0.1378             nan     0.1000    0.0023
##      3        0.1338             nan     0.1000    0.0017
##      4        0.1307             nan     0.1000    0.0012
##      5        0.1263             nan     0.1000    0.0019
##      6        0.1240             nan     0.1000    0.0010
##      7        0.1222             nan     0.1000    0.0000
##      8        0.1194             nan     0.1000    0.0010
##      9        0.1181             nan     0.1000    0.0001
##     10        0.1163             nan     0.1000    0.0007
##     20        0.1008             nan     0.1000    0.0000
##     40        0.0828             nan     0.1000    0.0000
##     60        0.0687             nan     0.1000   -0.0000
##     80        0.0622             nan     0.1000   -0.0004
##    100        0.0568             nan     0.1000   -0.0001
##    120        0.0516             nan     0.1000    0.0000
##    140        0.0461             nan     0.1000   -0.0002
##    150        0.0440             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1319             nan     0.1000    0.0156
##      2        0.1262             nan     0.1000    0.0021
##      3        0.1213             nan     0.1000    0.0022
##      4        0.1173             nan     0.1000    0.0018
##      5        0.1135             nan     0.1000    0.0010
##      6        0.1107             nan     0.1000    0.0005
##      7        0.1065             nan     0.1000    0.0013
##      8        0.1038             nan     0.1000    0.0003
##      9        0.1009             nan     0.1000    0.0008
##     10        0.0982             nan     0.1000    0.0003
##     20        0.0813             nan     0.1000    0.0002
##     40        0.0641             nan     0.1000    0.0000
##     60        0.0546             nan     0.1000   -0.0003
##     80        0.0473             nan     0.1000   -0.0002
##    100        0.0407             nan     0.1000   -0.0001
##    120        0.0364             nan     0.1000   -0.0001
##    140        0.0325             nan     0.1000   -0.0002
##    150        0.0322             nan     0.1000   -0.0000
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1651             nan     0.1000    0.0046
##      2        0.1588             nan     0.1000    0.0029
##      3        0.1543             nan     0.1000    0.0019
##      4        0.1511             nan     0.1000    0.0013
##      5        0.1469             nan     0.1000    0.0016
##      6        0.1425             nan     0.1000    0.0018
##      7        0.1395             nan     0.1000    0.0008
##      8        0.1376             nan     0.1000    0.0007
##      9        0.1360             nan     0.1000    0.0006
##     10        0.1341             nan     0.1000    0.0003
##     20        0.1210             nan     0.1000    0.0008
##     40        0.1043             nan     0.1000    0.0004
##     60        0.0947             nan     0.1000    0.0001
##     80        0.0882             nan     0.1000   -0.0002
##    100        0.0830             nan     0.1000   -0.0002
##    120        0.0779             nan     0.1000   -0.0000
##    140        0.0752             nan     0.1000   -0.0002
##    150        0.0737             nan     0.1000   -0.0001
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1413             nan     0.1000    0.0176
##      2        0.1310             nan     0.1000    0.0058
##      3        0.1267             nan     0.1000    0.0016
##      4        0.1246             nan     0.1000    0.0007
##      5        0.1220             nan     0.1000    0.0013
##      6        0.1193             nan     0.1000    0.0011
##      7        0.1161             nan     0.1000    0.0014
##      8        0.1130             nan     0.1000    0.0005
##      9        0.1095             nan     0.1000    0.0014
##     10        0.1084             nan     0.1000   -0.0000
##     20        0.0939             nan     0.1000    0.0003
##     40        0.0758             nan     0.1000    0.0000
##     60        0.0635             nan     0.1000   -0.0001
##     80        0.0567             nan     0.1000   -0.0001
##    100        0.0509             nan     0.1000   -0.0000
##    120        0.0478             nan     0.1000   -0.0000
##    140        0.0436             nan     0.1000   -0.0001
##    150        0.0423             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1316             nan     0.1000    0.0218
##      2        0.1269             nan     0.1000    0.0017
##      3        0.1204             nan     0.1000    0.0018
##      4        0.1158             nan     0.1000    0.0014
##      5        0.1112             nan     0.1000    0.0017
##      6        0.1079             nan     0.1000    0.0006
##      7        0.1065             nan     0.1000    0.0000
##      8        0.1046             nan     0.1000   -0.0002
##      9        0.1021             nan     0.1000    0.0004
##     10        0.0989             nan     0.1000    0.0006
##     20        0.0828             nan     0.1000    0.0001
##     40        0.0631             nan     0.1000    0.0000
##     60        0.0514             nan     0.1000    0.0000
##     80        0.0444             nan     0.1000   -0.0001
##    100        0.0391             nan     0.1000   -0.0002
##    120        0.0349             nan     0.1000   -0.0000
##    140        0.0309             nan     0.1000   -0.0000
##    150        0.0279             nan     0.1000   -0.0000
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1662             nan     0.1000    0.0044
##      2        0.1600             nan     0.1000    0.0030
##      3        0.1554             nan     0.1000    0.0019
##      4        0.1513             nan     0.1000    0.0017
##      5        0.1483             nan     0.1000    0.0015
##      6        0.1449             nan     0.1000    0.0014
##      7        0.1438             nan     0.1000    0.0001
##      8        0.1413             nan     0.1000    0.0008
##      9        0.1398             nan     0.1000    0.0004
##     10        0.1393             nan     0.1000   -0.0002
##     20        0.1251             nan     0.1000    0.0004
##     40        0.1090             nan     0.1000    0.0002
##     60        0.0993             nan     0.1000   -0.0001
##     80        0.0925             nan     0.1000   -0.0001
##    100        0.0865             nan     0.1000   -0.0001
##    120        0.0835             nan     0.1000   -0.0001
##    140        0.0811             nan     0.1000   -0.0001
##    150        0.0792             nan     0.1000   -0.0002
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1399             nan     0.1000    0.0179
##      2        0.1350             nan     0.1000    0.0022
##      3        0.1316             nan     0.1000    0.0017
##      4        0.1280             nan     0.1000    0.0012
##      5        0.1244             nan     0.1000    0.0014
##      6        0.1203             nan     0.1000    0.0011
##      7        0.1174             nan     0.1000    0.0008
##      8        0.1148             nan     0.1000    0.0008
##      9        0.1120             nan     0.1000    0.0009
##     10        0.1107             nan     0.1000    0.0004
##     20        0.0958             nan     0.1000   -0.0003
##     40        0.0787             nan     0.1000    0.0001
##     60        0.0684             nan     0.1000   -0.0002
##     80        0.0601             nan     0.1000   -0.0002
##    100        0.0548             nan     0.1000   -0.0001
##    120        0.0501             nan     0.1000   -0.0002
##    140        0.0465             nan     0.1000   -0.0001
##    150        0.0443             nan     0.1000   -0.0000
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1325             nan     0.1000    0.0211
##      2        0.1283             nan     0.1000    0.0015
##      3        0.1261             nan     0.1000    0.0007
##      4        0.1195             nan     0.1000    0.0021
##      5        0.1170             nan     0.1000    0.0001
##      6        0.1136             nan     0.1000    0.0006
##      7        0.1098             nan     0.1000   -0.0001
##      8        0.1062             nan     0.1000    0.0004
##      9        0.1039             nan     0.1000    0.0001
##     10        0.1009             nan     0.1000    0.0006
##     20        0.0842             nan     0.1000   -0.0003
##     40        0.0660             nan     0.1000   -0.0004
##     60        0.0573             nan     0.1000   -0.0002
##     80        0.0477             nan     0.1000   -0.0000
##    100        0.0432             nan     0.1000   -0.0001
##    120        0.0378             nan     0.1000   -0.0001
##    140        0.0330             nan     0.1000   -0.0001
##    150        0.0304             nan     0.1000   -0.0002
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1673             nan     0.1000    0.0048
##      2        0.1609             nan     0.1000    0.0029
##      3        0.1554             nan     0.1000    0.0024
##      4        0.1508             nan     0.1000    0.0016
##      5        0.1458             nan     0.1000    0.0013
##      6        0.1435             nan     0.1000    0.0007
##      7        0.1405             nan     0.1000    0.0015
##      8        0.1385             nan     0.1000    0.0002
##      9        0.1361             nan     0.1000    0.0009
##     10        0.1352             nan     0.1000   -0.0001
##     20        0.1232             nan     0.1000   -0.0002
##     40        0.1106             nan     0.1000   -0.0001
##     60        0.1016             nan     0.1000    0.0000
##     80        0.0951             nan     0.1000   -0.0000
##    100        0.0891             nan     0.1000   -0.0001
##    120        0.0858             nan     0.1000   -0.0001
##    140        0.0830             nan     0.1000   -0.0003
##    150        0.0809             nan     0.1000   -0.0002
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1459             nan     0.1000    0.0136
##      2        0.1402             nan     0.1000    0.0026
##      3        0.1369             nan     0.1000    0.0018
##      4        0.1331             nan     0.1000    0.0015
##      5        0.1298             nan     0.1000    0.0011
##      6        0.1268             nan     0.1000    0.0007
##      7        0.1222             nan     0.1000    0.0020
##      8        0.1211             nan     0.1000   -0.0001
##      9        0.1175             nan     0.1000    0.0014
##     10        0.1147             nan     0.1000    0.0009
##     20        0.1000             nan     0.1000   -0.0001
##     40        0.0833             nan     0.1000    0.0000
##     60        0.0729             nan     0.1000   -0.0002
##     80        0.0669             nan     0.1000    0.0000
##    100        0.0619             nan     0.1000    0.0000
##    120        0.0556             nan     0.1000   -0.0002
##    140        0.0501             nan     0.1000   -0.0001
##    150        0.0478             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1383             nan     0.1000    0.0193
##      2        0.1300             nan     0.1000    0.0030
##      3        0.1237             nan     0.1000    0.0014
##      4        0.1184             nan     0.1000    0.0001
##      5        0.1143             nan     0.1000    0.0015
##      6        0.1100             nan     0.1000    0.0010
##      7        0.1062             nan     0.1000    0.0013
##      8        0.1036             nan     0.1000    0.0010
##      9        0.1017             nan     0.1000    0.0004
##     10        0.0989             nan     0.1000    0.0006
##     20        0.0825             nan     0.1000    0.0001
##     40        0.0655             nan     0.1000   -0.0001
##     60        0.0559             nan     0.1000   -0.0004
##     80        0.0461             nan     0.1000   -0.0003
##    100        0.0405             nan     0.1000   -0.0001
##    120        0.0359             nan     0.1000   -0.0000
##    140        0.0311             nan     0.1000   -0.0002
##    150        0.0294             nan     0.1000   -0.0002
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1659             nan     0.1000    0.0045
##      2        0.1593             nan     0.1000    0.0025
##      3        0.1580             nan     0.1000   -0.0004
##      4        0.1525             nan     0.1000    0.0025
##      5        0.1485             nan     0.1000    0.0017
##      6        0.1456             nan     0.1000    0.0012
##      7        0.1428             nan     0.1000    0.0013
##      8        0.1404             nan     0.1000    0.0011
##      9        0.1376             nan     0.1000    0.0009
##     10        0.1360             nan     0.1000    0.0006
##     20        0.1238             nan     0.1000    0.0003
##     40        0.1121             nan     0.1000    0.0001
##     60        0.1028             nan     0.1000   -0.0000
##     80        0.0956             nan     0.1000   -0.0001
##    100        0.0917             nan     0.1000   -0.0001
##    120        0.0885             nan     0.1000   -0.0002
##    140        0.0849             nan     0.1000   -0.0001
##    150        0.0839             nan     0.1000   -0.0002
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1355             nan     0.1000    0.0139
##      2        0.1318             nan     0.1000    0.0011
##      3        0.1289             nan     0.1000    0.0011
##      4        0.1259             nan     0.1000    0.0011
##      5        0.1219             nan     0.1000    0.0009
##      6        0.1198             nan     0.1000    0.0002
##      7        0.1178             nan     0.1000    0.0005
##      8        0.1157             nan     0.1000    0.0007
##      9        0.1125             nan     0.1000   -0.0005
##     10        0.1098             nan     0.1000    0.0005
##     20        0.0983             nan     0.1000   -0.0003
##     40        0.0829             nan     0.1000   -0.0003
##     60        0.0711             nan     0.1000   -0.0002
##     80        0.0638             nan     0.1000    0.0001
##    100        0.0570             nan     0.1000    0.0001
##    120        0.0530             nan     0.1000   -0.0002
##    140        0.0483             nan     0.1000   -0.0003
##    150        0.0457             nan     0.1000   -0.0001
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1317             nan     0.1000    0.0144
##      2        0.1278             nan     0.1000    0.0017
##      3        0.1240             nan     0.1000    0.0015
##      4        0.1200             nan     0.1000    0.0010
##      5        0.1175             nan     0.1000    0.0006
##      6        0.1142             nan     0.1000    0.0006
##      7        0.1087             nan     0.1000    0.0008
##      8        0.1062             nan     0.1000    0.0007
##      9        0.1037             nan     0.1000    0.0000
##     10        0.1014             nan     0.1000    0.0007
##     20        0.0816             nan     0.1000    0.0000
##     40        0.0663             nan     0.1000   -0.0001
##     60        0.0582             nan     0.1000   -0.0000
##     80        0.0518             nan     0.1000   -0.0001
##    100        0.0462             nan     0.1000   -0.0001
##    120        0.0409             nan     0.1000    0.0000
##    140        0.0360             nan     0.1000   -0.0002
##    150        0.0343             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1687             nan     0.1000    0.0043
##      2        0.1613             nan     0.1000    0.0031
##      3        0.1567             nan     0.1000    0.0023
##      4        0.1531             nan     0.1000    0.0018
##      5        0.1487             nan     0.1000    0.0017
##      6        0.1449             nan     0.1000    0.0013
##      7        0.1429             nan     0.1000    0.0006
##      8        0.1406             nan     0.1000    0.0006
##      9        0.1394             nan     0.1000   -0.0003
##     10        0.1372             nan     0.1000    0.0009
##     20        0.1245             nan     0.1000    0.0004
##     40        0.1107             nan     0.1000   -0.0001
##     60        0.1027             nan     0.1000   -0.0002
##     80        0.0959             nan     0.1000   -0.0001
##    100        0.0900             nan     0.1000   -0.0002
##    120        0.0858             nan     0.1000   -0.0001
##    140        0.0821             nan     0.1000   -0.0001
##    150        0.0810             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1421             nan     0.1000    0.0143
##      2        0.1376             nan     0.1000    0.0023
##      3        0.1330             nan     0.1000    0.0012
##      4        0.1300             nan     0.1000    0.0012
##      5        0.1275             nan     0.1000    0.0006
##      6        0.1241             nan     0.1000    0.0011
##      7        0.1204             nan     0.1000    0.0012
##      8        0.1166             nan     0.1000    0.0017
##      9        0.1129             nan     0.1000    0.0010
##     10        0.1111             nan     0.1000    0.0003
##     20        0.0955             nan     0.1000   -0.0002
##     40        0.0777             nan     0.1000   -0.0001
##     60        0.0669             nan     0.1000   -0.0002
##     80        0.0597             nan     0.1000   -0.0001
##    100        0.0551             nan     0.1000   -0.0001
##    120        0.0506             nan     0.1000   -0.0001
##    140        0.0465             nan     0.1000   -0.0005
##    150        0.0448             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1370             nan     0.1000    0.0204
##      2        0.1337             nan     0.1000    0.0002
##      3        0.1313             nan     0.1000    0.0000
##      4        0.1269             nan     0.1000    0.0009
##      5        0.1225             nan     0.1000   -0.0005
##      6        0.1196             nan     0.1000    0.0003
##      7        0.1164             nan     0.1000    0.0007
##      8        0.1122             nan     0.1000   -0.0001
##      9        0.1103             nan     0.1000   -0.0003
##     10        0.1075             nan     0.1000    0.0008
##     20        0.0905             nan     0.1000    0.0000
##     40        0.0739             nan     0.1000   -0.0002
##     60        0.0584             nan     0.1000   -0.0000
##     80        0.0480             nan     0.1000   -0.0001
##    100        0.0407             nan     0.1000   -0.0000
##    120        0.0353             nan     0.1000   -0.0001
##    140        0.0311             nan     0.1000   -0.0002
##    150        0.0292             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1672             nan     0.1000    0.0050
##      2        0.1610             nan     0.1000    0.0027
##      3        0.1547             nan     0.1000    0.0021
##      4        0.1506             nan     0.1000    0.0014
##      5        0.1475             nan     0.1000    0.0017
##      6        0.1447             nan     0.1000    0.0012
##      7        0.1416             nan     0.1000    0.0014
##      8        0.1395             nan     0.1000    0.0007
##      9        0.1381             nan     0.1000    0.0002
##     10        0.1362             nan     0.1000    0.0007
##     20        0.1250             nan     0.1000   -0.0000
##     40        0.1094             nan     0.1000    0.0003
##     60        0.1024             nan     0.1000    0.0000
##     80        0.0956             nan     0.1000   -0.0001
##    100        0.0906             nan     0.1000    0.0000
##    120        0.0862             nan     0.1000   -0.0003
##    140        0.0829             nan     0.1000    0.0000
##    150        0.0803             nan     0.1000   -0.0000
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1449             nan     0.1000    0.0130
##      2        0.1405             nan     0.1000    0.0016
##      3        0.1366             nan     0.1000    0.0019
##      4        0.1326             nan     0.1000    0.0009
##      5        0.1299             nan     0.1000    0.0014
##      6        0.1266             nan     0.1000    0.0011
##      7        0.1247             nan     0.1000    0.0003
##      8        0.1218             nan     0.1000    0.0012
##      9        0.1200             nan     0.1000    0.0004
##     10        0.1177             nan     0.1000    0.0009
##     20        0.1023             nan     0.1000    0.0001
##     40        0.0858             nan     0.1000   -0.0003
##     60        0.0747             nan     0.1000   -0.0002
##     80        0.0675             nan     0.1000   -0.0001
##    100        0.0600             nan     0.1000   -0.0003
##    120        0.0549             nan     0.1000   -0.0003
##    140        0.0498             nan     0.1000   -0.0002
##    150        0.0484             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1316             nan     0.1000    0.0181
##      2        0.1277             nan     0.1000    0.0012
##      3        0.1251             nan     0.1000    0.0008
##      4        0.1206             nan     0.1000    0.0015
##      5        0.1178             nan     0.1000    0.0001
##      6        0.1145             nan     0.1000    0.0003
##      7        0.1111             nan     0.1000    0.0011
##      8        0.1086             nan     0.1000    0.0006
##      9        0.1068             nan     0.1000   -0.0000
##     10        0.1045             nan     0.1000   -0.0005
##     20        0.0893             nan     0.1000    0.0004
##     40        0.0701             nan     0.1000   -0.0006
##     60        0.0571             nan     0.1000   -0.0002
##     80        0.0480             nan     0.1000   -0.0002
##    100        0.0417             nan     0.1000   -0.0002
##    120        0.0370             nan     0.1000   -0.0003
##    140        0.0320             nan     0.1000   -0.0002
##    150        0.0305             nan     0.1000   -0.0002
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1634             nan     0.1000    0.0048
##      2        0.1580             nan     0.1000    0.0027
##      3        0.1522             nan     0.1000    0.0021
##      4        0.1494             nan     0.1000    0.0015
##      5        0.1453             nan     0.1000    0.0016
##      6        0.1414             nan     0.1000    0.0017
##      7        0.1390             nan     0.1000    0.0011
##      8        0.1365             nan     0.1000    0.0008
##      9        0.1350             nan     0.1000   -0.0006
##     10        0.1326             nan     0.1000    0.0008
##     20        0.1186             nan     0.1000    0.0000
##     40        0.1057             nan     0.1000    0.0003
##     60        0.0951             nan     0.1000    0.0003
##     80        0.0880             nan     0.1000    0.0001
##    100        0.0825             nan     0.1000    0.0000
##    120        0.0792             nan     0.1000   -0.0001
##    140        0.0762             nan     0.1000   -0.0002
##    150        0.0745             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1436             nan     0.1000    0.0203
##      2        0.1370             nan     0.1000    0.0027
##      3        0.1332             nan     0.1000    0.0018
##      4        0.1290             nan     0.1000    0.0018
##      5        0.1276             nan     0.1000   -0.0003
##      6        0.1250             nan     0.1000    0.0006
##      7        0.1224             nan     0.1000    0.0011
##      8        0.1186             nan     0.1000    0.0013
##      9        0.1165             nan     0.1000    0.0009
##     10        0.1142             nan     0.1000    0.0006
##     20        0.0986             nan     0.1000   -0.0008
##     40        0.0813             nan     0.1000   -0.0000
##     60        0.0691             nan     0.1000   -0.0001
##     80        0.0610             nan     0.1000   -0.0001
##    100        0.0544             nan     0.1000   -0.0002
##    120        0.0503             nan     0.1000   -0.0002
##    140        0.0445             nan     0.1000   -0.0001
##    150        0.0427             nan     0.1000   -0.0002
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1249             nan     0.1000    0.0230
##      2        0.1212             nan     0.1000    0.0014
##      3        0.1172             nan     0.1000    0.0017
##      4        0.1089             nan     0.1000    0.0015
##      5        0.1053             nan     0.1000    0.0012
##      6        0.1034             nan     0.1000    0.0003
##      7        0.1012             nan     0.1000    0.0003
##      8        0.0974             nan     0.1000    0.0004
##      9        0.0962             nan     0.1000   -0.0001
##     10        0.0936             nan     0.1000    0.0002
##     20        0.0810             nan     0.1000   -0.0001
##     40        0.0632             nan     0.1000   -0.0000
##     60        0.0524             nan     0.1000   -0.0001
##     80        0.0453             nan     0.1000   -0.0002
##    100        0.0379             nan     0.1000   -0.0001
##    120        0.0328             nan     0.1000    0.0000
##    140        0.0294             nan     0.1000   -0.0001
##    150        0.0280             nan     0.1000   -0.0001
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1647             nan     0.1000    0.0050
##      2        0.1585             nan     0.1000    0.0028
##      3        0.1536             nan     0.1000    0.0016
##      4        0.1492             nan     0.1000    0.0018
##      5        0.1457             nan     0.1000    0.0014
##      6        0.1428             nan     0.1000    0.0011
##      7        0.1405             nan     0.1000    0.0010
##      8        0.1387             nan     0.1000    0.0004
##      9        0.1372             nan     0.1000    0.0003
##     10        0.1355             nan     0.1000    0.0006
##     20        0.1221             nan     0.1000    0.0002
##     40        0.1102             nan     0.1000   -0.0001
##     60        0.1018             nan     0.1000   -0.0001
##     80        0.0930             nan     0.1000   -0.0002
##    100        0.0888             nan     0.1000   -0.0002
##    120        0.0837             nan     0.1000   -0.0001
##    140        0.0814             nan     0.1000   -0.0001
##    150        0.0806             nan     0.1000   -0.0002
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1434             nan     0.1000    0.0159
##      2        0.1379             nan     0.1000    0.0020
##      3        0.1359             nan     0.1000    0.0004
##      4        0.1301             nan     0.1000    0.0027
##      5        0.1275             nan     0.1000    0.0008
##      6        0.1245             nan     0.1000    0.0012
##      7        0.1229             nan     0.1000   -0.0002
##      8        0.1203             nan     0.1000    0.0007
##      9        0.1162             nan     0.1000    0.0016
##     10        0.1144             nan     0.1000    0.0006
##     20        0.0998             nan     0.1000   -0.0002
##     40        0.0799             nan     0.1000   -0.0001
##     60        0.0687             nan     0.1000    0.0001
##     80        0.0618             nan     0.1000   -0.0001
##    100        0.0567             nan     0.1000   -0.0002
##    120        0.0505             nan     0.1000   -0.0001
##    140        0.0473             nan     0.1000   -0.0001
##    150        0.0444             nan     0.1000   -0.0000
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1248             nan     0.1000    0.0191
##      2        0.1211             nan     0.1000    0.0008
##      3        0.1187             nan     0.1000    0.0008
##      4        0.1142             nan     0.1000   -0.0001
##      5        0.1120             nan     0.1000    0.0004
##      6        0.1092             nan     0.1000    0.0005
##      7        0.1048             nan     0.1000    0.0002
##      8        0.1037             nan     0.1000   -0.0000
##      9        0.1017             nan     0.1000    0.0002
##     10        0.1010             nan     0.1000   -0.0002
##     20        0.0862             nan     0.1000   -0.0002
##     40        0.0686             nan     0.1000    0.0001
##     60        0.0546             nan     0.1000   -0.0001
##     80        0.0464             nan     0.1000   -0.0001
##    100        0.0416             nan     0.1000   -0.0001
##    120        0.0370             nan     0.1000   -0.0002
##    140        0.0329             nan     0.1000   -0.0001
##    150        0.0306             nan     0.1000   -0.0003
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1647             nan     0.1000    0.0046
##      2        0.1580             nan     0.1000    0.0026
##      3        0.1534             nan     0.1000    0.0025
##      4        0.1491             nan     0.1000    0.0023
##      5        0.1448             nan     0.1000    0.0011
##      6        0.1413             nan     0.1000    0.0010
##      7        0.1382             nan     0.1000    0.0014
##      8        0.1356             nan     0.1000    0.0010
##      9        0.1336             nan     0.1000    0.0008
##     10        0.1323             nan     0.1000    0.0004
##     20        0.1212             nan     0.1000    0.0003
##     40        0.1052             nan     0.1000    0.0001
##     60        0.0965             nan     0.1000   -0.0002
##     80        0.0886             nan     0.1000   -0.0002
##    100        0.0840             nan     0.1000   -0.0001
##    120        0.0802             nan     0.1000   -0.0001
##    140        0.0773             nan     0.1000   -0.0003
##    150        0.0759             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1422             nan     0.1000    0.0187
##      2        0.1366             nan     0.1000    0.0017
##      3        0.1312             nan     0.1000    0.0016
##      4        0.1281             nan     0.1000    0.0015
##      5        0.1241             nan     0.1000    0.0008
##      6        0.1193             nan     0.1000    0.0024
##      7        0.1166             nan     0.1000    0.0013
##      8        0.1145             nan     0.1000    0.0006
##      9        0.1125             nan     0.1000    0.0006
##     10        0.1111             nan     0.1000   -0.0006
##     20        0.0968             nan     0.1000    0.0005
##     40        0.0762             nan     0.1000   -0.0001
##     60        0.0660             nan     0.1000    0.0001
##     80        0.0593             nan     0.1000   -0.0002
##    100        0.0545             nan     0.1000   -0.0002
##    120        0.0498             nan     0.1000   -0.0001
##    140        0.0454             nan     0.1000   -0.0002
##    150        0.0443             nan     0.1000   -0.0002
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
```

```
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1313             nan     0.1000    0.0251
##      2        0.1272             nan     0.1000    0.0017
##      3        0.1217             nan     0.1000    0.0027
##      4        0.1180             nan     0.1000    0.0014
##      5        0.1128             nan     0.1000    0.0021
##      6        0.1091             nan     0.1000    0.0003
##      7        0.1059             nan     0.1000    0.0011
##      8        0.1016             nan     0.1000    0.0006
##      9        0.0997             nan     0.1000    0.0003
##     10        0.0973             nan     0.1000   -0.0003
##     20        0.0818             nan     0.1000    0.0006
##     40        0.0635             nan     0.1000   -0.0002
##     60        0.0539             nan     0.1000   -0.0002
##     80        0.0465             nan     0.1000   -0.0002
##    100        0.0391             nan     0.1000   -0.0002
##    120        0.0339             nan     0.1000   -0.0002
##    140        0.0301             nan     0.1000   -0.0000
##    150        0.0284             nan     0.1000   -0.0001
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 12: coldwar has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 16: decade4 has no variation.
## Iter   TrainDeviance   ValidDeviance   StepSize   Improve
##      1        0.1670             nan     0.1000    0.0049
##      2        0.1612             nan     0.1000    0.0032
##      3        0.1555             nan     0.1000    0.0021
##      4        0.1504             nan     0.1000    0.0018
##      5        0.1472             nan     0.1000    0.0012
##      6        0.1450             nan     0.1000    0.0009
##      7        0.1418             nan     0.1000    0.0012
##      8        0.1396             nan     0.1000    0.0009
##      9        0.1370             nan     0.1000    0.0011
##     10        0.1351             nan     0.1000    0.0007
##     20        0.1225             nan     0.1000    0.0003
##     40        0.1107             nan     0.1000    0.0003
##     60        0.1010             nan     0.1000   -0.0000
##     80        0.0940             nan     0.1000   -0.0002
##    100        0.0886             nan     0.1000   -0.0001
##    120        0.0862             nan     0.1000   -0.0002
##    140        0.0824             nan     0.1000   -0.0001
##    150        0.0799             nan     0.1000   -0.0002
```

```
results<-resamples(models)
summary(results)
```

```
##
## Call:
## summary.resamples(object = results)
##
## Models: glmnet, rf, gbm
## Number of resamples: 10
##
## ROC
##             Min.   1st Qu.    Median      Mean   3rd Qu.      Max. NA's
## glmnet 0.7083795 0.7929125 0.8554817 0.8352212 0.8921189 0.9128830    0
## rf     0.8143226 0.9292174 0.9500738 0.9343521 0.9677246 0.9817276    0
## gbm    0.8623108 0.9276947 0.9641934 0.9452328 0.9682540 0.9727541    0
##
## Sens
##             Min.  1st Qu.    Median      Mean 3rd Qu. Max. NA's
## glmnet 0.9974227 1.000000 1.0000000 0.9997423       1    1    0
## rf     0.9974160 1.000000 1.0000000 0.9997416       1    1    0
## gbm    0.9948320 0.997416 0.9987113 0.9984503       1    1    0
##
## Spec
##        Min. 1st Qu.    Median       Mean   3rd Qu.      Max. NA's
## glmnet    0       0 0.0000000 0.00000000 0.0000000 0.0000000    0
## rf        0       0 0.0000000 0.01428571 0.0000000 0.1428571    0
## gbm       0       0 0.1428571 0.12857143 0.1428571 0.4285714    0
```

```
stackControl<-trainControl(method="cv",
                           number = 10,
                           summaryFunction = twoClassSummary,
                           classProbs = T,
                           savePredictions = TRUE,
                           allowParallel = TRUE)

set.seed(38745)
stack.keras<-caretStack(models, method = "monmlp", metric="ROC", trControl = stackControl)
```

```
## ** Ensemble 1
## 0.7912558
## ** 0.7912558
##
## ** Ensemble 1
## 0.6981366
## ** 0.6981366
##
## ** Ensemble 1
## 0.6987086
## ** 0.6987086
##
## ** Ensemble 1
## 0.7942321
## ** 0.7942321
##
## ** Ensemble 1
## 0.7276381
## ** 0.7276381
##
## ** Ensemble 1
## 0.7088583
## ** 0.7088583
##
## ** Ensemble 1
## 0.7989577
## ** 0.7989577
##
## ** Ensemble 1
## 0.7221918
## ** 0.7221918
##
## ** Ensemble 1
## 0.7226149
## ** 0.7226149
##
## ** Ensemble 1
## 0.7854547
## ** 0.7854547
##
## ** Ensemble 1
## 0.6977028
## ** 0.6977028
##
## ** Ensemble 1
## 0.6810872
## ** 0.6810872
##
## ** Ensemble 1
## 0.8060264
## ** 0.8060264
##
## ** Ensemble 1
## 0.7143915
## ** 0.7143915
##
## ** Ensemble 1
## 0.6539457
## ** 0.6539457
##
## ** Ensemble 1
## 0.7702113
## ** 0.7702113
##
## ** Ensemble 1
## 0.7102702
## ** 0.7102702
##
## ** Ensemble 1
## 0.6020368
## ** 0.6020368
##
## ** Ensemble 1
## 0.7594912
## ** 0.7594912
##
## ** Ensemble 1
## 0.6669404
## ** 0.6669404
##
## ** Ensemble 1
## 0.6574597
## ** 0.6574597
##
## ** Ensemble 1
## 0.7761929
## ** 0.7761929
##
## ** Ensemble 1
## 0.7031958
## ** 0.7031958
##
## ** Ensemble 1
## 0.6698391
## ** 0.6698391
##
## ** Ensemble 1
## 0.7875393
## ** 0.7875393
##
## ** Ensemble 1
## 0.7041783
## ** 0.7041783
##
## ** Ensemble 1
## 0.6863098
## ** 0.6863098
##
## ** Ensemble 1
## 0.825561
## ** 0.825561
##
## ** Ensemble 1
## 0.7330561
## ** 0.7330561
##
## ** Ensemble 1
## 0.6989418
## ** 0.6989418
##
## ** Ensemble 1
## 0.7918568
## ** 0.7918568
```

```
pred.stack_nn<-predict(stack.keras, newdata = testing, type = "raw")
```

```
confusionMatrix(pred.stack_nn, testing$warstds, positive = "CivilWar", mode = "everything")
```

```
## Confusion Matrix and Statistics
## 
##           Reference
## Prediction None CivilWar
##   None     3142       44
##   CivilWar   11        3
## 
##                Accuracy : 0.9828
##                  95% CI : (0.9777, 0.987)
##     No Information Rate : 0.9853
##     P-Value [Acc > NIR] : 0.8921
## 
##                   Kappa : 0.0922
## 
##  Mcnemar's Test P-Value : 1.597e-05
## 
##             Sensitivity : 0.0638298
##             Specificity : 0.9965113
##          Pos Pred Value : 0.2142857
##          Neg Pred Value : 0.9861896
##               Precision : 0.2142857
##                  Recall : 0.0638298
##                      F1 : 0.0983607
##              Prevalence : 0.0146875
##          Detection Rate : 0.0009375
##    Detection Prevalence : 0.0043750
##       Balanced Accuracy : 0.5301705
## 
##        'Positive' Class : CivilWar
## 
```

The ensemble model does not outperform any of the individual models on any metric that we have looked at above (accuracy, precision, recall, or F1). I would say that random forests is the most accurate model because it produces the highest number of accurate predictions, even though it does have a relatively high level of false positives. Still, it provides more information than models that have only a handful of true positives.