Text as Data Final Paper

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May 10, 2016

```
# LDA model for debate: debate_LDA_15
# topic names for debate: debate_LDA_15_names
# data frame for twitter: twitter.df
# dfm for twitter: twitter_dfm
# posterior topic distribution (LDA) = @gamma
# LDA model for twitter: use simple_lda_20, simple_lda_15, simple_lda_10
# LDA posterior for twitter using debate topics: twitter.topics$topics
all(nrow(twitter_dfm) == sum(twitter.df$debate_topic != 0),
    nrow(twitter_dfm)  == nrow(twitter.topics$topics))
```

```
## [1] TRUE
```

```
table(twitter.df$debate_topic)
```

```
## 
##    0    1    2    3    4    5    6    7    8    9   10   11   12   13   14 
## 2940  525  937  430  533 1387  618  490  617  622  673  406 2340  480  415 
##   15 
##  456
```

```
debate_LDA_15_names
```

```
##  [1] "common core"  "mods1"        "foreign pol"  "social sec"  
##  [5] "mods1"        "immigration"  "economics"    "border"      
##  [9] "budget"       "Paul Ryan"    "military"     "mods2"       
## [13] "gen election" "iran"         "marriage"
```

```
# pos.neg <- dplyr::select(twitter.df[tweet_indices,], -tweet_created)
# pos.neg <- filter(pos.neg, sentiment != "Neutral")
# pos.neg$candidate[pos.neg$candidate == "OTHER"] <- NA
# pos.neg$subject_matter[pos.neg$subject_matter == "None of the above"] <- NA
# pos.neg <- droplevels(pos.neg)
levels(pos.neg$sentiment)
```

```
## [1] "Negative" "Positive"
```

```
levels(pos.neg$candidate)
```

```
##  [1] "Ben Carson"     "Chris Christie" "Donald Trump"   "Jeb Bush"      
##  [5] "John Kasich"    "Marco Rubio"    "Mike Huckabee"  "Rand Paul"     
##  [9] "Scott Walker"   "Ted Cruz"
```

```
levels(pos.neg$subject_matter)
```

```
 [1] "Abortion"
 [2] "Foreign Policy"
 [3] "FOX News or Moderators"
 [4] "Gun Control"
 [5] "Healthcare (including Medicare)"
 [6] "Immigration"
 [7] "Jobs and Economy"
 [8] "LGBT issues"
 [9] "Racial issues"
[10] "Religion"
[11] "Women's Issues (not abortion though)"
```

```
dropped.rows <- which(twitter.df[tweet_indices, "sentiment"] == "Neutral")
nrow(pos.neg) + length(dropped.rows) == nrow(twitter.topics$topics)
```

```
[1] TRUE
```

```
all(dim(simple_lda_15@gamma) == dim(twitter.topics$topics),
    class(simple_lda_15@gamma) == class(twitter.topics$topics))
```

```
[1] TRUE
```

```
dim(simple_lda_25@gamma[-dropped.rows,])
```

```
[1] 8722   25
```

```
dim(twitter.topics$topics[-dropped.rows,])
```

```
[1] 8722   15
```

```
all(abs(rowSums(simple_lda_25@gamma) - 1) < 1e-10)
```

```
[1] TRUE
```

```
all(abs(rowSums(twitter.topics$topics) - 1) < 1e-10)
```

```
[1] TRUE
```

```
# build a logistic regression from lda model parameters, additional predictors as parameter
glm_lda_model <- function(lda_model_post, modified_data,
                          predictors = c("candidate", "subject_matter")) {
    x <- lda_model_post[,-2] # need to drop one of the topics, I drop #2
    colnames(x) <- paste("topic", 1:(ncol(x)+1), sep=".")[-2]
    data <- cbind(modified_data, x)
    formula <- paste("sentiment ~ ",
                     paste(c(colnames(x), predictors), collapse = " + "))
    fit <- glm(as.formula(formula) , data = data, family = "binomial")
    print(summary(fit))
    fit
}

# use forward-backward stepwise procedure with AIC criterion to choose best model from full model
stepwise_twitter <- function(lda_model_post, modified_data,
                        predictors = c("candidate", "subject_matter")) {
  x <- lda_model_post # don't drop any topics
  colnames(x) <- paste("topic", 1:(ncol(x)), sep=".")
  data <- cbind(modified_data, x)
  formula <- paste("sentiment ~ ",
                   paste(c(colnames(x), predictors), collapse = " + "))
  fit <- glm(as.formula(formula) , data = data, family = "binomial")
  stepAIC(fit, trace = FALSE) # stops verbose printing
}
```

```
sentiment_twitter_candidate_10 <- glm_lda_model(simple_lda_10@gamma[-dropped.rows,] ,
                              modified_data = pos.neg, predictors = "candidate")
sentiment_twitter_candidate_15 <- glm_lda_model(simple_lda_15@gamma[-dropped.rows,] ,
                              modified_data = pos.neg, predictors = "candidate")
sentiment_twitter_candidate_20 <- glm_lda_model(simple_lda_20@gamma[-dropped.rows,] ,
                              modified_data = pos.neg, predictors = "candidate")
sentiment_twitter_candidate_25 <- glm_lda_model(simple_lda_25@gamma[-dropped.rows,] ,
                              modified_data = pos.neg, predictors = "candidate")
sentiment_twitter_candidate_30 <- glm_lda_model(simple_lda_30@gamma[-dropped.rows,] ,
                              modified_data = pos.neg, predictors = "candidate")
sentiment_twitter_candidate_50 <- glm_lda_model(simple_lda_50@gamma[-dropped.rows,] ,
                              modified_data = pos.neg, predictors = "candidate")
```

```
which.max(c(k10 = simple_lda_10@loglikelihood, k15 = simple_lda_15@loglikelihood,
            k20 = simple_lda_20@loglikelihood, k25 = simple_lda_25@loglikelihood,
            k30 = simple_lda_30@loglikelihood, k50 = simple_lda_50@loglikelihood))
```

```
    k25
      4
```

```
which.min(c(k10 = AIC(sentiment_twitter_candidate_10), k15 = AIC(sentiment_twitter_candidate_15),
          k20 = AIC(sentiment_twitter_candidate_20), k25 = AIC(sentiment_twitter_candidate_25),
          k30 = AIC(sentiment_twitter_candidate_30), k50 = AIC(sentiment_twitter_candidate_50)))
```

```
    k25
      4
```

```
sort(c(k10 = BIC(sentiment_twitter_candidate_10), k15 = BIC(sentiment_twitter_candidate_15),
            k20 = BIC(sentiment_twitter_candidate_20), k25 = BIC(sentiment_twitter_candidate_25),
            k30 = BIC(sentiment_twitter_candidate_30), k50 = BIC(sentiment_twitter_candidate_50)),
     decreasing = TRUE)
```

```
         k50      k30      k15      k25      k20      k10
    5301.986 5183.816 5143.212 5119.215 5089.087 5084.702
```

```r
anova(sentiment_twitter_candidate_20, sentiment_twitter_candidate_25, test="Chisq")
```

```
Analysis of Deviance Table

Model 1: sentiment ~ topic.1 + topic.3 + topic.4 + topic.5 + topic.6 + 
    topic.7 + topic.8 + topic.9 + topic.10 + topic.11 + topic.12 + 
    topic.13 + topic.14 + topic.15 + topic.16 + topic.17 + topic.18 + 
    topic.19 + topic.20 + candidate
Model 2: sentiment ~ topic.1 + topic.3 + topic.4 + topic.5 + topic.6 + 
    topic.7 + topic.8 + topic.9 + topic.10 + topic.11 + topic.12 + 
    topic.13 + topic.14 + topic.15 + topic.16 + topic.17 + topic.18 + 
    topic.19 + topic.20 + topic.21 + topic.22 + topic.23 + topic.24 + 
    topic.25 + candidate
  Resid. Df Resid. Dev Df Deviance Pr(>Chi)  
1      4607     4844.3                        
2      4602     4832.2  5    12.08   0.0337 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
sentiment_debate_candidate <- glm_lda_model(twitter.topics$topics[-dropped.rows,] ,
                                modified_data = pos.neg, predictors = "candidate")
```

```
Call:
glm(formula = as.formula(formula), family = "binomial", data = data)

Deviance Residuals: 
    Min       1Q   Median       3Q      Max  
-1.6155  -0.7945  -0.6544   1.0755   2.5197  

Coefficients:
                        Estimate Std. Error z value Pr(>|z|)    
(Intercept)              -0.2373     0.2486  -0.954  0.33988    
topic.1                  -0.1039     0.5407  -0.192  0.84760    
topic.3                  -0.2809     0.5949  -0.472  0.63680    
topic.4                  -0.7597     0.5416  -1.403  0.16069    
topic.5                  -0.1932     0.3620  -0.534  0.59353    
topic.6                   1.1004     0.4433   2.483  0.01304 *  
topic.7                   0.8795     0.5398   1.629  0.10325    
topic.8                   0.2195     0.4832   0.454  0.64962    
topic.9                   0.5589     0.4449   1.256  0.20901    
topic.10                  0.1810     0.4278   0.423  0.67225    
topic.11                 -0.4272     0.4949  -0.863  0.38800    
topic.12                  0.2434     0.3346   0.727  0.46703    
topic.13                 -0.2289     0.4552  -0.503  0.61505    
topic.14                  1.2349     0.4708   2.623  0.00873 ** 
topic.15                 -0.1230     0.4439  -0.277  0.78173    
candidateChris Christie  -1.7096     0.2362  -7.237 4.57e-13 ***
candidateDonald Trump    -0.9433     0.1441  -6.546 5.91e-11 ***
candidateJeb Bush        -2.7767     0.2191 -12.674  < 2e-16 ***
candidateJohn Kasich      0.4412     0.2087   2.114  0.03450 *  
candidateMarco Rubio      0.1148     0.1929   0.595  0.55181    
```

```
candidateMike Huckabee   -1.2379     0.2066  -5.993 2.07e-09 ***
candidateRand Paul       -0.8864     0.2200  -4.029 5.59e-05 ***
candidateScott Walker    -1.5672     0.2374  -6.603 4.03e-11 ***
candidateTed Cruz         0.2480     0.1617   1.534  0.12503    
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 5551.6  on 4635  degrees of freedom
Residual deviance: 4967.0  on 4612  degrees of freedom
  (4086 observations deleted due to missingness)
AIC: 5015

Number of Fisher Scoring iterations: 5
```

```
AIC(sentiment_debate_candidate); BIC(sentiment_debate_candidate)
```

```
[1] 5015.035
```

```
[1] 5169.634
```

```
AIC(sentiment_twitter_candidate_25); BIC(sentiment_twitter_candidate_25)
```

```
[1] 4900.2
```

```
[1] 5119.215
```

```
anova(sentiment_debate_candidate, sentiment_twitter_candidate_25, test="Chisq")
```

```
Analysis of Deviance Table

Model 1: sentiment ~ topic.1 + topic.3 + topic.4 + topic.5 + topic.6 + 
    topic.7 + topic.8 + topic.9 + topic.10 + topic.11 + topic.12 + 
    topic.13 + topic.14 + topic.15 + candidate
Model 2: sentiment ~ topic.1 + topic.3 + topic.4 + topic.5 + topic.6 + 
    topic.7 + topic.8 + topic.9 + topic.10 + topic.11 + topic.12 + 
    topic.13 + topic.14 + topic.15 + topic.16 + topic.17 + topic.18 + 
    topic.19 + topic.20 + topic.21 + topic.22 + topic.23 + topic.24 + 
    topic.25 + candidate
  Resid. Df Resid. Dev Df Deviance  Pr(>Chi)    
1      4612     4967.0                          
2      4602     4832.2 10   134.84 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
require(MASS)
```

```
Loading required package: MASS
```

```r
step_25_candidate_subject <- stepwise_twitter(simple_lda_25@gamma[-dropped.rows,],
                            pos.neg.sub, predictors = c("candidate", "subject_matter"))
step_25_candidate_subject$anova
```

```
Stepwise Model Path 
Analysis of Deviance Table

Initial Model:
sentiment ~ topic.1 + topic.2 + topic.3 + topic.4 + topic.5 + 
    topic.6 + topic.7 + topic.8 + topic.9 + topic.10 + topic.11 + 
    topic.12 + topic.13 + topic.14 + topic.15 + topic.16 + topic.17 + 
    topic.18 + topic.19 + topic.20 + topic.21 + topic.22 + topic.23 + 
    topic.24 + topic.25 + candidate + subject_matter

Final Model:
sentiment ~ topic.1 + topic.2 + topic.3 + topic.4 + topic.6 + 
    topic.8 + topic.11 + topic.13 + topic.14 + topic.15 + topic.16 + 
    topic.17 + topic.19 + topic.22 + topic.23 + topic.24 + candidate + 
    subject_matter


         Step Df   Deviance Resid. Df Resid. Dev      AIC
1                                8676   7371.464 7463.464
2  - topic.25  0 0.00000000      8676   7371.464 7463.464
3   - topic.5  1 0.04248644      8677   7371.506 7461.506
4  - topic.10  1 0.06326254      8678   7371.570 7459.570
5   - topic.9  1 0.06924882      8679   7371.639 7457.639
6  - topic.21  1 0.16682058      8680   7371.806 7455.806
7   - topic.7  1 0.49511827      8681   7372.301 7454.301
8  - topic.18  1 0.72221103      8682   7373.023 7453.023
9  - topic.20  1 1.08137289      8683   7374.104 7452.104
10 - topic.12  1 1.47842730      8684   7375.583 7451.583
```

```r
summary(step_25_candidate_subject)
```

```

Call:
glm(formula = sentiment ~ topic.1 + topic.2 + topic.3 + topic.4 + 
    topic.6 + topic.8 + topic.11 + topic.13 + topic.14 + topic.15 + 
    topic.16 + topic.17 + topic.19 + topic.22 + topic.23 + topic.24 + 
    candidate + subject_matter, family = "binomial", data = data)

Deviance Residuals: 
    Min       1Q   Median       3Q      Max  
-1.9741  -0.6583  -0.4530  -0.2559   2.8157  

Coefficients:
                                                     Estimate Std. Error
(Intercept)                                         -5.282085   1.354942
topic.1                                             13.711103   4.049753
topic.2                                            -11.620507   5.948299
topic.3                                             10.878613   4.879918
topic.4                                             10.579727   3.776517
topic.6                                             11.553613   4.852787
topic.8                                              8.867997   5.847927
topic.11                                            -8.925792   5.476606
topic.13                                             9.721931   5.511908
topic.14                                            27.278398   4.883344
topic.15                                            30.948666   4.901999
topic.16                                           -13.841999   7.144440
topic.17                                           -11.059203   5.432706
topic.19                                            22.451599   4.801794
topic.22                                            15.048531   3.703971
topic.23                                           -19.988527   6.336070
topic.24                                            24.278079   5.178959
candidateChris Christie                             -1.553775   0.255412
candidateDonald Trump                               -1.180442   0.138379
candidateJeb Bush                                   -2.574033   0.260114
candidateJohn Kasich                                 0.318412   0.203706
candidateMarco Rubio                                -0.201864   0.199531
candidateMike Huckabee                              -0.999883   0.225492
candidateRand Paul                                  -1.052019   0.213535
candidateScott Walker                               -1.630008   0.232306
candidateTed Cruz                                   -0.123238   0.169722
candidateother                                      -2.110719   0.136885
subject_matterForeign Policy                         0.147148   0.301641
subject_matterFOX News or Moderators                 0.293252   0.245595
subject_matterGun Control                          -13.193683 215.215383
subject_matterHealthcare (including Medicare)        0.487323   0.436864
subject_matterImmigration                            0.912597   0.316465
subject_matterJobs and Economy                      -0.001804   0.318501
subject_matterLGBT issues                            0.148386   0.367211
subject_matterRacial issues                         -0.827960   0.343091
subject_matterReligion                              -0.711367   0.341760
subject_matterWomen's Issues (not abortion though)  -1.306857   0.398521
subject_matterother                                  0.737697   0.236063
                                                   z value Pr(>|z|)    
(Intercept)                                         -3.898 9.68e-05 ***
topic.1                                              3.386  0.00071 ***
topic.2                                             -1.954  0.05075 .  
topic.3                                              2.229  0.02580 *  
topic.4                                              2.801  0.00509 ** 
topic.6                                              2.381  0.01727 *  
topic.8                                              1.516  0.12941    
topic.11                                            -1.630  0.10314    
topic.13                                             1.764  0.07776 .  
topic.14                                             5.586 2.32e-08 ***
topic.15                                             6.313 2.73e-10 ***
topic.16                                            -1.937  0.05269 .  
topic.17                                            -2.036  0.04178 *  
topic.19                                             4.676 2.93e-06 ***
topic.22                                             4.063 4.85e-05 ***
topic.23                                            -3.155  0.00161 ** 
topic.24                                             4.688 2.76e-06 ***
candidateChris Christie                             -6.083 1.18e-09 ***
candidateDonald Trump                               -8.531  < 2e-16 ***
```

```
candidateJeb Bush                                   -9.896  < 2e-16 ***
candidateJohn Kasich                                 1.563  0.11803    
candidateMarco Rubio                                -1.012  0.31169    
candidateMike Huckabee                              -4.434 9.24e-06 ***
candidateRand Paul                                  -4.927 8.36e-07 ***
candidateScott Walker                               -7.017 2.27e-12 ***
candidateTed Cruz                                   -0.726  0.46777    
candidateother                                     -15.420  < 2e-16 ***
subject_matterForeign Policy                         0.488  0.62567    
subject_matterFOX News or Moderators                 1.194  0.23246    
subject_matterGun Control                           -0.061  0.95112    
subject_matterHealthcare (including Medicare)        1.116  0.26464    
subject_matterImmigration                            2.884  0.00393 ** 
subject_matterJobs and Economy                      -0.006  0.99548    
subject_matterLGBT issues                            0.404  0.68615    
subject_matterRacial issues                         -2.413  0.01581 *  
subject_matterReligion                              -2.081  0.03739 *  
subject_matterWomen's Issues (not abortion though)  -3.279  0.00104 ** 
subject_matterother                                  3.125  0.00178 ** 
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 8774.8  on 8721  degrees of freedom
Residual deviance: 7375.6  on 8684  degrees of freedom
AIC: 7451.6

Number of Fisher Scoring iterations: 14
```

```
step_debate_topics <- stepwise_twitter(twitter.topics$topics[-dropped.rows,],
                        pos.neg.sub, predictors = c("candidate", "subject_matter"))
step_debate_topics$anova
```

```
Stepwise Model Path 
Analysis of Deviance Table

Initial Model:
sentiment ~ topic.1 + topic.2 + topic.3 + topic.4 + topic.5 + 
    topic.6 + topic.7 + topic.8 + topic.9 + topic.10 + topic.11 + 
    topic.12 + topic.13 + topic.14 + topic.15 + candidate + subject_matter

Final Model:
sentiment ~ topic.3 + topic.4 + topic.5 + topic.9 + candidate + 
    subject_matter


         Step Df  Deviance Resid. Df Resid. Dev      AIC
1                               8686   7506.915 7578.915
2  - topic.15  0 0.0000000      8686   7506.915 7578.915
3  - topic.11  1 0.0361263      8687   7506.951 7576.951
4  - topic.13  1 0.1544666      8688   7507.105 7575.105
5   - topic.2  1 0.1144348      8689   7507.220 7573.220
6   - topic.1  1 0.1522128      8690   7507.372 7571.372
```

```
7  - topic.10  1 1.0886845      8691   7508.461 7570.461
8  - topic.12  1 1.2258320      8692   7509.687 7569.687
9   - topic.6  1 0.8967099      8693   7510.583 7568.583
10 - topic.14  1 0.9235075      8694   7511.507 7567.507
11  - topic.8  1 0.9577672      8695   7512.465 7566.465
12  - topic.7  1 1.3343270      8696   7513.799 7565.799
```

```r
summary(step_debate_topics)
```

```
Call:
glm(formula = sentiment ~ topic.3 + topic.4 + topic.5 + topic.9 + 
    candidate + subject_matter, family = "binomial", data = data)

Deviance Residuals: 
    Min       1Q   Median       3Q      Max  
-1.4871  -0.6432  -0.4516  -0.2665   3.0724  

Coefficients:
                                                    Estimate Std. Error
(Intercept)                                         -0.38258    0.26277
topic.3                                             -0.84461    0.44540
topic.4                                             -1.38034    0.39837
topic.5                                             -0.54730    0.20716
topic.9                                              0.44076    0.26667
candidateChris Christie                             -1.83143    0.23146
candidateDonald Trump                               -0.95344    0.13538
candidateJeb Bush                                   -2.96046    0.21748
candidateJohn Kasich                                 0.31489    0.20195
candidateMarco Rubio                                 0.03744    0.19177
candidateMike Huckabee                              -1.27677    0.19832
candidateRand Paul                                  -1.01944    0.20981
candidateScott Walker                               -1.54588    0.22962
candidateTed Cruz                                    0.14478    0.15684
candidateother                                      -1.97076    0.13278
subject_matterForeign Policy                         0.03311    0.29551
subject_matterFOX News or Moderators                 0.18841    0.23921
subject_matterGun Control                          -12.40812  131.77517
subject_matterHealthcare (including Medicare)        0.50775    0.43309
subject_matterImmigration                            0.93757    0.29532
subject_matterJobs and Economy                       0.06306    0.31517
subject_matterLGBT issues                            0.08448    0.35991
subject_matterRacial issues                         -0.89991    0.34039
subject_matterReligion                              -0.76217    0.33691
subject_matterWomen's Issues (not abortion though)  -1.32550    0.39724
subject_matterother                                  0.69955    0.23190
                                                   z value Pr(>|z|)    
(Intercept)                                         -1.456 0.145414    
topic.3                                             -1.896 0.057922 .  
topic.4                                             -3.465 0.000530 ***
topic.5                                             -2.642 0.008245 ** 
topic.9                                              1.653 0.098367 .  
candidateChris Christie                             -7.912 2.52e-15 ***
candidateDonald Trump                               -7.043 1.89e-12 ***
```

```
candidateJeb Bush                                 -13.613  < 2e-16 ***
candidateJohn Kasich                                1.559 0.118928    
candidateMarco Rubio                                0.195 0.845204    
candidateMike Huckabee                             -6.438 1.21e-10 ***
candidateRand Paul                                 -4.859 1.18e-06 ***
candidateScott Walker                              -6.732 1.67e-11 ***
candidateTed Cruz                                   0.923 0.355957    
candidateother                                    -14.843  < 2e-16 ***
subject_matterForeign Policy                        0.112 0.910784    
subject_matterFOX News or Moderators                0.788 0.430916    
subject_matterGun Control                          -0.094 0.924981    
subject_matterHealthcare (including Medicare)       1.172 0.241037    
subject_matterImmigration                           3.175 0.001500 ** 
subject_matterJobs and Economy                      0.200 0.841410    
subject_matterLGBT issues                           0.235 0.814423    
subject_matterRacial issues                        -2.644 0.008199 ** 
subject_matterReligion                             -2.262 0.023681 *  
subject_matterWomen's Issues (not abortion though) -3.337 0.000848 ***
subject_matterother                                 3.017 0.002557 ** 
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 8774.8  on 8721  degrees of freedom
Residual deviance: 7513.8  on 8696  degrees of freedom
AIC: 7565.8

Number of Fisher Scoring iterations: 13
```

```
anova(step_debate_topics, step_25_candidate_subject, test="Chisq")
```

```
Analysis of Deviance Table

Model 1: sentiment ~ topic.3 + topic.4 + topic.5 + topic.9 + candidate + 
    subject_matter
Model 2: sentiment ~ topic.1 + topic.2 + topic.3 + topic.4 + topic.6 + 
    topic.8 + topic.11 + topic.13 + topic.14 + topic.15 + topic.16 + 
    topic.17 + topic.19 + topic.22 + topic.23 + topic.24 + candidate + 
    subject_matter
  Resid. Df Resid. Dev Df Deviance  Pr(>Chi)    
1      8696     7513.8                          
2      8684     7375.6 12   138.22 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```