

Chapter 4, Machine Learning with R, Brett Lantz

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5/13/2017

```
sms_raw <- read.csv('sms_spam.csv', stringsAsFactors = FALSE)

str(sms_raw)

## 'data.frame': 5574 obs. of 2 variables:
## $ type: chr "ham" "ham" "spam" "ham" ...
## $ text: chr "Go until jurong point, crazy.. Available only in bugis n great world la e buffet... C

sms_raw$type <- as.factor(sms_raw$type)
str(sms_raw$type)

## Factor w/ 2 levels "ham","spam": 1 1 2 1 1 2 1 1 2 2 ...
table(sms_raw$type)

##
## ham spam
## 4827 747

library(tm)

## Warning: package 'tm' was built under R version 3.3.2
## Loading required package: NLP
## Warning: package 'NLP' was built under R version 3.3.2

sms_corpus <- VCorpus(VectorSource(sms_raw$text))
print(sms_corpus)

## <<VCorpus>>
## Metadata: corpus specific: 0, document level (indexed): 0
## Content: documents: 5574

inspect(sms_corpus[1:2])

## <<VCorpus>>
## Metadata: corpus specific: 0, document level (indexed): 0
## Content: documents: 2
##
## [[1]]
## <<PlainTextDocument>>
## Metadata: 7
## Content: chars: 111
##
## [[2]]
## <<PlainTextDocument>>
## Metadata: 7
## Content: chars: 29

as.character(sms_corpus[[1]])

## [1] "Go until jurong point, crazy.. Available only in bugis n great world la e buffet... Cine there g
```

```

lapply(sms_corpus[1:2], as.character)

## $`1`
## [1] "Go until jurong point, crazy.. Available only in bugis n great world la e buffet... Cine there
##
## $`2`
## [1] "Ok lar... Joking wif u oni..."

sms_corpus_clean <- tm_map(sms_corpus, content_transformer(tolower))
as.character(sms_corpus_clean[[1]])

## [1] "go until jurong point, crazy.. available only in bugis n great world la e buffet... cine there
sms_corpus_clean <- tm_map(sms_corpus_clean, removeNumbers)

sms_corpus_clean <- tm_map(sms_corpus_clean, removeWords, stopwords())

sms_corpus_clean <- tm_map(sms_corpus_clean, removePunctuation)

library(SnowballC)
sms_corpus_clean <- tm_map(sms_corpus_clean, stemDocument)

sms_corpus_clean <- tm_map(sms_corpus_clean, stripWhitespace)

as.character(sms_corpus_clean[10:12])

## [1] "list(list(content = \"mobil month u r entitl updat latest colour mobil camera free call mobil up
## [2] "list()"
## [3] "list()"

sms_dtm <- DocumentTermMatrix(sms_corpus_clean)
sms_dtm2 <- DocumentTermMatrix(sms_corpus, control = list(tolower = TRUE,
                                                         removeNumbers = TRUE,
                                                         stopwords = TRUE,
                                                         removePunctuation = TRUE,
                                                         stemming = TRUE
                                                         ))

sms_dtm

## <<DocumentTermMatrix (documents: 5574, terms: 6564)>>
## Non-/sparse entries: 42589/36545147
## Sparsity           : 100%
## Maximal term length: 40
## Weighting           : term frequency (tf)

sms_dtm2

## <<DocumentTermMatrix (documents: 5574, terms: 8326)>>
## Non-/sparse entries: 44197/46364927
## Sparsity           : 100%
## Maximal term length: 40
## Weighting           : term frequency (tf)

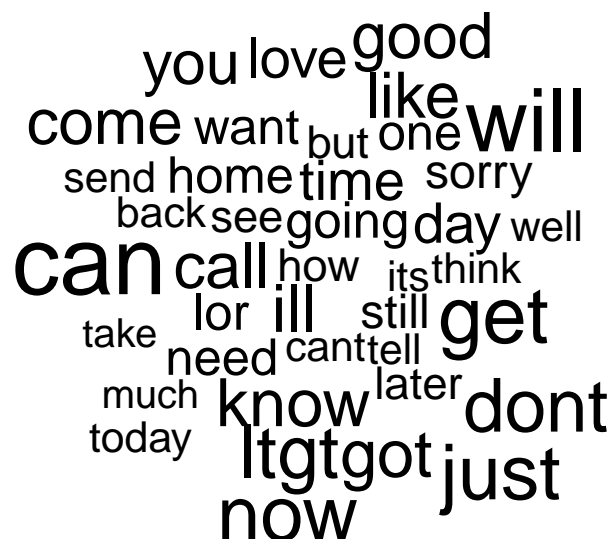
sms_dtm_train <- sms_dtm[1:4169,]
sms_dtm_test <- sms_dtm[4170:5559,]

sms_train_labels <- sms_raw[1:4169,]$type
sms_test_labels <- sms_raw[4170:5559,]$type

```




```
wordcloud(ham$text, max.words = 40, scale = c(3, 0.5))
```



```
sms_freq_words <- findFreqTerms(sms_dtm_train, 5)
```

```
str(sms_freq_words)
```

```
## chr [1:1156] "abiola" "abl" "abt" "accept" "access" ...
```

```
sms_dtm_freq_train <- sms_dtm_train[, sms_freq_words]
```

```
sms_dtm_freq_test <- sms_dtm_test[, sms_freq_words]
```

```
convert_counts <- function(x) {
  x <- ifelse(x > 0, "Yes", "No")
}
```

```
sms_train <- apply(sms_dtm_freq_train, 2, convert_counts)
```

```
sms_test <- apply(sms_dtm_freq_test, 2, convert_counts)
```

```
library(e1071)
```

```
sms_classifier <- naiveBayes(sms_train, sms_train_labels)
```

```
sms_classifier
```

```
##
```

```
## Naive Bayes Classifier for Discrete Predictors
```

```
##
```

```
## Call:
```

```

## naiveBayes.default(x = sms_train, y = sms_train_labels)
##
## A-priori probabilities:
## sms_train_labels
##      ham      spam
## 0.8647158 0.1352842
##
## Conditional probabilities:
##      abiola
## sms_train_labels      No      Yes
##      ham 0.996948682 0.003051318
##      spam 1.000000000 0.000000000
##
##      abl
## sms_train_labels      No      Yes
##      ham 0.995006935 0.004993065
##      spam 1.000000000 0.000000000
##
##      abt
## sms_train_labels      No      Yes
##      ham 0.99445215 0.00554785
##      spam 1.00000000 0.00000000
##
##      accept
## sms_train_labels      No      Yes
##      ham 0.998335645 0.001664355
##      spam 1.000000000 0.000000000
##
##      access
## sms_train_labels      No      Yes
##      ham 0.999445215 0.000554785
##      spam 0.992907801 0.007092199
##
##      account
## sms_train_labels      No      Yes
##      ham 0.995839112 0.004160888
##      spam 0.980496454 0.019503546
##
##      across
## sms_train_labels      No      Yes
##      ham 0.997503467 0.002496533
##      spam 1.000000000 0.000000000
##
##      activ
## sms_train_labels      No      Yes
##      ham 0.99889043 0.00110957
##      spam 0.98758865 0.01241135
##
##      actual
## sms_train_labels      No      Yes
##      ham 0.993065187 0.006934813
##      spam 1.000000000 0.000000000
##
##      add

```

```

## sms_train_labels      No      Yes
##      ham 0.998335645 0.001664355
##      spam 1.000000000 0.000000000
##
##      address
## sms_train_labels      No      Yes
##      ham 0.996393897 0.003606103
##      spam 0.992907801 0.007092199
##
##      admir
## sms_train_labels      No      Yes
##      ham 1.0000000 0.0000000
##      spam 0.9858156 0.0141844
##
##      adult
## sms_train_labels      No      Yes
##      ham 0.999445215 0.000554785
##      spam 0.994680851 0.005319149
##
##      advanc
## sms_train_labels      No      Yes
##      ham 0.998335645 0.001664355
##      spam 1.000000000 0.000000000
##
##      aft
## sms_train_labels      No      Yes
##      ham 0.99556172 0.00443828
##      spam 1.00000000 0.00000000
##
##      afternoon
## sms_train_labels      No      Yes
##      ham 0.99334258 0.00665742
##      spam 1.00000000 0.00000000
##
##      aftr
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 1.000000000 0.000000000
##
##      age
## sms_train_labels      No      Yes
##      ham 0.998335645 0.001664355
##      spam 0.978723404 0.021276596
##
##      ago
## sms_train_labels      No      Yes
##      ham 0.997226075 0.002773925
##      spam 1.000000000 0.000000000
##
##      ahead
## sms_train_labels      No      Yes
##      ham 0.998058252 0.001941748
##      spam 1.000000000 0.000000000
##

```

```

##          aight
## sms_train_labels      No      Yes
##          ham  0.992787795  0.007212205
##          spam 1.000000000  0.000000000
##
##          aint
## sms_train_labels      No      Yes
##          ham  0.99778086  0.00221914
##          spam 1.00000000  0.00000000
##
##          air
## sms_train_labels      No      Yes
##          ham  0.998058252  0.001941748
##          spam 1.000000000  0.000000000
##
##          aiyah
## sms_train_labels      No      Yes
##          ham  0.998613037  0.001386963
##          spam 1.000000000  0.000000000
##
##          alex
## sms_train_labels      No      Yes
##          ham  0.998335645  0.001664355
##          spam 1.000000000  0.000000000
##
##          almost
## sms_train_labels      No      Yes
##          ham  0.996948682  0.003051318
##          spam 1.000000000  0.000000000
##
##          alon
## sms_train_labels      No      Yes
##          ham  0.997503467  0.002496533
##          spam 0.994680851  0.005319149
##
##          alreadi
## sms_train_labels      No      Yes
##          ham  0.98141470  0.01858530
##          spam 0.99822695  0.00177305
##
##          alright
## sms_train_labels      No      Yes
##          ham  0.995006935  0.004993065
##          spam 1.000000000  0.000000000
##
##          alrit
## sms_train_labels      No      Yes
##          ham  0.998058252  0.001941748
##          spam 1.000000000  0.000000000
##
##          also
## sms_train_labels      No      Yes
##          ham  0.986685160  0.013314840
##          spam 0.994680851  0.005319149

```

```

##
##          alway
## sms_train_labels      No      Yes
##          ham  0.98668516 0.01331484
##          spam 1.00000000 0.00000000
##
##          amp
## sms_train_labels      No      Yes
##          ham  0.98585298 0.01414702
##          spam 1.00000000 0.00000000
##
##          angri
## sms_train_labels      No      Yes
##          ham  0.997503467 0.002496533
##          spam 1.000000000 0.000000000
##
##          announc
## sms_train_labels      No      Yes
##          ham  0.9997226075 0.0002773925
##          spam 0.9911347518 0.0088652482
##
##          anoth
## sms_train_labels      No      Yes
##          ham  0.992510402 0.007489598
##          spam 1.000000000 0.000000000
##
##          answer
## sms_train_labels      No      Yes
##          ham  0.995284327 0.004715673
##          spam 0.989361702 0.010638298
##
##          anybodi
## sms_train_labels      No      Yes
##          ham  0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          anymor
## sms_train_labels      No      Yes
##          ham  0.99778086 0.00221914
##          spam 1.00000000 0.00000000
##
##          anyon
## sms_train_labels      No      Yes
##          ham  0.996393897 0.003606103
##          spam 0.998226950 0.001773050
##
##          anyth
## sms_train_labels      No      Yes
##          ham  0.98751734 0.01248266
##          spam 1.00000000 0.00000000
##
##          anytim
## sms_train_labels      No      Yes
##          ham  0.999445215 0.000554785

```



```

##          spam 0.982269504 0.017730496
##
##          anyway
## sms_train_labels      No      Yes
##          ham 0.99445215 0.00554785
##          spam 1.00000000 0.00000000
##
##          apart
## sms_train_labels      No      Yes
##          ham 0.997226075 0.002773925
##          spam 1.000000000 0.000000000
##
##          app
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 0.994680851 0.005319149
##
##          appli
## sms_train_labels      No      Yes
##          ham 0.9991678225 0.0008321775
##          spam 0.9592198582 0.0407801418
##
##          appoint
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          appreci
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          april
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          ard
## sms_train_labels      No      Yes
##          ham 0.99556172 0.00443828
##          spam 1.00000000 0.00000000
##
##          area
## sms_train_labels      No      Yes
##          ham 0.99889043 0.00110957
##          spam 0.98758865 0.01241135
##
##          argument
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          arm
## sms_train_labels      No      Yes

```

```

##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          around
## sms_train_labels      No          Yes
##          ham 0.988349515 0.011650485
##          spam 0.996453901 0.003546099
##
##          arrang
## sms_train_labels      No          Yes
##          ham 0.9991678225 0.0008321775
##          spam 0.9964539007 0.0035460993
##
##          arrest
## sms_train_labels      No          Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          arriv
## sms_train_labels      No          Yes
##          ham 0.9991678225 0.0008321775
##          spam 0.9893617021 0.0106382979
##
##          asap
## sms_train_labels      No          Yes
##          ham 0.999445215 0.000554785
##          spam 0.989361702 0.010638298
##
##          ask
## sms_train_labels      No          Yes
##          ham 0.976144244 0.023855756
##          spam 0.994680851 0.005319149
##
##          askd
## sms_train_labels      No          Yes
##          ham 0.996948682 0.003051318
##          spam 1.000000000 0.000000000
##
##          asleep
## sms_train_labels      No          Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          ass
## sms_train_labels      No          Yes
##          ham 0.996948682 0.003051318
##          spam 1.000000000 0.000000000
##
##          attempt
## sms_train_labels      No          Yes
##          ham 0.9997226075 0.0002773925
##          spam 0.9734042553 0.0265957447
##
##          auction

```

```

## sms_train_labels      No      Yes
##      ham 0.9997226075 0.0002773925
##      spam 0.9875886525 0.0124113475
##
##      avail
## sms_train_labels      No      Yes
##      ham 0.996393897 0.003606103
##      spam 0.996453901 0.003546099
##
##      ave
## sms_train_labels      No      Yes
##      ham 0.99889043 0.00110957
##      spam 0.99822695 0.00177305
##
##      avoid
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 1.000000000 0.000000000
##
##      await
## sms_train_labels      No      Yes
##      ham 0.9997226075 0.0002773925
##      spam 0.9734042553 0.0265957447
##
##      award
## sms_train_labels      No      Yes
##      ham 0.9997226075 0.0002773925
##      spam 0.9219858156 0.0780141844
##
##      away
## sms_train_labels      No      Yes
##      ham 0.996116505 0.003883495
##      spam 0.996453901 0.003546099
##
##      awesom
## sms_train_labels      No      Yes
##      ham 0.995839112 0.004160888
##      spam 1.000000000 0.000000000
##
##      babe
## sms_train_labels      No      Yes
##      ham 0.9850208 0.0149792
##      spam 0.9893617 0.0106383
##
##      babi
## sms_train_labels      No      Yes
##      ham 0.994174757 0.005825243
##      spam 0.998226950 0.001773050
##
##      back
## sms_train_labels      No      Yes
##      ham 0.97503467 0.02496533
##      spam 0.96631206 0.03368794
##

```

```

##          bad
## sms_train_labels      No      Yes
##          ham  0.994174757 0.005825243
##          spam 0.998226950 0.001773050
##
##          bag
## sms_train_labels      No      Yes
##          ham  0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          bak
## sms_train_labels      No      Yes
##          ham  0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          balanc
## sms_train_labels      No      Yes
##          ham  0.99889043 0.00110957
##          spam 0.99822695 0.00177305
##
##          bank
## sms_train_labels      No      Yes
##          ham  0.998058252 0.001941748
##          spam 0.996453901 0.003546099
##
##          bare
## sms_train_labels      No      Yes
##          ham  0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          bath
## sms_train_labels      No      Yes
##          ham  0.995006935 0.004993065
##          spam 1.000000000 0.000000000
##
##          batteri
## sms_train_labels      No      Yes
##          ham  0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          bcoz
## sms_train_labels      No      Yes
##          ham  0.997226075 0.002773925
##          spam 1.000000000 0.000000000
##
##          bcum
## sms_train_labels      No      Yes
##          ham  0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          bday
## sms_train_labels      No      Yes
##          ham  0.997226075 0.002773925
##          spam 1.000000000 0.000000000

```

```

##
##          beauti
## sms_train_labels      No      Yes
##          ham  0.995839112 0.004160888
##          spam 1.000000000 0.000000000
##
##          becom
## sms_train_labels      No      Yes
##          ham  0.998335645 0.001664355
##          spam 0.998226950 0.001773050
##
##          bed
## sms_train_labels      No      Yes
##          ham  0.99334258 0.00665742
##          spam 1.00000000 0.00000000
##
##          bedroom
## sms_train_labels      No      Yes
##          ham  0.998613037 0.001386963
##          spam 0.998226950 0.001773050
##
##          begin
## sms_train_labels      No      Yes
##          ham  0.99889043 0.00110957
##          spam 0.99822695 0.00177305
##
##          believ
## sms_train_labels      No      Yes
##          ham  0.996948682 0.003051318
##          spam 0.998226950 0.001773050
##
##          belli
## sms_train_labels      No      Yes
##          ham  0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          best
## sms_train_labels      No      Yes
##          ham  0.991678225 0.008321775
##          spam 0.989361702 0.010638298
##
##          better
## sms_train_labels      No      Yes
##          ham  0.991955617 0.008044383
##          spam 0.998226950 0.001773050
##
##          bid
## sms_train_labels      No      Yes
##          ham  0.9997226075 0.0002773925
##          spam 0.9964539007 0.0035460993
##
##          big
## sms_train_labels      No      Yes
##          ham  0.992787795 0.007212205

```

```

##          spam 0.998226950 0.001773050
##
##          bill
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 0.996453901 0.003546099
##
##          bird
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 0.998226950 0.001773050
##
##          birthday
## sms_train_labels      No      Yes
##          ham 0.99445215 0.00554785
##          spam 0.99822695 0.00177305
##
##          bit
## sms_train_labels      No      Yes
##          ham 0.990846047 0.009153953
##          spam 1.000000000 0.000000000
##
##          black
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          blank
## sms_train_labels      No      Yes
##          ham 0.9991678225 0.0008321775
##          spam 1.0000000000 0.0000000000
##
##          bless
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          blue
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          bluetooth
## sms_train_labels      No      Yes
##          ham 1.0000000 0.0000000
##          spam 0.9893617 0.0106383
##
##          bodi
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          bold
## sms_train_labels      No      Yes

```

```

##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          bonus
## sms_train_labels      No      Yes
##          ham 1.000000000 0.000000000
##          spam 0.96808511 0.03191489
##
##          boo
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          book
## sms_train_labels      No      Yes
##          ham 0.993619972 0.006380028
##          spam 0.992907801 0.007092199
##
##          bore
## sms_train_labels      No      Yes
##          ham 0.995006935 0.004993065
##          spam 0.994680851 0.005319149
##
##          boss
## sms_train_labels      No      Yes
##          ham 0.99778086 0.00221914
##          spam 1.00000000 0.00000000
##
##          bother
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          bout
## sms_train_labels      No      Yes
##          ham 0.99667129 0.00332871
##          spam 0.99822695 0.00177305
##
##          bowl
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          box
## sms_train_labels      No      Yes
##          ham 0.9991678225 0.0008321775
##          spam 0.9343971631 0.0656028369
##
##          boy
## sms_train_labels      No      Yes
##          ham 0.995561720 0.004438280
##          spam 0.996453901 0.003546099
##
##          boytoy

```

```

## sms_train_labels      No      Yes
##      ham 0.996948682 0.003051318
##      spam 1.000000000 0.000000000
##
##      brand
## sms_train_labels      No      Yes
##      ham 0.999445215 0.000554785
##      spam 0.994680851 0.005319149
##
##      break
## sms_train_labels      No      Yes
##      ham 0.996948682 0.003051318
##      spam 0.994680851 0.005319149
##
##      breath
## sms_train_labels      No      Yes
##      ham 0.9991678225 0.0008321775
##      spam 0.9964539007 0.0035460993
##
##      brilliant
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 1.000000000 0.000000000
##
##      bring
## sms_train_labels      No      Yes
##      ham 0.993619972 0.006380028
##      spam 0.996453901 0.003546099
##
##      brother
## sms_train_labels      No      Yes
##      ham 0.99667129 0.00332871
##      spam 0.99822695 0.00177305
##
##      bslvyl
## sms_train_labels      No      Yes
##      ham 0.997226075 0.002773925
##      spam 1.000000000 0.000000000
##
##      btnationalr
## sms_train_labels      No      Yes
##      ham 1.0000000 0.0000000
##      spam 0.9893617 0.0106383
##
##      budget
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 1.000000000 0.000000000
##
##      bugi
## sms_train_labels      No      Yes
##      ham 0.998335645 0.001664355
##      spam 1.000000000 0.000000000
##

```



```

##          bus
## sms_train_labels      No      Yes
##          ham  0.99445215  0.00554785
##          spam 1.00000000  0.00000000
##
##          busi
## sms_train_labels      No      Yes
##          ham  0.99556172  0.00443828
##          spam 1.00000000  0.00000000
##
##          buy
## sms_train_labels      No      Yes
##          ham  0.98723994  0.01276006
##          spam 0.99822695  0.00177305
##
##          buzz
## sms_train_labels      No      Yes
##          ham  0.998613037  0.001386963
##          spam 1.000000000  0.000000000
##
##          cabin
## sms_train_labels      No      Yes
##          ham  0.998613037  0.001386963
##          spam 1.000000000  0.000000000
##
##          cafe
## sms_train_labels      No      Yes
##          ham  0.998613037  0.001386963
##          spam 1.000000000  0.000000000
##
##          cal
## sms_train_labels      No      Yes
##          ham  0.998613037  0.001386963
##          spam 1.000000000  0.000000000
##
##          call
## sms_train_labels      No      Yes
##          ham  0.94341193  0.05658807
##          spam 0.56382979  0.43617021
##
##          caller
## sms_train_labels      No      Yes
##          ham  0.998335645  0.001664355
##          spam 0.980496454  0.019503546
##
##          callertun
## sms_train_labels      No      Yes
##          ham  0.998613037  0.001386963
##          spam 1.000000000  0.000000000
##
##          camcord
## sms_train_labels      No      Yes
##          ham  1.00000000  0.00000000
##          spam 0.98049645  0.01950355

```

```

##
##           came
## sms_train_labels      No      Yes
##           ham  0.994174757  0.005825243
##           spam 0.998226950  0.001773050
##
##           camera
## sms_train_labels      No      Yes
##           ham  0.999445215  0.000554785
##           spam 0.962765957  0.037234043
##
##           can
## sms_train_labels      No      Yes
##           ham  0.93120666  0.06879334
##           spam 0.96099291  0.03900709
##
##           cancel
## sms_train_labels      No      Yes
##           ham  0.9991678225 0.0008321775
##           spam 0.9964539007 0.0035460993
##
##           cant
## sms_train_labels      No      Yes
##           ham  0.988904300 0.011095700
##           spam 0.994680851 0.005319149
##
##           car
## sms_train_labels      No      Yes
##           ham  0.990568655 0.009431345
##           spam 1.000000000 0.000000000
##
##           card
## sms_train_labels      No      Yes
##           ham  0.997226075 0.002773925
##           spam 0.994680851 0.005319149
##
##           care
## sms_train_labels      No      Yes
##           ham  0.9852982 0.0147018
##           spam 0.9893617 0.0106383
##
##           carlo
## sms_train_labels      No      Yes
##           ham  0.996393897 0.003606103
##           spam 1.000000000 0.000000000
##
##           case
## sms_train_labels      No      Yes
##           ham  0.996116505 0.003883495
##           spam 1.000000000 0.000000000
##
##           cash
## sms_train_labels      No      Yes
##           ham  0.997503467 0.002496533

```

```

##          spam 0.911347518 0.088652482
##
##          cashbal
## sms_train_labels      No      Yes
##          ham 1.0000000 0.0000000
##          spam 0.9893617 0.0106383
##
##          catch
## sms_train_labels      No      Yes
##          ham 0.99667129 0.00332871
##          spam 1.00000000 0.00000000
##
##          caus
## sms_train_labels      No      Yes
##          ham 0.995284327 0.004715673
##          spam 1.000000000 0.000000000
##
##          chanc
## sms_train_labels      No      Yes
##          ham 0.997226075 0.002773925
##          spam 0.957446809 0.042553191
##
##          chang
## sms_train_labels      No      Yes
##          ham 0.99334258 0.00665742
##          spam 0.99822695 0.00177305
##
##          charact
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          charg
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 0.969858156 0.030141844
##
##          chariti
## sms_train_labels      No      Yes
##          ham 1.000000000 0.000000000
##          spam 0.996453901 0.003546099
##
##          chat
## sms_train_labels      No      Yes
##          ham 0.996948682 0.003051318
##          spam 0.941489362 0.058510638
##
##          cheap
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 0.992907801 0.007092199
##
##          check
## sms_train_labels      No      Yes

```

```

##          ham 0.988904300 0.011095700
##          spam 0.996453901 0.003546099
##
##          cheer
## sms_train_labels      No      Yes
##          ham 0.99778086 0.00221914
##          spam 1.00000000 0.00000000
##
##          chennai
## sms_train_labels      No      Yes
##          ham 0.996948682 0.003051318
##          spam 1.000000000 0.000000000
##
##          chikku
## sms_train_labels      No      Yes
##          ham 0.997503467 0.002496533
##          spam 1.000000000 0.000000000
##
##          childish
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          children
## sms_train_labels      No      Yes
##          ham 0.998890430 0.001109570
##          spam 0.996453901 0.003546099
##
##          chines
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          choic
## sms_train_labels      No      Yes
##          ham 0.9991678225 0.0008321775
##          spam 0.9946808511 0.0053191489
##
##          choos
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 0.987588652 0.012411348
##
##          christma
## sms_train_labels      No      Yes
##          ham 0.99778086 0.00221914
##          spam 0.99822695 0.00177305
##
##          cine
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          cinema

```

```

## sms_train_labels      No      Yes
##      ham 0.998890430 0.001109570
##      spam 0.994680851 0.005319149
##
##      claim
## sms_train_labels      No      Yes
##      ham 1.0000000 0.0000000
##      spam 0.8510638 0.1489362
##
##      class
## sms_train_labels      No      Yes
##      ham 0.98945908 0.01054092
##      spam 0.99822695 0.00177305
##
##      clean
## sms_train_labels      No      Yes
##      ham 0.996948682 0.003051318
##      spam 1.000000000 0.000000000
##
##      clear
## sms_train_labels      No      Yes
##      ham 0.998335645 0.001664355
##      spam 1.000000000 0.000000000
##
##      click
## sms_train_labels      No      Yes
##      ham 0.9997226075 0.0002773925
##      spam 0.9946808511 0.0053191489
##
##      clock
## sms_train_labels      No      Yes
##      ham 0.99889043 0.00110957
##      spam 1.00000000 0.00000000
##
##      close
## sms_train_labels      No      Yes
##      ham 0.995839112 0.004160888
##      spam 0.994680851 0.005319149
##
##      club
## sms_train_labels      No      Yes
##      ham 1.00000000 0.00000000
##      spam 0.97340426 0.02659574
##
##      code
## sms_train_labels      No      Yes
##      ham 0.9997226075 0.0002773925
##      spam 0.9663120567 0.0336879433
##
##      coffe
## sms_train_labels      No      Yes
##      ham 0.998058252 0.001941748
##      spam 1.000000000 0.000000000
##

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```

##          coin
## sms_train_labels      No      Yes
##          ham  0.99889043 0.00110957
##          spam 1.00000000 0.00000000
##
##          cold
## sms_train_labels      No      Yes
##          ham  0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          colleagu
## sms_train_labels      No      Yes
##          ham  0.99889043 0.00110957
##          spam 1.00000000 0.00000000
##
##          collect
## sms_train_labels      No      Yes
##          ham  0.997503467 0.002496533
##          spam 0.939716312 0.060283688
##
##          colleg
## sms_train_labels      No      Yes
##          ham  0.996393897 0.003606103
##          spam 1.000000000 0.000000000
##
##          colour
## sms_train_labels      No      Yes
##          ham  0.9991678225 0.0008321775
##          spam 0.9822695035 0.0177304965
##
##          come
## sms_train_labels      No      Yes
##          ham  0.943134535 0.056865465
##          spam 0.992907801 0.007092199
##
##          comin
## sms_train_labels      No      Yes
##          ham  0.997226075 0.002773925
##          spam 1.000000000 0.000000000
##
##          comp
## sms_train_labels      No      Yes
##          ham  1.000000000 0.000000000
##          spam 0.98758865 0.01241135
##
##          compani
## sms_train_labels      No      Yes
##          ham  0.996948682 0.003051318
##          spam 0.994680851 0.005319149
##
##          competit
## sms_train_labels      No      Yes
##          ham  0.999445215 0.000554785
##          spam 0.994680851 0.005319149

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##
##          complet
## sms_train_labels      No      Yes
##          ham  0.996948682 0.003051318
##          spam 0.998226950 0.001773050
##
##          complimentari
## sms_train_labels      No      Yes
##          ham  1.0000000 0.0000000
##          spam 0.9858156 0.0141844
##
##          comput
## sms_train_labels      No      Yes
##          ham  0.998335645 0.001664355
##          spam 0.996453901 0.003546099
##
##          concentr
## sms_train_labels      No      Yes
##          ham  0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          condit
## sms_train_labels      No      Yes
##          ham  0.9997226075 0.0002773925
##          spam 0.9929078014 0.0070921986
##
##          confid
## sms_train_labels      No      Yes
##          ham  0.99889043 0.00110957
##          spam 1.00000000 0.00000000
##
##          confirm
## sms_train_labels      No      Yes
##          ham  0.997226075 0.002773925
##          spam 0.998226950 0.001773050
##
##          congrat
## sms_train_labels      No      Yes
##          ham  0.998613037 0.001386963
##          spam 0.989361702 0.010638298
##
##          congratul
## sms_train_labels      No      Yes
##          ham  0.9997226075 0.0002773925
##          spam 0.9787234043 0.0212765957
##
##          connect
## sms_train_labels      No      Yes
##          ham  0.998613037 0.001386963
##          spam 0.994680851 0.005319149
##
##          contact
## sms_train_labels      No      Yes
##          ham  0.997226075 0.002773925

```

```

##          spam 0.918439716 0.081560284
##
##          content
## sms_train_labels      No          Yes
##          ham 0.9991678225 0.0008321775
##          spam 0.9822695035 0.0177304965
##
##          convey
## sms_train_labels      No          Yes
##          ham 0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          cook
## sms_train_labels      No          Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          cool
## sms_train_labels      No          Yes
##          ham 0.992787795 0.007212205
##          spam 0.998226950 0.001773050
##
##          copi
## sms_train_labels      No          Yes
##          ham 0.997503467 0.002496533
##          spam 1.000000000 0.000000000
##
##          correct
## sms_train_labels      No          Yes
##          ham 0.997780860 0.002219140
##          spam 0.992907801 0.007092199
##
##          cos
## sms_train_labels      No          Yes
##          ham 0.98640777 0.01359223
##          spam 1.00000000 0.00000000
##
##          cost
## sms_train_labels      No          Yes
##          ham 0.99667129 0.00332871
##          spam 0.95921986 0.04078014
##
##          countri
## sms_train_labels      No          Yes
##          ham 0.999445215 0.000554785
##          spam 0.992907801 0.007092199
##
##          coupl
## sms_train_labels      No          Yes
##          ham 0.997503467 0.002496533
##          spam 1.000000000 0.000000000
##
##          cours
## sms_train_labels      No          Yes

```



```

##          ham  0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          cover
## sms_train_labels      No      Yes
##          ham  0.99778086 0.00221914
##          spam 1.00000000 0.00000000
##
##          coz
## sms_train_labels      No      Yes
##          ham  0.995284327 0.004715673
##          spam 1.000000000 0.000000000
##
##          crave
## sms_train_labels      No      Yes
##          ham  0.997503467 0.002496533
##          spam 1.000000000 0.000000000
##
##          crazi
## sms_train_labels      No      Yes
##          ham  0.997780860 0.002219140
##          spam 0.996453901 0.003546099
##
##          credit
## sms_train_labels      No      Yes
##          ham  0.998058252 0.001941748
##          spam 0.973404255 0.026595745
##
##          cri
## sms_train_labels      No      Yes
##          ham  0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          croydon
## sms_train_labels      No      Yes
##          ham  1.000000000 0.000000000
##          spam 0.98758865 0.01241135
##
##          cuddl
## sms_train_labels      No      Yes
##          ham  0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          cum
## sms_train_labels      No      Yes
##          ham  0.998335645 0.001664355
##          spam 0.991134752 0.008865248
##
##          cup
## sms_train_labels      No      Yes
##          ham  0.9991678225 0.0008321775
##          spam 0.9911347518 0.0088652482
##
##          current

```

```

## sms_train_labels      No      Yes
##      ham  0.99889043  0.00110957
##      spam 0.98226950  0.01773050
##
##      custcar
## sms_train_labels      No      Yes
##      ham  1.00000000  0.00000000
##      spam 0.9858156  0.0141844
##
##      custom
## sms_train_labels      No      Yes
##      ham  0.99778086  0.00221914
##      spam 0.93262411  0.06737589
##
##      cut
## sms_train_labels      No      Yes
##      ham  0.997503467  0.002496533
##      spam 1.000000000  0.000000000
##
##      cute
## sms_train_labels      No      Yes
##      ham  0.998058252  0.001941748
##      spam 0.998226950  0.001773050
##
##      cuz
## sms_train_labels      No      Yes
##      ham  0.998335645  0.001664355
##      spam 1.000000000  0.000000000
##
##      dad
## sms_train_labels      No      Yes
##      ham  0.994729542  0.005270458
##      spam 1.000000000  0.000000000
##
##      daddi
## sms_train_labels      No      Yes
##      ham  0.998058252  0.001941748
##      spam 1.000000000  0.000000000
##
##      damn
## sms_train_labels      No      Yes
##      ham  0.998335645  0.001664355
##      spam 1.000000000  0.000000000
##
##      darl
## sms_train_labels      No      Yes
##      ham  0.9991678225  0.0008321775
##      spam 0.9964539007  0.0035460993
##
##      darlin
## sms_train_labels      No      Yes
##      ham  0.996948682  0.003051318
##      spam 1.000000000  0.000000000
##

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```

##                darren
## sms_train_labels      No          Yes
##                ham  0.99778086  0.00221914
##                spam 1.00000000  0.00000000
##
##                dat
## sms_train_labels      No          Yes
##                ham  0.992510402  0.007489598
##                spam 1.000000000  0.000000000
##
##                date
## sms_train_labels      No          Yes
##                ham  0.998058252  0.001941748
##                spam 0.966312057  0.033687943
##
##                day
## sms_train_labels      No          Yes
##                ham  0.95644938  0.04355062
##                spam 0.95390071  0.04609929
##
##                dead
## sms_train_labels      No          Yes
##                ham  0.998335645  0.001664355
##                spam 1.000000000  0.000000000
##
##                deal
## sms_train_labels      No          Yes
##                ham  0.998058252  0.001941748
##                spam 0.998226950  0.001773050
##
##                dear
## sms_train_labels      No          Yes
##                ham  0.98002774  0.01997226
##                spam 0.97695035  0.02304965
##
##                decid
## sms_train_labels      No          Yes
##                ham  0.99445215  0.00554785
##                spam 1.00000000  0.00000000
##
##                deep
## sms_train_labels      No          Yes
##                ham  0.998058252  0.001941748
##                spam 1.000000000  0.000000000
##
##                definit
## sms_train_labels      No          Yes
##                ham  0.998058252  0.001941748
##                spam 0.998226950  0.001773050
##
##                del
## sms_train_labels      No          Yes
##                ham  0.9997226075  0.0002773925
##                spam 0.9911347518  0.0088652482

```

```

##
##          delet
## sms_train_labels      No      Yes
##          ham  0.998613037  0.001386963
##          spam 1.000000000  0.000000000
##
##          deliv
## sms_train_labels      No      Yes
##          ham  0.999445215  0.000554785
##          spam 0.994680851  0.005319149
##
##          deliveri
## sms_train_labels      No      Yes
##          ham  0.9997226075  0.0002773925
##          spam 0.9734042553  0.0265957447
##
##          den
## sms_train_labels      No      Yes
##          ham  0.99445215  0.00554785
##          spam 1.00000000  0.00000000
##
##          depend
## sms_train_labels      No      Yes
##          ham  0.997503467  0.002496533
##          spam 1.000000000  0.000000000
##
##          detail
## sms_train_labels      No      Yes
##          ham  0.996116505  0.003883495
##          spam 0.991134752  0.008865248
##
##          dey
## sms_train_labels      No      Yes
##          ham  0.998613037  0.001386963
##          spam 1.000000000  0.000000000
##
##          didnt
## sms_train_labels      No      Yes
##          ham  0.993897365  0.006102635
##          spam 1.000000000  0.000000000
##
##          die
## sms_train_labels      No      Yes
##          ham  0.996116505  0.003883495
##          spam 0.998226950  0.001773050
##
##          differ
## sms_train_labels      No      Yes
##          ham  0.998058252  0.001941748
##          spam 1.000000000  0.000000000
##
##          difficult
## sms_train_labels      No      Yes
##          ham  0.997503467  0.002496533

```

```

##          spam 1.000000000 0.000000000
##
##          digit
## sms_train_labels      No          Yes
##          ham 0.9997226075 0.0002773925
##          spam 0.9893617021 0.0106382979
##
##          din
## sms_train_labels      No          Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          dinner
## sms_train_labels      No          Yes
##          ham 0.993897365 0.006102635
##          spam 1.000000000 0.000000000
##
##          direct
## sms_train_labels      No          Yes
##          ham 0.998613037 0.001386963
##          spam 0.984042553 0.015957447
##
##          dis
## sms_train_labels      No          Yes
##          ham 0.99556172 0.00443828
##          spam 0.99822695 0.00177305
##
##          discount
## sms_train_labels      No          Yes
##          ham 1.000000000 0.000000000
##          spam 0.98404255 0.01595745
##
##          discuss
## sms_train_labels      No          Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          disturb
## sms_train_labels      No          Yes
##          ham 0.997503467 0.002496533
##          spam 1.000000000 0.000000000
##
##          dnt
## sms_train_labels      No          Yes
##          ham 0.99667129 0.00332871
##          spam 1.000000000 0.000000000
##
##          doctor
## sms_train_labels      No          Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          doesnt
## sms_train_labels      No          Yes

```

```

##          ham 0.997503467 0.002496533
##          spam 1.000000000 0.000000000
##
##          dog
## sms_train_labels      No      Yes
##          ham 0.9991678225 0.0008321775
##          spam 0.9858156028 0.0141843972
##
##          doin
## sms_train_labels      No      Yes
##          ham 0.997503467 0.002496533
##          spam 1.000000000 0.000000000
##
##          dollar
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          don
## sms_train_labels      No      Yes
##          ham 0.997226075 0.002773925
##          spam 1.000000000 0.000000000
##
##          done
## sms_train_labels      No      Yes
##          ham 0.990013870 0.009986130
##          spam 0.996453901 0.003546099
##
##          dont
## sms_train_labels      No      Yes
##          ham 0.97142857 0.02857143
##          spam 0.98226950 0.01773050
##
##          door
## sms_train_labels      No      Yes
##          ham 0.99778086 0.00221914
##          spam 0.99822695 0.00177305
##
##          doubl
## sms_train_labels      No      Yes
##          ham 0.99889043 0.00110957
##          spam 0.98226950 0.01773050
##
##          download
## sms_train_labels      No      Yes
##          ham 0.997780860 0.002219140
##          spam 0.991134752 0.008865248
##
##          draw
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 0.948581560 0.051418440
##
##          dream

```

```

## sms_train_labels      No      Yes
##      ham 0.996393897 0.003606103
##      spam 0.994680851 0.005319149
##
##      drink
## sms_train_labels      No      Yes
##      ham 0.996116505 0.003883495
##      spam 0.996453901 0.003546099
##
##      drive
## sms_train_labels      No      Yes
##      ham 0.993065187 0.006934813
##      spam 0.998226950 0.001773050
##
##      drop
## sms_train_labels      No      Yes
##      ham 0.995561720 0.004438280
##      spam 0.996453901 0.003546099
##
##      drug
## sms_train_labels      No      Yes
##      ham 0.996393897 0.003606103
##      spam 1.000000000 0.000000000
##
##      dude
## sms_train_labels      No      Yes
##      ham 0.994174757 0.005825243
##      spam 1.000000000 0.000000000
##
##      dun
## sms_train_labels      No      Yes
##      ham 0.99001387 0.00998613
##      spam 1.00000000 0.00000000
##
##      dunno
## sms_train_labels      No      Yes
##      ham 0.992787795 0.007212205
##      spam 1.000000000 0.000000000
##
##      dvd
## sms_train_labels      No      Yes
##      ham 0.9997226075 0.0002773925
##      spam 0.9893617021 0.0106382979
##
##      earli
## sms_train_labels      No      Yes
##      ham 0.992510402 0.007489598
##      spam 1.000000000 0.000000000
##
##      earlier
## sms_train_labels      No      Yes
##      ham 0.99667129 0.00332871
##      spam 1.00000000 0.00000000
##

```

```

##          easi
## sms_train_labels      No      Yes
##          ham  0.99667129 0.00332871
##          spam 0.98404255 0.01595745
##
##          eat
## sms_train_labels      No      Yes
##          ham  0.990291262 0.009708738
##          spam 1.000000000 0.000000000
##
##          eatin
## sms_train_labels      No      Yes
##          ham  0.99889043 0.00110957
##          spam 1.00000000 0.00000000
##
##          either
## sms_train_labels      No      Yes
##          ham  0.997503467 0.002496533
##          spam 0.985815603 0.014184397
##
##          els
## sms_train_labels      No      Yes
##          ham  0.995839112 0.004160888
##          spam 0.998226950 0.001773050
##
##          email
## sms_train_labels      No      Yes
##          ham  0.996116505 0.003883495
##          spam 0.998226950 0.001773050
##
##          embarrass
## sms_train_labels      No      Yes
##          ham  0.9991678225 0.0008321775
##          spam 1.0000000000 0.0000000000
##
##          empti
## sms_train_labels      No      Yes
##          ham  0.99889043 0.00110957
##          spam 1.00000000 0.00000000
##
##          end
## sms_train_labels      No      Yes
##          ham  0.990846047 0.009153953
##          spam 0.962765957 0.037234043
##
##          enemi
## sms_train_labels      No      Yes
##          ham  0.99889043 0.00110957
##          spam 1.00000000 0.00000000
##
##          energi
## sms_train_labels      No      Yes
##          ham  0.998890430 0.001109570
##          spam 0.996453901 0.003546099

```



```

##
##          england
## sms_train_labels      No          Yes
##          ham  1.000000000 0.000000000
##          spam 0.992907801 0.007092199
##
##          enjoy
## sms_train_labels      No          Yes
##          ham  0.994174757 0.005825243
##          spam 0.984042553 0.015957447
##
##          enough
## sms_train_labels      No          Yes
##          ham  0.994452150 0.005547850
##          spam 0.996453901 0.003546099
##
##          enter
## sms_train_labels      No          Yes
##          ham  0.997503467 0.002496533
##          spam 0.976950355 0.023049645
##
##          entri
## sms_train_labels      No          Yes
##          ham  1.000000000 0.000000000
##          spam 0.96985816 0.03014184
##
##          envelop
## sms_train_labels      No          Yes
##          ham  0.999445215 0.000554785
##          spam 0.996453901 0.003546099
##
##          espec
## sms_train_labels      No          Yes
##          ham  0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          etc
## sms_train_labels      No          Yes
##          ham  0.9991678225 0.0008321775
##          spam 0.9911347518 0.0088652482
##
##          euro
## sms_train_labels      No          Yes
##          ham  1.000000000 0.000000000
##          spam 0.991134752 0.008865248
##
##          eve
## sms_train_labels      No          Yes
##          ham  0.997503467 0.002496533
##          spam 0.994680851 0.005319149
##
##          even
## sms_train_labels      No          Yes
##          ham  0.98307906 0.01692094

```

```

##          spam 0.98936170 0.01063830
##
##          ever
## sms_train_labels      No      Yes
##          ham 0.993897365 0.006102635
##          spam 0.996453901 0.003546099
##
##          everi
## sms_train_labels      No      Yes
##          ham 0.992510402 0.007489598
##          spam 0.952127660 0.047872340
##
##          everyon
## sms_train_labels      No      Yes
##          ham 0.996393897 0.003606103
##          spam 0.996453901 0.003546099
##
##          everyth
## sms_train_labels      No      Yes
##          ham 0.99445215 0.00554785
##          spam 1.00000000 0.00000000
##
##          exact
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          exam
## sms_train_labels      No      Yes
##          ham 0.997503467 0.002496533
##          spam 1.000000000 0.000000000
##
##          excel
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          excit
## sms_train_labels      No      Yes
##          ham 0.9991678225 0.0008321775
##          spam 0.9946808511 0.0053191489
##
##          excus
## sms_train_labels      No      Yes
##          ham 0.99778086 0.00221914
##          spam 1.00000000 0.00000000
##
##          expect
## sms_train_labels      No      Yes
##          ham 0.997226075 0.002773925
##          spam 1.000000000 0.000000000
##
##          experi
## sms_train_labels      No      Yes

```

```

##          ham 0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          expir
## sms_train_labels      No          Yes
##          ham 0.9997226075 0.0002773925
##          spam 0.9822695035 0.0177304965
##
##          extra
## sms_train_labels      No          Yes
##          ham 0.998613037 0.001386963
##          spam 0.992907801 0.007092199
##
##          eye
## sms_train_labels      No          Yes
##          ham 0.998335645 0.001664355
##          spam 0.998226950 0.001773050
##
##          face
## sms_train_labels      No          Yes
##          ham 0.996948682 0.003051318
##          spam 1.000000000 0.000000000
##
##          facebook
## sms_train_labels      No          Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          fact
## sms_train_labels      No          Yes
##          ham 0.997503467 0.002496533
##          spam 0.998226950 0.001773050
##
##          fall
## sms_train_labels      No          Yes
##          ham 0.998613037 0.001386963
##          spam 0.998226950 0.001773050
##
##          famili
## sms_train_labels      No          Yes
##          ham 0.996116505 0.003883495
##          spam 1.000000000 0.000000000
##
##          fanci
## sms_train_labels      No          Yes
##          ham 0.9991678225 0.0008321775
##          spam 0.9804964539 0.0195035461
##
##          fantasi
## sms_train_labels      No          Yes
##          ham 1.000000000 0.000000000
##          spam 0.98404255 0.01595745
##
##          fantast

```

```

## sms_train_labels      No      Yes
##      ham 0.999445215 0.000554785
##      spam 0.994680851 0.005319149
##
##      far
## sms_train_labels      No      Yes
##      ham 0.996393897 0.003606103
##      spam 1.000000000 0.000000000
##
##      fast
## sms_train_labels      No      Yes
##      ham 0.996393897 0.003606103
##      spam 0.998226950 0.001773050
##
##      fat
## sms_train_labels      No      Yes
##      ham 0.998335645 0.001664355
##      spam 1.000000000 0.000000000
##
##      father
## sms_train_labels      No      Yes
##      ham 0.998058252 0.001941748
##      spam 1.000000000 0.000000000
##
##      fault
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 1.000000000 0.000000000
##
##      feel
## sms_train_labels      No      Yes
##      ham 0.980582524 0.019417476
##      spam 0.996453901 0.003546099
##
##      felt
## sms_train_labels      No      Yes
##      ham 0.996393897 0.003606103
##      spam 1.000000000 0.000000000
##
##      fetch
## sms_train_labels      No      Yes
##      ham 0.998335645 0.001664355
##      spam 1.000000000 0.000000000
##
##      fight
## sms_train_labels      No      Yes
##      ham 0.998058252 0.001941748
##      spam 1.000000000 0.000000000
##
##      figur
## sms_train_labels      No      Yes
##      ham 0.997503467 0.002496533
##      spam 1.000000000 0.000000000
##

```

```

##          file
## sms_train_labels      No      Yes
##          ham  0.998335645  0.001664355
##          spam 1.000000000  0.000000000
##
##          fill
## sms_train_labels      No      Yes
##          ham  0.998058252  0.001941748
##          spam 1.000000000  0.000000000
##
##          film
## sms_train_labels      No      Yes
##          ham  0.998335645  0.001664355
##          spam 0.994680851  0.005319149
##
##          final
## sms_train_labels      No      Yes
##          ham  0.996948682  0.003051318
##          spam 0.973404255  0.026595745
##
##          find
## sms_train_labels      No      Yes
##          ham  0.98918169  0.01081831
##          spam 0.96453901  0.03546099
##
##          fine
## sms_train_labels      No      Yes
##          ham  0.990846047  0.009153953
##          spam 1.000000000  0.000000000
##
##          finger
## sms_train_labels      No      Yes
##          ham  0.998613037  0.001386963
##          spam 1.000000000  0.000000000
##
##          finish
## sms_train_labels      No      Yes
##          ham  0.98668516  0.01331484
##          spam 1.00000000  0.00000000
##
##          first
## sms_train_labels      No      Yes
##          ham  0.9889043  0.0110957
##          spam 0.9893617  0.0106383
##
##          five
## sms_train_labels      No      Yes
##          ham  0.9991678225  0.0008321775
##          spam 0.9946808511  0.0053191489
##
##          fix
## sms_train_labels      No      Yes
##          ham  0.997503467  0.002496533
##          spam 0.998226950  0.001773050

```

```

##
##          flight
## sms_train_labels      No      Yes
##          ham  0.999445215  0.000554785
##          spam 0.989361702  0.010638298
##
##          flirt
## sms_train_labels      No      Yes
##          ham  0.9997226075  0.0002773925
##          spam 0.9911347518  0.0088652482
##
##          flower
## sms_train_labels      No      Yes
##          ham  0.998890430  0.001109570
##          spam 0.994680851  0.005319149
##
##          follow
## sms_train_labels      No      Yes
##          ham  0.999445215  0.000554785
##          spam 0.987588652  0.012411348
##
##          fone
## sms_train_labels      No      Yes
##          ham  0.998890430  0.001109570
##          spam 0.992907801  0.007092199
##
##          food
## sms_train_labels      No      Yes
##          ham  0.994729542  0.005270458
##          spam 1.000000000  0.000000000
##
##          forev
## sms_train_labels      No      Yes
##          ham  0.998335645  0.001664355
##          spam 1.000000000  0.000000000
##
##          forget
## sms_train_labels      No      Yes
##          ham  0.996671290  0.003328710
##          spam 0.996453901  0.003546099
##
##          forgot
## sms_train_labels      No      Yes
##          ham  0.994174757  0.005825243
##          spam 1.000000000  0.000000000
##
##          forward
## sms_train_labels      No      Yes
##          ham  0.996948682  0.003051318
##          spam 0.992907801  0.007092199
##
##          found
## sms_train_labels      No      Yes
##          ham  0.996116505  0.003883495

```

```

##          spam 0.998226950 0.001773050
##
##          free
## sms_train_labels      No      Yes
##          ham 0.98834951 0.01165049
##          spam 0.77127660 0.22872340
##
##          freemsg
## sms_train_labels      No      Yes
##          ham 1.00000000 0.00000000
##          spam 0.98404255 0.01595745
##
##          freephon
## sms_train_labels      No      Yes
##          ham 1.00000000 0.00000000
##          spam 0.9858156 0.0141844
##
##          fren
## sms_train_labels      No      Yes
##          ham 0.996948682 0.003051318
##          spam 1.000000000 0.000000000
##
##          fri
## sms_train_labels      No      Yes
##          ham 0.996948682 0.003051318
##          spam 0.996453901 0.003546099
##
##          friday
## sms_train_labels      No      Yes
##          ham 0.996948682 0.003051318
##          spam 1.000000000 0.000000000
##
##          friend
## sms_train_labels      No      Yes
##          ham 0.98252427 0.01747573
##          spam 0.98226950 0.01773050
##
##          friendship
## sms_train_labels      No      Yes
##          ham 0.995839112 0.004160888
##          spam 1.000000000 0.000000000
##
##          frm
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          frnd
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 0.998226950 0.001773050
##
##          frnds
## sms_train_labels      No      Yes

```

```

##          ham 0.99667129 0.00332871
##          spam 1.00000000 0.00000000
##
##          fuck
## sms_train_labels      No      Yes
##          ham 0.99112344 0.00887656
##          spam 1.00000000 0.00000000
##
##          full
## sms_train_labels      No      Yes
##          ham 0.995839112 0.004160888
##          spam 1.000000000 0.000000000
##
##          fullonsmscom
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          fun
## sms_train_labels      No      Yes
##          ham 0.995839112 0.004160888
##          spam 0.985815603 0.014184397
##
##          funni
## sms_train_labels      No      Yes
##          ham 0.99778086 0.00221914
##          spam 1.00000000 0.00000000
##
##          futur
## sms_train_labels      No      Yes
##          ham 0.999445215 0.000554785
##          spam 0.994680851 0.005319149
##
##          gal
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          game
## sms_train_labels      No      Yes
##          ham 0.997503467 0.002496533
##          spam 0.980496454 0.019503546
##
##          gap
## sms_train_labels      No      Yes
##          ham 0.9991678225 0.0008321775
##          spam 1.0000000000 0.0000000000
##
##          gas
## sms_train_labels      No      Yes
##          ham 0.99778086 0.00221914
##          spam 1.00000000 0.00000000
##
##          gave

```



```

## sms_train_labels      No      Yes
##      ham  0.998335645  0.001664355
##      spam 1.000000000  0.000000000
##
##      gay
## sms_train_labels      No      Yes
##      ham  1.000000000  0.000000000
##      spam 0.991134752  0.008865248
##
##      gentl
## sms_train_labels      No      Yes
##      ham  0.998613037  0.001386963
##      spam 1.000000000  0.000000000
##
##      get
## sms_train_labels      No      Yes
##      ham  0.9295423  0.0704577
##      spam 0.8847518  0.1152482
##
##      gettin
## sms_train_labels      No      Yes
##      ham  0.998335645  0.001664355
##      spam 0.996453901  0.003546099
##
##      gift
## sms_train_labels      No      Yes
##      ham  0.997503467  0.002496533
##      spam 0.975177305  0.024822695
##
##      girl
## sms_train_labels      No      Yes
##      ham  0.991955617  0.008044383
##      spam 0.989361702  0.010638298
##
##      give
## sms_train_labels      No      Yes
##      ham  0.979750347  0.020249653
##      spam 0.991134752  0.008865248
##
##      glad
## sms_train_labels      No      Yes
##      ham  0.998613037  0.001386963
##      spam 0.998226950  0.001773050
##
##      god
## sms_train_labels      No      Yes
##      ham  0.991955617  0.008044383
##      spam 0.998226950  0.001773050
##
##      goe
## sms_train_labels      No      Yes
##      ham  0.993897365  0.006102635
##      spam 1.000000000  0.000000000
##

```

```

##                goin
## sms_train_labels      No      Yes
##                ham  0.995839112 0.004160888
##                spam 1.000000000 0.000000000
##
##                gone
## sms_train_labels      No      Yes
##                ham  0.997226075 0.002773925
##                spam 1.000000000 0.000000000
##
##                gonna
## sms_train_labels      No      Yes
##                ham  0.9889043 0.0110957
##                spam 1.0000000 0.0000000
##
##                good
## sms_train_labels      No      Yes
##                ham  0.95589459 0.04410541
##                spam 0.98226950 0.01773050
##
##                goodmorn
## sms_train_labels      No      Yes
##                ham  0.996116505 0.003883495
##                spam 1.000000000 0.000000000
##
##                goodnight
## sms_train_labels      No      Yes
##                ham  0.998613037 0.001386963
##                spam 1.000000000 0.000000000
##
##                got
## sms_train_labels      No      Yes
##                ham  0.954230236 0.045769764
##                spam 0.994680851 0.005319149
##
##                goto
## sms_train_labels      No      Yes
##                ham  0.9997226075 0.0002773925
##                spam 0.9929078014 0.0070921986
##
##                gotta
## sms_train_labels      No      Yes
##                ham  0.997226075 0.002773925
##                spam 1.000000000 0.000000000
##
##                great
## sms_train_labels      No      Yes
##                ham  0.981137309 0.018862691
##                spam 0.991134752 0.008865248
##
##                green
## sms_train_labels      No      Yes
##                ham  0.998613037 0.001386963
##                spam 0.998226950 0.001773050

```

```

##
##          greet
## sms_train_labels      No      Yes
##          ham  0.998335645  0.001664355
##          spam 1.000000000  0.000000000
##
##          grin
## sms_train_labels      No      Yes
##          ham  0.99778086  0.00221914
##          spam 1.00000000  0.00000000
##
##          group
## sms_train_labels      No      Yes
##          ham  0.998613037  0.001386963
##          spam 1.000000000  0.000000000
##
##          guarante
## sms_train_labels      No      Yes
##          ham  1.00000000  0.00000000
##          spam 0.93085106  0.06914894
##
##          gud
## sms_train_labels      No      Yes
##          ham  0.98779473  0.01220527
##          spam 1.00000000  0.00000000
##
##          guess
## sms_train_labels      No      Yes
##          ham  0.992787795  0.007212205
##          spam 0.989361702  0.010638298
##
##          guy
## sms_train_labels      No      Yes
##          ham  0.989181692  0.010818308
##          spam 0.991134752  0.008865248
##
##          gym
## sms_train_labels      No      Yes
##          ham  0.998058252  0.001941748
##          spam 1.000000000  0.000000000
##
##          haf
## sms_train_labels      No      Yes
##          ham  0.995839112  0.004160888
##          spam 1.000000000  0.000000000
##
##          haha
## sms_train_labels      No      Yes
##          ham  0.98945908  0.01054092
##          spam 1.00000000  0.00000000
##
##          hai
## sms_train_labels      No      Yes
##          ham  0.9991678225  0.0008321775

```

```

##          spam 1.0000000000 0.0000000000
##
##          hair
## sms_train_labels      No      Yes
##          ham 0.995839112 0.004160888
##          spam 1.000000000 0.000000000
##
##          half
## sms_train_labels      No      Yes
##          ham 0.99445215 0.00554785
##          spam 0.98226950 0.01773050
##
##          hand
## sms_train_labels      No      Yes
##          ham 0.995839112 0.004160888
##          spam 1.000000000 0.000000000
##
##          hang
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          happen
## sms_train_labels      No      Yes
##          ham 0.9889043 0.0110957
##          spam 1.0000000 0.0000000
##
##          happi
## sms_train_labels      No      Yes
##          ham 0.97919556 0.02080444
##          spam 1.00000000 0.00000000
##
##          hard
## sms_train_labels      No      Yes
##          ham 0.996948682 0.003051318
##          spam 0.994680851 0.005319149
##
##          hav
## sms_train_labels      No      Yes
##          ham 0.99445215 0.00554785
##          spam 1.00000000 0.00000000
##
##          havent
## sms_train_labels      No      Yes
##          ham 0.996393897 0.003606103
##          spam 1.000000000 0.000000000
##
##          head
## sms_train_labels      No      Yes
##          ham 0.99445215 0.00554785
##          spam 1.00000000 0.00000000
##
##          hear
## sms_train_labels      No      Yes

```

```

##          ham 0.993897365 0.006102635
##          spam 0.994680851 0.005319149
##
##          heard
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 0.994680851 0.005319149
##
##          heart
## sms_train_labels      No      Yes
##          ham 0.991678225 0.008321775
##          spam 0.996453901 0.003546099
##
##          heavi
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          hee
## sms_train_labels      No      Yes
##          ham 0.996948682 0.003051318
##          spam 1.000000000 0.000000000
##
##          hell
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          hello
## sms_train_labels      No      Yes
##          ham 0.991400832 0.008599168
##          spam 0.992907801 0.007092199
##
##          help
## sms_train_labels      No      Yes
##          ham 0.992510402 0.007489598
##          spam 0.971631206 0.028368794
##
##          hey
## sms_train_labels      No      Yes
##          ham 0.979472954 0.020527046
##          spam 0.991134752 0.008865248
##
##          hgsuiteland
## sms_train_labels      No      Yes
##          ham 1.000000000 0.000000000
##          spam 0.98758865 0.01241135
##
##          high
## sms_train_labels      No      Yes
##          ham 0.998890430 0.001109570
##          spam 0.994680851 0.005319149
##
##          hit

```

```

## sms_train_labels      No      Yes
##      ham 0.997780860 0.002219140
##      spam 0.994680851 0.005319149
##
##      hiya
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 1.000000000 0.000000000
##
##      hmm
## sms_train_labels      No      Yes
##      ham 0.99778086 0.00221914
##      spam 1.00000000 0.00000000
##
##      hmmm
## sms_train_labels      No      Yes
##      ham 0.997503467 0.002496533
##      spam 1.000000000 0.000000000
##
##      hmv
## sms_train_labels      No      Yes
##      ham 1.000000000 0.000000000
##      spam 0.994680851 0.005319149
##
##      hol
## sms_train_labels      No      Yes
##      ham 0.999445215 0.000554785
##      spam 0.994680851 0.005319149
##
##      hold
## sms_train_labels      No      Yes
##      ham 0.99556172 0.00443828
##      spam 1.00000000 0.00000000
##
##      holder
## sms_train_labels      No      Yes
##      ham 1.000000000 0.000000000
##      spam 0.991134752 0.008865248
##
##      holiday
## sms_train_labels      No      Yes
##      ham 0.997226075 0.002773925
##      spam 0.960992908 0.039007092
##
##      home
## sms_train_labels      No      Yes
##      ham 0.968377254 0.031622746
##      spam 0.996453901 0.003546099
##
##      honey
## sms_train_labels      No      Yes
##      ham 0.998335645 0.001664355
##      spam 1.000000000 0.000000000
##

```

```

##                hook
## sms_train_labels      No          Yes
##                ham  0.998335645  0.001664355
##                spam 1.000000000  0.000000000
##
##                hop
## sms_train_labels      No          Yes
##                ham  0.998613037  0.001386963
##                spam 1.000000000  0.000000000
##
##                hope
## sms_train_labels      No          Yes
##                ham  0.976421637  0.023578363
##                spam 0.992907801  0.007092199
##
##                horni
## sms_train_labels      No          Yes
##                ham  1.000000000  0.000000000
##                spam 0.991134752  0.008865248
##
##                hospit
## sms_train_labels      No          Yes
##                ham  0.998613037  0.001386963
##                spam 1.000000000  0.000000000
##
##                hot
## sms_train_labels      No          Yes
##                ham  0.998613037  0.001386963
##                spam 0.976950355  0.023049645
##
##                hotel
## sms_train_labels      No          Yes
##                ham  0.9991678225  0.0008321775
##                spam 0.9929078014  0.0070921986
##
##                hour
## sms_train_labels      No          Yes
##                ham  0.989736477  0.010263523
##                spam 0.994680851  0.005319149
##
##                hous
## sms_train_labels      No          Yes
##                ham  0.992787795  0.007212205
##                spam 1.000000000  0.000000000
##
##                housemaid
## sms_train_labels      No          Yes
##                ham  0.998335645  0.001664355
##                spam 1.000000000  0.000000000
##
##                how
## sms_train_labels      No          Yes
##                ham  0.99778086  0.00221914
##                spam 1.00000000  0.00000000

```

```

##
##           howev
## sms_train_labels      No      Yes
##           ham  0.998058252  0.001941748
##           spam 0.998226950  0.001773050
##
##           howz
## sms_train_labels      No      Yes
##           ham  0.998335645  0.001664355
##           spam 1.000000000  0.000000000
##
##           hrs
## sms_train_labels      No      Yes
##           ham  0.99778086  0.00221914
##           spam 0.97163121  0.02836879
##
##           hug
## sms_train_labels      No      Yes
##           ham  0.99889043  0.00110957
##           spam 1.00000000  0.00000000
##
##           huh
## sms_train_labels      No      Yes
##           ham  0.995839112  0.004160888
##           spam 1.000000000  0.000000000
##
##           hungri
## sms_train_labels      No      Yes
##           ham  0.997503467  0.002496533
##           spam 0.998226950  0.001773050
##
##           hurri
## sms_train_labels      No      Yes
##           ham  0.998058252  0.001941748
##           spam 0.998226950  0.001773050
##
##           hurt
## sms_train_labels      No      Yes
##           ham  0.99445215  0.00554785
##           spam 1.00000000  0.00000000
##
##           iam
## sms_train_labels      No      Yes
##           ham  0.9991678225  0.0008321775
##           spam 1.0000000000  0.0000000000
##
##           ice
## sms_train_labels      No      Yes
##           ham  0.998335645  0.001664355
##           spam 0.998226950  0.001773050
##
##           idea
## sms_train_labels      No      Yes
##           ham  0.997226075  0.002773925

```



```

##          spam 1.000000000 0.000000000
##
##          identifi
## sms_train_labels      No      Yes
##          ham 1.00000000 0.00000000
##          spam 0.98404255 0.01595745
##
##          ignor
## sms_train_labels      No      Yes
##          ham 0.99889043 0.00110957
##          spam 0.99822695 0.00177305
##
##          ill
## sms_train_labels      No      Yes
##          ham 0.99112344 0.00887656
##          spam 0.99822695 0.00177305
##
##          imagin
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          imma
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          immedi
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 0.992907801 0.007092199
##
##          import
## sms_train_labels      No      Yes
##          ham 0.997503467 0.002496533
##          spam 0.989361702 0.010638298
##
##          inc
## sms_train_labels      No      Yes
##          ham 1.000000000 0.000000000
##          spam 0.991134752 0.008865248
##
##          inch
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          includ
## sms_train_labels      No      Yes
##          ham 0.99889043 0.00110957
##          spam 0.99822695 0.00177305
##
##          india
## sms_train_labels      No      Yes

```

```

##          ham 0.99778086 0.00221914
##          spam 1.00000000 0.00000000
##
##          indian
## sms_train_labels      No      Yes
##          ham 0.99889043 0.00110957
##          spam 1.00000000 0.00000000
##
##          info
## sms_train_labels      No      Yes
##          ham 0.9997226075 0.0002773925
##          spam 0.9858156028 0.0141843972
##
##          inform
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 0.989361702 0.010638298
##
##          instead
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          interest
## sms_train_labels      No      Yes
##          ham 0.997503467 0.002496533
##          spam 0.998226950 0.001773050
##
##          interview
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          invit
## sms_train_labels      No      Yes
##          ham 0.997226075 0.002773925
##          spam 0.991134752 0.008865248
##
##          ipod
## sms_train_labels      No      Yes
##          ham 1.00000000 0.00000000
##          spam 0.9858156 0.0141844
##
##          irrit
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          ish
## sms_train_labels      No      Yes
##          ham 0.99667129 0.00332871
##          spam 1.00000000 0.00000000
##
##          isnt

```

```

## sms_train_labels      No      Yes
##      ham 0.998335645 0.001664355
##      spam 1.000000000 0.000000000
##
##      issu
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 0.996453901 0.003546099
##
##      ive
## sms_train_labels      No      Yes
##      ham 0.998335645 0.001664355
##      spam 1.000000000 0.000000000
##
##      izzit
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 1.000000000 0.000000000
##
##      januari
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 0.998226950 0.001773050
##
##      jay
## sms_train_labels      No      Yes
##      ham 0.996393897 0.003606103
##      spam 1.000000000 0.000000000
##
##      job
## sms_train_labels      No      Yes
##      ham 0.98973648 0.01026352
##      spam 1.00000000 0.00000000
##
##      john
## sms_train_labels      No      Yes
##      ham 0.998058252 0.001941748
##      spam 1.000000000 0.000000000
##
##      join
## sms_train_labels      No      Yes
##      ham 0.996116505 0.003883495
##      spam 0.969858156 0.030141844
##
##      joke
## sms_train_labels      No      Yes
##      ham 0.997503467 0.002496533
##      spam 1.000000000 0.000000000
##
##      joy
## sms_train_labels      No      Yes
##      ham 0.99778086 0.00221914
##      spam 1.00000000 0.00000000
##

```

```

##          jus
## sms_train_labels      No      Yes
##          ham  0.99334258 0.00665742
##          spam 1.00000000 0.00000000
##
##          just
## sms_train_labels      No      Yes
##          ham  0.94257975 0.05742025
##          spam 0.88652482 0.11347518
##
##          juz
## sms_train_labels      No      Yes
##          ham  0.99556172 0.00443828
##          spam 1.00000000 0.00000000
##
##          kalli
## sms_train_labels      No      Yes
##          ham  0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          kate
## sms_train_labels      No      Yes
##          ham  0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          keep
## sms_train_labels      No      Yes
##          ham  0.988904300 0.011095700
##          spam 0.992907801 0.007092199
##
##          kept
## sms_train_labels      No      Yes
##          ham  0.9991678225 0.0008321775
##          spam 0.9946808511 0.0053191489
##
##          key
## sms_train_labels      No      Yes
##          ham  0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          kick
## sms_train_labels      No      Yes
##          ham  0.998335645 0.001664355
##          spam 0.994680851 0.005319149
##
##          kid
## sms_train_labels      No      Yes
##          ham  0.99778086 0.00221914
##          spam 1.00000000 0.00000000
##
##          kill
## sms_train_labels      No      Yes
##          ham  0.998335645 0.001664355
##          spam 1.000000000 0.000000000

```

```

##
##          kind
## sms_train_labels      No      Yes
##          ham  0.99667129  0.00332871
##          spam 1.00000000  0.00000000
##
##          kinda
## sms_train_labels      No      Yes
##          ham  0.99778086  0.00221914
##          spam 0.99822695  0.00177305
##
##          king
## sms_train_labels      No      Yes
##          ham  0.9991678225  0.0008321775
##          spam 0.9964539007  0.0035460993
##
##          kiss
## sms_train_labels      No      Yes
##          ham  0.993619972  0.006380028
##          spam 1.000000000  0.000000000
##
##          knew
## sms_train_labels      No      Yes
##          ham  0.99778086  0.00221914
##          spam 1.00000000  0.00000000
##
##          know
## sms_train_labels      No      Yes
##          ham  0.95006935  0.04993065
##          spam 0.96453901  0.03546099
##
##          knw
## sms_train_labels      No      Yes
##          ham  0.99778086  0.00221914
##          spam 1.00000000  0.00000000
##
##          ladi
## sms_train_labels      No      Yes
##          ham  0.998058252  0.001941748
##          spam 0.996453901  0.003546099
##
##          land
## sms_train_labels      No      Yes
##          ham  1.00000000  0.00000000
##          spam 0.97340426  0.02659574
##
##          landlin
## sms_train_labels      No      Yes
##          ham  0.999445215  0.000554785
##          spam 0.955673759  0.044326241
##
##          laptop
## sms_train_labels      No      Yes
##          ham  0.99667129  0.00332871

```

```

##          spam 1.00000000 0.00000000
##
##          lar
## sms_train_labels      No      Yes
##          ham 0.991955617 0.008044383
##          spam 1.000000000 0.000000000
##
##          last
## sms_train_labels      No      Yes
##          ham 0.98751734 0.01248266
##          spam 0.98404255 0.01595745
##
##          late
## sms_train_labels      No      Yes
##          ham 0.98668516 0.01331484
##          spam 0.99822695 0.00177305
##
##          later
## sms_train_labels      No      Yes
##          ham 0.97614424 0.02385576
##          spam 1.00000000 0.00000000
##
##          latest
## sms_train_labels      No      Yes
##          ham 0.9991678225 0.0008321775
##          spam 0.9592198582 0.0407801418
##
##          laugh
## sms_train_labels      No      Yes
##          ham 0.996948682 0.003051318
##          spam 1.000000000 0.000000000
##
##          lazi
## sms_train_labels      No      Yes
##          ham 0.99778086 0.00221914
##          spam 1.00000000 0.00000000
##
##          ldn
## sms_train_labels      No      Yes
##          ham 1.00000000 0.00000000
##          spam 0.9858156 0.0141844
##
##          lead
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          learn
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 0.998226950 0.001773050
##
##          least
## sms_train_labels      No      Yes

```

```

##          ham 0.997503467 0.002496533
##          spam 1.000000000 0.000000000
##
##          leav
## sms_train_labels      No      Yes
##          ham 0.984466019 0.015533981
##          spam 0.996453901 0.003546099
##
##          lect
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          left
## sms_train_labels      No      Yes
##          ham 0.993897365 0.006102635
##          spam 1.000000000 0.000000000
##
##          leh
## sms_train_labels      No      Yes
##          ham 0.994729542 0.005270458
##          spam 1.000000000 0.000000000
##
##          lei
## sms_train_labels      No      Yes
##          ham 0.99556172 0.00443828
##          spam 1.00000000 0.00000000
##
##          lemm
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          less
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          lesson
## sms_train_labels      No      Yes
##          ham 0.995006935 0.004993065
##          spam 1.000000000 0.000000000
##
##          let
## sms_train_labels      No      Yes
##          ham 0.98280166 0.01719834
##          spam 1.00000000 0.00000000
##
##          letter
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          liao

```

```

## sms_train_labels      No      Yes
##      ham 0.993065187 0.006934813
##      spam 1.000000000 0.000000000
##
##      librari
## sms_train_labels      No      Yes
##      ham 0.99778086 0.00221914
##      spam 1.00000000 0.00000000
##
##      lick
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 1.000000000 0.000000000
##
##      lie
## sms_train_labels      No      Yes
##      ham 0.998335645 0.001664355
##      spam 1.000000000 0.000000000
##
##      life
## sms_train_labels      No      Yes
##      ham 0.987239945 0.012760055
##      spam 0.994680851 0.005319149
##
##      lift
## sms_train_labels      No      Yes
##      ham 0.998058252 0.001941748
##      spam 1.000000000 0.000000000
##
##      light
## sms_train_labels      No      Yes
##      ham 0.996116505 0.003883495
##      spam 1.000000000 0.000000000
##
##      like
## sms_train_labels      No      Yes
##      ham 0.95090153 0.04909847
##      spam 0.98404255 0.01595745
##
##      line
## sms_train_labels      No      Yes
##      ham 0.997503467 0.002496533
##      spam 0.948581560 0.051418440
##
##      link
## sms_train_labels      No      Yes
##      ham 0.9991678225 0.0008321775
##      spam 0.9929078014 0.0070921986
##
##      list
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 1.000000000 0.000000000
##

```



```

##          listen
## sms_train_labels      No          Yes
##          ham  0.997503467  0.002496533
##          spam 0.996453901  0.003546099
##
##          littl
## sms_train_labels      No          Yes
##          ham  0.994729542  0.005270458
##          spam 0.998226950  0.001773050
##
##          live
## sms_train_labels      No          Yes
##          ham  0.994174757  0.005825243
##          spam 0.960992908  0.039007092
##
##          load
## sms_train_labels      No          Yes
##          ham  0.996948682  0.003051318
##          spam 0.998226950  0.001773050
##
##          loan
## sms_train_labels      No          Yes
##          ham  0.998335645  0.001664355
##          spam 0.991134752  0.008865248
##
##          local
## sms_train_labels      No          Yes
##          ham  1.000000000  0.000000000
##          spam 0.991134752  0.008865248
##
##          locat
## sms_train_labels      No          Yes
##          ham  0.999445215  0.000554785
##          spam 0.991134752  0.008865248
##
##          log
## sms_train_labels      No          Yes
##          ham  0.998058252  0.001941748
##          spam 0.994680851  0.005319149
##
##          login
## sms_train_labels      No          Yes
##          ham  0.999445215  0.000554785
##          spam 0.994680851  0.005319149
##
##          lol
## sms_train_labels      No          Yes
##          ham  0.98391123  0.01608877
##          spam 1.00000000  0.00000000
##
##          long
## sms_train_labels      No          Yes
##          ham  0.99112344  0.00887656
##          spam 1.00000000  0.00000000

```

```

##
##           longer
## sms_train_labels      No      Yes
##           ham  0.998613037 0.001386963
##           spam 1.000000000 0.000000000
##
##           look
## sms_train_labels      No      Yes
##           ham  0.98751734 0.01248266
##           spam 0.98404255 0.01595745
##
##           lor
## sms_train_labels      No      Yes
##           ham  0.96920943 0.03079057
##           spam 1.00000000 0.00000000
##
##           lose
## sms_train_labels      No      Yes
##           ham  0.996116505 0.003883495
##           spam 0.998226950 0.001773050
##
##           lost
## sms_train_labels      No      Yes
##           ham  0.997226075 0.002773925
##           spam 0.996453901 0.003546099
##
##           lot
## sms_train_labels      No      Yes
##           ham  0.98945908 0.01054092
##           spam 0.99822695 0.00177305
##
##           lovabl
## sms_train_labels      No      Yes
##           ham  0.997503467 0.002496533
##           spam 1.000000000 0.000000000
##
##           love
## sms_train_labels      No      Yes
##           ham  0.9556172 0.0443828
##           spam 0.9858156 0.0141844
##
##           lover
## sms_train_labels      No      Yes
##           ham  0.997503467 0.002496533
##           spam 0.996453901 0.003546099
##
##           loverboy
## sms_train_labels      No      Yes
##           ham  0.998335645 0.001664355
##           spam 1.000000000 0.000000000
##
##           loyalty
## sms_train_labels      No      Yes
##           ham  1.00000000 0.00000000

```

```

##          spam 0.98758865 0.01241135
##
##          ltd
## sms_train_labels      No      Yes
##          ham 1.0000000 0.0000000
##          spam 0.9787234 0.0212766
##
##          ltdecimalgt
## sms_train_labels      No      Yes
##          ham 0.995006935 0.004993065
##          spam 1.000000000 0.000000000
##
##          ltgt
## sms_train_labels      No      Yes
##          ham 0.95506241 0.04493759
##          spam 1.00000000 0.00000000
##
##          lttimegt
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          luck
## sms_train_labels      No      Yes
##          ham 0.998890430 0.001109570
##          spam 0.992907801 0.007092199
##
##          lucki
## sms_train_labels      No      Yes
##          ham 0.997503467 0.002496533
##          spam 0.992907801 0.007092199
##
##          lunch
## sms_train_labels      No      Yes
##          ham 0.992510402 0.007489598
##          spam 1.000000000 0.000000000
##
##          luv
## sms_train_labels      No      Yes
##          ham 0.993897365 0.006102635
##          spam 0.991134752 0.008865248
##
##          made
## sms_train_labels      No      Yes
##          ham 0.994174757 0.005825243
##          spam 0.998226950 0.001773050
##
##          mah
## sms_train_labels      No      Yes
##          ham 0.997226075 0.002773925
##          spam 1.000000000 0.000000000
##
##          mail
## sms_train_labels      No      Yes

```

```

##          ham 0.993619972 0.006380028
##          spam 1.000000000 0.000000000
##
##          make
## sms_train_labels      No      Yes
##          ham 0.97364771 0.02635229
##          spam 0.98404255 0.01595745
##
##          man
## sms_train_labels      No      Yes
##          ham 0.99001387 0.00998613
##          spam 1.00000000 0.00000000
##
##          mani
## sms_train_labels      No      Yes
##          ham 0.990291262 0.009708738
##          spam 0.994680851 0.005319149
##
##          march
## sms_train_labels      No      Yes
##          ham 0.996948682 0.003051318
##          spam 1.000000000 0.000000000
##
##          mark
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          marri
## sms_train_labels      No      Yes
##          ham 0.997503467 0.002496533
##          spam 0.996453901 0.003546099
##
##          marriag
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          match
## sms_train_labels      No      Yes
##          ham 0.9991678225 0.0008321775
##          spam 0.9840425532 0.0159574468
##
##          mate
## sms_train_labels      No      Yes
##          ham 0.997503467 0.002496533
##          spam 0.985815603 0.014184397
##
##          matter
## sms_train_labels      No      Yes
##          ham 0.99889043 0.00110957
##          spam 1.00000000 0.00000000
##
##          maxim

```

```

## sms_train_labels      No      Yes
##      ham 1.0000000 0.0000000
##      spam 0.9893617 0.0106383
##
##      may
## sms_train_labels      No      Yes
##      ham 0.991400832 0.008599168
##      spam 0.989361702 0.010638298
##
##      mayb
## sms_train_labels      No      Yes
##      ham 0.992787795 0.007212205
##      spam 1.000000000 0.000000000
##
##      mean
## sms_train_labels      No      Yes
##      ham 0.9889043 0.0110957
##      spam 1.0000000 0.0000000
##
##      meant
## sms_train_labels      No      Yes
##      ham 0.996393897 0.003606103
##      spam 1.000000000 0.000000000
##
##      med
## sms_train_labels      No      Yes
##      ham 0.999445215 0.000554785
##      spam 0.996453901 0.003546099
##
##      medic
## sms_train_labels      No      Yes
##      ham 0.99889043 0.00110957
##      spam 1.00000000 0.00000000
##
##      meet
## sms_train_labels      No      Yes
##      ham 0.97697642 0.02302358
##      spam 0.98936170 0.01063830
##
##      meh
## sms_train_labels      No      Yes
##      ham 0.99778086 0.00221914
##      spam 1.00000000 0.00000000
##
##      mell
## sms_train_labels      No      Yes
##      ham 0.9991678225 0.0008321775
##      spam 1.0000000000 0.0000000000
##
##      member
## sms_train_labels      No      Yes
##      ham 0.999445215 0.000554785
##      spam 0.985815603 0.014184397
##

```

```

##                men
## sms_train_labels      No      Yes
##          ham  0.998890430 0.001109570
##          spam 0.994680851 0.005319149
##
##                menu
## sms_train_labels      No      Yes
##          ham  0.99889043 0.00110957
##          spam 0.99822695 0.00177305
##
##                merri
## sms_train_labels      No      Yes
##          ham  0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##                messag
## sms_train_labels      No      Yes
##          ham  0.98363384 0.01636616
##          spam 0.95035461 0.04964539
##
##                met
## sms_train_labels      No      Yes
##          ham  0.99778086 0.00221914
##          spam 0.99822695 0.00177305
##
##                mid
## sms_train_labels      No      Yes
##          ham  0.998058252 0.001941748
##          spam 0.996453901 0.003546099
##
##                midnight
## sms_train_labels      No      Yes
##          ham  0.998613037 0.001386963
##          spam 0.998226950 0.001773050
##
##                might
## sms_train_labels      No      Yes
##          ham  0.992787795 0.007212205
##          spam 1.000000000 0.000000000
##
##                min
## sms_train_labels      No      Yes
##          ham  0.993065187 0.006934813
##          spam 0.930851064 0.069148936
##
##                mind
## sms_train_labels      No      Yes
##          ham  0.991123440 0.008876560
##          spam 0.996453901 0.003546099
##
##                mine
## sms_train_labels      No      Yes
##          ham  0.996393897 0.003606103
##          spam 1.000000000 0.000000000

```

```

##
##          minut
## sms_train_labels      No      Yes
##          ham  0.991678225 0.008321775
##          spam 0.985815603 0.014184397
##
##          miracl
## sms_train_labels      No      Yes
##          ham  0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          miss
## sms_train_labels      No      Yes
##          ham  0.97891817 0.02108183
##          spam 0.98581560 0.01418440
##
##          mistak
## sms_train_labels      No      Yes
##          ham  0.998058252 0.001941748
##          spam 0.998226950 0.001773050
##
##          moan
## sms_train_labels      No      Yes
##          ham  0.998613037 0.001386963
##          spam 0.998226950 0.001773050
##
##          mob
## sms_train_labels      No      Yes
##          ham  1.000000000 0.000000000
##          spam 0.96453901 0.03546099
##
##          mobil
## sms_train_labels      No      Yes
##          ham  0.997503467 0.002496533
##          spam 0.852836879 0.147163121
##
##          mobileupd
## sms_train_labels      No      Yes
##          ham  1.000000000 0.000000000
##          spam 0.97695035 0.02304965
##
##          mode
## sms_train_labels      No      Yes
##          ham  0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          mom
## sms_train_labels      No      Yes
##          ham  0.99556172 0.00443828
##          spam 1.000000000 0.000000000
##
##          moment
## sms_train_labels      No      Yes
##          ham  0.99778086 0.00221914

```

```

##          spam 1.00000000 0.00000000
##
##          mon
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          monday
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          money
## sms_train_labels      No      Yes
##          ham 0.988349515 0.011650485
##          spam 0.996453901 0.003546099
##
##          month
## sms_train_labels      No      Yes
##          ham 0.992787795 0.007212205
##          spam 0.982269504 0.017730496
##
##          mood
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          moon
## sms_train_labels      No      Yes
##          ham 0.998890430 0.001109570
##          spam 0.996453901 0.003546099
##
##          morn
## sms_train_labels      No      Yes
##          ham 0.98224688 0.01775312
##          spam 1.00000000 0.00000000
##
##          motorola
## sms_train_labels      No      Yes
##          ham 0.9997226075 0.0002773925
##          spam 0.9858156028 0.0141843972
##
##          move
## sms_train_labels      No      Yes
##          ham 0.995839112 0.004160888
##          spam 1.000000000 0.000000000
##
##          movi
## sms_train_labels      No      Yes
##          ham 0.993897365 0.006102635
##          spam 0.996453901 0.003546099
##
##          mrng
## sms_train_labels      No      Yes

```



```

##          ham 0.99667129 0.00332871
##          spam 1.00000000 0.00000000
##
##          mrt
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          msg
## sms_train_labels      No      Yes
##          ham 0.98918169 0.01081831
##          spam 0.95744681 0.04255319
##
##          msgs
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 0.989361702 0.010638298
##
##          mths
## sms_train_labels      No      Yes
##          ham 1.00000000 0.00000000
##          spam 0.9822695 0.0177305
##
##          much
## sms_train_labels      No      Yes
##          ham 0.97836338 0.02163662
##          spam 0.99822695 0.00177305
##
##          mum
## sms_train_labels      No      Yes
##          ham 0.99556172 0.00443828
##          spam 1.00000000 0.00000000
##
##          murder
## sms_train_labels      No      Yes
##          ham 0.997503467 0.002496533
##          spam 1.000000000 0.000000000
##
##          music
## sms_train_labels      No      Yes
##          ham 0.9991678225 0.0008321775
##          spam 0.9787234043 0.0212765957
##
##          must
## sms_train_labels      No      Yes
##          ham 0.995006935 0.004993065
##          spam 0.992907801 0.007092199
##
##          muz
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 0.992907801 0.007092199
##
##          nah

```

```

## sms_train_labels      No      Yes
##      ham 0.997503467 0.002496533
##      spam 1.000000000 0.000000000
##
##      naked
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 0.998226950 0.001773050
##
##      name
## sms_train_labels      No      Yes
##      ham 0.994729542 0.005270458
##      spam 0.976950355 0.023049645
##
##      nation
## sms_train_labels      No      Yes
##      ham 1.0000000 0.0000000
##      spam 0.9787234 0.0212766
##
##      natur
## sms_train_labels      No      Yes
##      ham 0.99778086 0.00221914
##      spam 1.0000000 0.0000000
##
##      naughti
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 1.000000000 0.000000000
##
##      near
## sms_train_labels      No      Yes
##      ham 0.997503467 0.002496533
##      spam 0.998226950 0.001773050
##
##      need
## sms_train_labels      No      Yes
##      ham 0.96643551 0.03356449
##      spam 0.98936170 0.01063830
##
##      net
## sms_train_labels      No      Yes
##      ham 0.998058252 0.001941748
##      spam 1.000000000 0.000000000
##
##      network
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 0.962765957 0.037234043
##
##      neva
## sms_train_labels      No      Yes
##      ham 0.996393897 0.003606103
##      spam 1.000000000 0.000000000
##

```

```

##                never
## sms_train_labels      No          Yes
##                ham  0.992787795  0.007212205
##                spam 0.998226950  0.001773050
##
##                new
## sms_train_labels      No          Yes
##                ham  0.98751734  0.01248266
##                spam 0.90602837  0.09397163
##
##                news
## sms_train_labels      No          Yes
##                ham  0.998335645  0.001664355
##                spam 0.985815603  0.014184397
##
##                next
## sms_train_labels      No          Yes
##                ham  0.992510402  0.007489598
##                spam 0.980496454  0.019503546
##
##                nice
## sms_train_labels      No          Yes
##                ham  0.9889043  0.0110957
##                spam 1.0000000  0.0000000
##
##                nigeria
## sms_train_labels      No          Yes
##                ham  0.998613037  0.001386963
##                spam 1.000000000  0.000000000
##
##                night
## sms_train_labels      No          Yes
##                ham  0.979195562  0.020804438
##                spam 0.991134752  0.008865248
##
##                nite
## sms_train_labels      No          Yes
##                ham  0.995839112  0.004160888
##                spam 0.992907801  0.007092199
##
##                nobodi
## sms_train_labels      No          Yes
##                ham  0.998335645  0.001664355
##                spam 1.000000000  0.000000000
##
##                noe
## sms_train_labels      No          Yes
##                ham  0.99556172  0.00443828
##                spam 1.00000000  0.00000000
##
##                nokia
## sms_train_labels      No          Yes
##                ham  0.9997226075  0.0002773925
##                spam 0.9255319149  0.0744680851

```

```

##
##          none
## sms_train_labels      No      Yes
##          ham  0.9991678225  0.0008321775
##          spam 1.0000000000  0.0000000000
##
##          noon
## sms_train_labels      No      Yes
##          ham  0.996948682  0.003051318
##          spam 1.000000000  0.000000000
##
##          nope
## sms_train_labels      No      Yes
##          ham  0.997226075  0.002773925
##          spam 1.000000000  0.000000000
##
##          normal
## sms_train_labels      No      Yes
##          ham  0.997503467  0.002496533
##          spam 1.000000000  0.000000000
##
##          noth
## sms_train_labels      No      Yes
##          ham  0.992787795  0.007212205
##          spam 0.994680851  0.005319149
##
##          notic
## sms_train_labels      No      Yes
##          ham  0.9991678225  0.0008321775
##          spam 0.9946808511  0.0053191489
##
##          now
## sms_train_labels      No      Yes
##          ham  0.94119279  0.05880721
##          spam 0.74645390  0.25354610
##
##          ntt
## sms_train_labels      No      Yes
##          ham  1.0000000  0.0000000
##          spam 0.9822695  0.0177305
##
##          num
## sms_train_labels      No      Yes
##          ham  0.998613037  0.001386963
##          spam 1.000000000  0.000000000
##
##          number
## sms_train_labels      No      Yes
##          ham  0.98807212  0.01192788
##          spam 0.95921986  0.04078014
##
##          nxt
## sms_train_labels      No      Yes
##          ham  0.998613037  0.001386963

```

```

##          spam 1.000000000 0.000000000
##
##          nyt
## sms_train_labels      No      Yes
##          ham 0.997226075 0.002773925
##          spam 0.996453901 0.003546099
##
##          offer
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 0.941489362 0.058510638
##
##          offic
## sms_train_labels      No      Yes
##          ham 0.994729542 0.005270458
##          spam 0.998226950 0.001773050
##
##          offici
## sms_train_labels      No      Yes
##          ham 0.9991678225 0.0008321775
##          spam 0.9964539007 0.0035460993
##
##          okay
## sms_train_labels      No      Yes
##          ham 0.994174757 0.005825243
##          spam 1.000000000 0.000000000
##
##          oki
## sms_train_labels      No      Yes
##          ham 0.996393897 0.003606103
##          spam 1.000000000 0.000000000
##
##          old
## sms_train_labels      No      Yes
##          ham 0.997226075 0.002773925
##          spam 0.996453901 0.003546099
##
##          omw
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          one
## sms_train_labels      No      Yes
##          ham 0.96726768 0.03273232
##          spam 0.98758865 0.01241135
##
##          onlin
## sms_train_labels      No      Yes
##          ham 0.995284327 0.004715673
##          spam 1.000000000 0.000000000
##
##          oop
## sms_train_labels      No      Yes

```

```

##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          open
## sms_train_labels      No      Yes
##          ham 0.99667129 0.00332871
##          spam 0.99822695 0.00177305
##
##          oper
## sms_train_labels      No      Yes
##          ham 0.9997226075 0.0002773925
##          spam 0.9804964539 0.0195035461
##
##          opinion
## sms_train_labels      No      Yes
##          ham 0.99778086 0.00221914
##          spam 0.99822695 0.00177305
##
##          opt
## sms_train_labels      No      Yes
##          ham 0.9997226075 0.0002773925
##          spam 0.9751773050 0.0248226950
##
##          optout
## sms_train_labels      No      Yes
##          ham 1.00000000 0.00000000
##          spam 0.98758865 0.01241135
##
##          orang
## sms_train_labels      No      Yes
##          ham 0.9991678225 0.0008321775
##          spam 0.9645390071 0.0354609929
##
##          orchard
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          order
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 0.976950355 0.023049645
##
##          oredi
## sms_train_labels      No      Yes
##          ham 0.996393897 0.003606103
##          spam 1.000000000 0.000000000
##
##          oso
## sms_train_labels      No      Yes
##          ham 0.995006935 0.004993065
##          spam 1.000000000 0.000000000
##
##          other

```

```

## sms_train_labels      No      Yes
##      ham 0.998335645 0.001664355
##      spam 1.000000000 0.000000000
##
##      otherwis
## sms_train_labels      No      Yes
##      ham 0.997503467 0.002496533
##      spam 1.000000000 0.000000000
##
##      outsid
## sms_train_labels      No      Yes
##      ham 0.996393897 0.003606103
##      spam 1.000000000 0.000000000
##
##      pack
## sms_train_labels      No      Yes
##      ham 0.999445215 0.000554785
##      spam 0.998226950 0.001773050
##
##      page
## sms_train_labels      No      Yes
##      ham 0.99778086 0.00221914
##      spam 0.99822695 0.00177305
##
##      paid
## sms_train_labels      No      Yes
##      ham 0.99889043 0.00110957
##      spam 0.99822695 0.00177305
##
##      pain
## sms_train_labels      No      Yes
##      ham 0.993619972 0.006380028
##      spam 1.000000000 0.000000000
##
##      paper
## sms_train_labels      No      Yes
##      ham 0.997226075 0.002773925
##      spam 1.000000000 0.000000000
##
##      parent
## sms_train_labels      No      Yes
##      ham 0.997226075 0.002773925
##      spam 1.000000000 0.000000000
##
##      park
## sms_train_labels      No      Yes
##      ham 0.997226075 0.002773925
##      spam 0.998226950 0.001773050
##
##      part
## sms_train_labels      No      Yes
##      ham 0.996116505 0.003883495
##      spam 0.985815603 0.014184397
##

```

```

##          parti
## sms_train_labels      No      Yes
##          ham  0.99667129  0.00332871
##          spam 1.00000000  0.00000000
##
##          partner
## sms_train_labels      No      Yes
##          ham  1.000000000  0.000000000
##          spam 0.991134752  0.008865248
##
##          pass
## sms_train_labels      No      Yes
##          ham  0.997226075  0.002773925
##          spam 0.992907801  0.007092199
##
##          passion
## sms_train_labels      No      Yes
##          ham  0.99889043  0.00110957
##          spam 0.99822695  0.00177305
##
##          password
## sms_train_labels      No      Yes
##          ham  0.9991678225  0.0008321775
##          spam 0.9946808511  0.0053191489
##
##          past
## sms_train_labels      No      Yes
##          ham  0.998335645  0.001664355
##          spam 1.000000000  0.000000000
##
##          pay
## sms_train_labels      No      Yes
##          ham  0.991400832  0.008599168
##          spam 0.996453901  0.003546099
##
##          peac
## sms_train_labels      No      Yes
##          ham  0.998613037  0.001386963
##          spam 1.000000000  0.000000000
##
##          peopl
## sms_train_labels      No      Yes
##          ham  0.990568655  0.009431345
##          spam 0.994680851  0.005319149
##
##          per
## sms_train_labels      No      Yes
##          ham  0.996393897  0.003606103
##          spam 0.930851064  0.069148936
##
##          person
## sms_train_labels      No      Yes
##          ham  0.987794730  0.012205270
##          spam 0.996453901  0.003546099

```



```

##
##           pete
## sms_train_labels      No      Yes
##           ham  0.998613037 0.001386963
##           spam 0.998226950 0.001773050
##
##           phone
## sms_train_labels      No      Yes
##           ham  0.98335645 0.01664355
##           spam 0.92730496 0.07269504
##
##           photo
## sms_train_labels      No      Yes
##           ham  0.998058252 0.001941748
##           spam 0.996453901 0.003546099
##
##           pic
## sms_train_labels      No      Yes
##           ham  0.99667129 0.00332871
##           spam 0.97695035 0.02304965
##
##           pick
## sms_train_labels      No      Yes
##           ham  0.982246879 0.017753121
##           spam 0.994680851 0.005319149
##
##           pictur
## sms_train_labels      No      Yes
##           ham  0.998613037 0.001386963
##           spam 0.998226950 0.001773050
##
##           piec
## sms_train_labels      No      Yes
##           ham  0.998613037 0.001386963
##           spam 1.000000000 0.000000000
##
##           pix
## sms_train_labels      No      Yes
##           ham  0.999445215 0.000554785
##           spam 0.994680851 0.005319149
##
##           pizza
## sms_train_labels      No      Yes
##           ham  0.998335645 0.001664355
##           spam 1.000000000 0.000000000
##
##           place
## sms_train_labels      No      Yes
##           ham  0.986962552 0.013037448
##           spam 0.991134752 0.008865248
##
##           plan
## sms_train_labels      No      Yes
##           ham  0.990291262 0.009708738

```

```

##          spam 1.000000000 0.000000000
##
##          plane
## sms_train_labels      No      Yes
##          ham 0.9991678225 0.0008321775
##          spam 1.0000000000 0.0000000000
##
##          play
## sms_train_labels      No      Yes
##          ham 0.99445215 0.00554785
##          spam 0.97517730 0.02482270
##
##          player
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 0.982269504 0.017730496
##
##          pleas
## sms_train_labels      No      Yes
##          ham 0.98557559 0.01442441
##          spam 0.91843972 0.08156028
##
##          pleasur
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          pls
## sms_train_labels      No      Yes
##          ham 0.98252427 0.01747573
##          spam 0.98758865 0.01241135
##
##          plus
## sms_train_labels      No      Yes
##          ham 0.99667129 0.00332871
##          spam 0.98936170 0.01063830
##
##          plz
## sms_train_labels      No      Yes
##          ham 0.995284327 0.004715673
##          spam 1.000000000 0.000000000
##
##          pmin
## sms_train_labels      No      Yes
##          ham 1.0000000 0.0000000
##          spam 0.9787234 0.0212766
##
##          pmsg
## sms_train_labels      No      Yes
##          ham 1.00000000 0.00000000
##          spam 0.97340426 0.02659574
##
##          pobox
## sms_train_labels      No      Yes

```

```

##          ham 1.00000000 0.00000000
##          spam 0.96276596 0.03723404
##
##          poboxwwq
## sms_train_labels      No      Yes
##          ham 1.000000000 0.000000000
##          spam 0.991134752 0.008865248
##
##          point
## sms_train_labels      No      Yes
##          ham 0.996116505 0.003883495
##          spam 0.984042553 0.015957447
##
##          poli
## sms_train_labels      No      Yes
##          ham 1.00000000 0.00000000
##          spam 0.9751773 0.0248227
##
##          polic
## sms_train_labels      No      Yes
##          ham 0.9991678225 0.0008321775
##          spam 1.0000000000 0.0000000000
##
##          poor
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          pop
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          possibl
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          post
## sms_train_labels      No      Yes
##          ham 0.995284327 0.004715673
##          spam 0.994680851 0.005319149
##
##          pound
## sms_train_labels      No      Yes
##          ham 0.99889043 0.00110957
##          spam 0.96985816 0.03014184
##
##          power
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          pple

```

```

## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 1.000000000 0.000000000
##
##      ppm
## sms_train_labels      No      Yes
##      ham 1.000000000 0.000000000
##      spam 0.93794326 0.06205674
##
##      practic
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 1.000000000 0.000000000
##
##      pray
## sms_train_labels      No      Yes
##      ham 0.998058252 0.001941748
##      spam 1.000000000 0.000000000
##
##      prefer
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 1.000000000 0.000000000
##
##      prepar
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 1.000000000 0.000000000
##
##      press
## sms_train_labels      No      Yes
##      ham 0.997226075 0.002773925
##      spam 0.998226950 0.001773050
##
##      pretti
## sms_train_labels      No      Yes
##      ham 0.997226075 0.002773925
##      spam 1.000000000 0.000000000
##
##      price
## sms_train_labels      No      Yes
##      ham 0.998335645 0.001664355
##      spam 0.975177305 0.024822695
##
##      princess
## sms_train_labels      No      Yes
##      ham 0.993065187 0.006934813
##      spam 1.000000000 0.000000000
##
##      privat
## sms_train_labels      No      Yes
##      ham 0.9997226075 0.0002773925
##      spam 0.9822695035 0.0177304965
##

```

```

##                prize
## sms_train_labels      No      Yes
##                ham  1.0000000 0.0000000
##                spam 0.8794326 0.1205674
##
##                prob
## sms_train_labels      No      Yes
##                ham  0.996393897 0.003606103
##                spam 1.000000000 0.000000000
##
##                probabl
## sms_train_labels      No      Yes
##                ham  0.99334258 0.00665742
##                spam 1.00000000 0.00000000
##
##                problem
## sms_train_labels      No      Yes
##                ham  0.99334258 0.00665742
##                spam 1.00000000 0.00000000
##
##                process
## sms_train_labels      No      Yes
##                ham  0.998613037 0.001386963
##                spam 1.000000000 0.000000000
##
##                project
## sms_train_labels      No      Yes
##                ham  0.996948682 0.003051318
##                spam 1.000000000 0.000000000
##
##                promis
## sms_train_labels      No      Yes
##                ham  0.997503467 0.002496533
##                spam 0.998226950 0.001773050
##
##                pub
## sms_train_labels      No      Yes
##                ham  0.997226075 0.002773925
##                spam 0.996453901 0.003546099
##
##                put
## sms_train_labels      No      Yes
##                ham  0.992510402 0.007489598
##                spam 0.998226950 0.001773050
##
##                qualiti
## sms_train_labels      No      Yes
##                ham  0.99889043 0.00110957
##                spam 0.99822695 0.00177305
##
##                question
## sms_train_labels      No      Yes
##                ham  0.993897365 0.006102635
##                spam 0.989361702 0.010638298

```

```

##
##           quick
## sms_train_labels      No      Yes
##           ham  0.99778086 0.00221914
##           spam 1.00000000 0.00000000
##
##           quit
## sms_train_labels      No      Yes
##           ham  0.991678225 0.008321775
##           spam 1.000000000 0.000000000
##
##           quiz
## sms_train_labels      No      Yes
##           ham  1.00000000 0.00000000
##           spam 0.9787234 0.0212766
##
##           quot
## sms_train_labels      No      Yes
##           ham  0.998890430 0.001109570
##           spam 0.992907801 0.007092199
##
##           rain
## sms_train_labels      No      Yes
##           ham  0.996393897 0.003606103
##           spam 1.000000000 0.000000000
##
##           rate
## sms_train_labels      No      Yes
##           ham  0.999445215 0.000554785
##           spam 0.962765957 0.037234043
##
##           rather
## sms_train_labels      No      Yes
##           ham  0.998613037 0.001386963
##           spam 1.000000000 0.000000000
##
##           rcvd
## sms_train_labels      No      Yes
##           ham  1.00000000 0.00000000
##           spam 0.9893617 0.0106383
##
##           reach
## sms_train_labels      No      Yes
##           ham  0.991123440 0.008876560
##           spam 0.991134752 0.008865248
##
##           read
## sms_train_labels      No      Yes
##           ham  0.99445215 0.00554785
##           spam 0.99822695 0.00177305
##
##           readi
## sms_train_labels      No      Yes
##           ham  0.992510402 0.007489598

```

```

##          spam 0.994680851 0.005319149
##
##          real
## sms_train_labels      No      Yes
##          ham 0.994729542 0.005270458
##          spam 0.980496454 0.019503546
##
##          realiz
## sms_train_labels      No      Yes
##          ham 0.99889043 0.00110957
##          spam 0.99822695 0.00177305
##
##          realli
## sms_train_labels      No      Yes
##          ham 0.98335645 0.01664355
##          spam 0.99822695 0.00177305
##
##          reason
## sms_train_labels      No      Yes
##          ham 0.996393897 0.003606103
##          spam 1.000000000 0.000000000
##
##          receipt
## sms_train_labels      No      Yes
##          ham 0.999445215 0.000554785
##          spam 0.994680851 0.005319149
##
##          receiv
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 0.955673759 0.044326241
##
##          recent
## sms_train_labels      No      Yes
##          ham 0.998890430 0.001109570
##          spam 0.992907801 0.007092199
##
##          record
## sms_train_labels      No      Yes
##          ham 0.99889043 0.00110957
##          spam 0.99822695 0.00177305
##
##          refer
## sms_train_labels      No      Yes
##          ham 0.998890430 0.001109570
##          spam 0.992907801 0.007092199
##
##          regard
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 0.998226950 0.001773050
##
##          regist
## sms_train_labels      No      Yes

```

```

##          ham 0.998890430 0.001109570
##          spam 0.991134752 0.008865248
##
##          remain
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          rememb
## sms_train_labels      No      Yes
##          ham 0.991678225 0.008321775
##          spam 1.000000000 0.000000000
##
##          remind
## sms_train_labels      No      Yes
##          ham 0.99778086 0.00221914
##          spam 0.99822695 0.00177305
##
##          remov
## sms_train_labels      No      Yes
##          ham 0.998890430 0.001109570
##          spam 0.992907801 0.007092199
##
##          rent
## sms_train_labels      No      Yes
##          ham 0.997503467 0.002496533
##          spam 1.000000000 0.000000000
##
##          rental
## sms_train_labels      No      Yes
##          ham 1.000000000 0.000000000
##          spam 0.98404255 0.01595745
##
##          repli
## sms_train_labels      No      Yes
##          ham 0.9889043 0.0110957
##          spam 0.8705674 0.1294326
##
##          repres
## sms_train_labels      No      Yes
##          ham 1.0000000 0.0000000
##          spam 0.9858156 0.0141844
##
##          request
## sms_train_labels      No      Yes
##          ham 0.997780860 0.002219140
##          spam 0.996453901 0.003546099
##
##          respond
## sms_train_labels      No      Yes
##          ham 0.998890430 0.001109570
##          spam 0.996453901 0.003546099
##
##          respons

```



```

## sms_train_labels      No      Yes
##      ham 0.9991678225 0.0008321775
##      spam 0.9964539007 0.0035460993
##
##      rest
## sms_train_labels      No      Yes
##      ham 0.998058252 0.001941748
##      spam 1.000000000 0.000000000
##
##      result
## sms_train_labels      No      Yes
##      ham 0.9991678225 0.0008321775
##      spam 0.9946808511 0.0053191489
##
##      return
## sms_train_labels      No      Yes
##      ham 0.997503467 0.002496533
##      spam 1.000000000 0.000000000
##
##      reveal
## sms_train_labels      No      Yes
##      ham 1.000000000 0.000000000
##      spam 0.991134752 0.008865248
##
##      review
## sms_train_labels      No      Yes
##      ham 0.9997226075 0.0002773925
##      spam 0.9929078014 0.0070921986
##
##      right
## sms_train_labels      No      Yes
##      ham 0.980582524 0.019417476
##      spam 0.996453901 0.003546099
##
##      ring
## sms_train_labels      No      Yes
##      ham 0.996948682 0.003051318
##      spam 0.996453901 0.003546099
##
##      rington
## sms_train_labels      No      Yes
##      ham 1.000000000 0.000000000
##      spam 0.95567376 0.04432624
##
##      rite
## sms_train_labels      No      Yes
##      ham 0.99667129 0.00332871
##      spam 1.000000000 0.000000000
##
##      road
## sms_train_labels      No      Yes
##      ham 0.99778086 0.00221914
##      spam 1.000000000 0.000000000
##

```

```

##                rock
## sms_train_labels      No          Yes
##                ham  0.997226075  0.002773925
##                spam 0.998226950  0.001773050
##
##                room
## sms_train_labels      No          Yes
##                ham  0.991955617  0.008044383
##                spam 0.998226950  0.001773050
##
##                roommat
## sms_train_labels      No          Yes
##                ham  0.998335645  0.001664355
##                spam 1.000000000  0.000000000
##
##                rose
## sms_train_labels      No          Yes
##                ham  0.998613037  0.001386963
##                spam 0.998226950  0.001773050
##
##                round
## sms_train_labels      No          Yes
##                ham  0.998335645  0.001664355
##                spam 0.998226950  0.001773050
##
##                rowwjl
## sms_train_labels      No          Yes
##                ham  1.000000000  0.000000000
##                spam 0.98758865  0.01241135
##
##                rpli
## sms_train_labels      No          Yes
##                ham  0.998613037  0.001386963
##                spam 0.992907801  0.007092199
##
##                rreveal
## sms_train_labels      No          Yes
##                ham  1.0000000  0.0000000
##                spam 0.9893617  0.0106383
##
##                run
## sms_train_labels      No          Yes
##                ham  0.993897365  0.006102635
##                spam 0.998226950  0.001773050
##
##                sad
## sms_train_labels      No          Yes
##                ham  0.996116505  0.003883495
##                spam 1.000000000  0.000000000
##
##                sae
## sms_train_labels      No          Yes
##                ham  1.000000000  0.000000000
##                spam 0.97695035  0.02304965

```

```

##
##          safe
## sms_train_labels      No      Yes
##          ham  0.997503467  0.002496533
##          spam 1.000000000  0.000000000
##
##          said
## sms_train_labels      No      Yes
##          ham  0.98224688  0.01775312
##          spam 1.00000000  0.00000000
##
##          sale
## sms_train_labels      No      Yes
##          ham  0.998890430  0.001109570
##          spam 0.992907801  0.007092199
##
##          sam
## sms_train_labels      No      Yes
##          ham  0.999445215  0.000554785
##          spam 0.994680851  0.005319149
##
##          sat
## sms_train_labels      No      Yes
##          ham  0.995006935  0.004993065
##          spam 0.998226950  0.001773050
##
##          saturday
## sms_train_labels      No      Yes
##          ham  0.998058252  0.001941748
##          spam 0.992907801  0.007092199
##
##          savamob
## sms_train_labels      No      Yes
##          ham  1.00000000  0.00000000
##          spam 0.98758865  0.01241135
##
##          save
## sms_train_labels      No      Yes
##          ham  0.998058252  0.001941748
##          spam 0.996453901  0.003546099
##
##          saw
## sms_train_labels      No      Yes
##          ham  0.995284327  0.004715673
##          spam 1.00000000  0.00000000
##
##          say
## sms_train_labels      No      Yes
##          ham  0.97281553  0.02718447
##          spam 0.99822695  0.00177305
##
##          sch
## sms_train_labels      No      Yes
##          ham  0.995839112  0.004160888

```

```

##          spam 1.000000000 0.000000000
##
##          school
## sms_train_labels      No      Yes
##          ham 0.99556172 0.00443828
##          spam 1.00000000 0.00000000
##
##          score
## sms_train_labels      No      Yes
##          ham 0.9991678225 0.0008321775
##          spam 0.9964539007 0.0035460993
##
##          scream
## sms_train_labels      No      Yes
##          ham 0.99667129 0.00332871
##          spam 1.00000000 0.00000000
##
##          sea
## sms_train_labels      No      Yes
##          ham 0.996393897 0.003606103
##          spam 1.000000000 0.000000000
##
##          search
## sms_train_labels      No      Yes
##          ham 0.995284327 0.004715673
##          spam 0.996453901 0.003546099
##
##          season
## sms_train_labels      No      Yes
##          ham 0.99889043 0.00110957
##          spam 0.99822695 0.00177305
##
##          sec
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          second
## sms_train_labels      No      Yes
##          ham 0.995839112 0.004160888
##          spam 1.000000000 0.000000000
##
##          secret
## sms_train_labels      No      Yes
##          ham 0.99889043 0.00110957
##          spam 0.98226950 0.01773050
##
##          see
## sms_train_labels      No      Yes
##          ham 0.96865465 0.03134535
##          spam 0.98226950 0.01773050
##
##          seem
## sms_train_labels      No      Yes

```

```

##          ham 0.99667129 0.00332871
##          spam 0.99822695 0.00177305
##
##          seen
## sms_train_labels      No          Yes
##          ham 0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          select
## sms_train_labels      No          Yes
##          ham 0.9991678225 0.0008321775
##          spam 0.9609929078 0.0390070922
##
##          self
## sms_train_labels      No          Yes
##          ham 0.9991678225 0.0008321775
##          spam 0.9964539007 0.0035460993
##
##          sell
## sms_train_labels      No          Yes
##          ham 0.997503467 0.002496533
##          spam 0.996453901 0.003546099
##
##          semest
## sms_train_labels      No          Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          send
## sms_train_labels      No          Yes
##          ham 0.97198336 0.02801664
##          spam 0.91134752 0.08865248
##
##          sens
## sms_train_labels      No          Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          sent
## sms_train_labels      No          Yes
##          ham 0.98751734 0.01248266
##          spam 0.98404255 0.01595745
##
##          serious
## sms_train_labels      No          Yes
##          ham 0.996393897 0.003606103
##          spam 1.000000000 0.000000000
##
##          servic
## sms_train_labels      No          Yes
##          ham 0.999445215 0.000554785
##          spam 0.900709220 0.099290780
##
##          set

```

```

## sms_train_labels      No      Yes
##      ham 0.995006935 0.004993065
##      spam 0.996453901 0.003546099
##
##      settl
## sms_train_labels      No      Yes
##      ham 0.99778086 0.00221914
##      spam 1.00000000 0.00000000
##
##      sex
## sms_train_labels      No      Yes
##      ham 0.999445215 0.000554785
##      spam 0.987588652 0.012411348
##
##      sexi
## sms_train_labels      No      Yes
##      ham 0.997226075 0.002773925
##      spam 0.976950355 0.023049645
##
##      shall
## sms_train_labels      No      Yes
##      ham 0.993619972 0.006380028
##      spam 1.000000000 0.000000000
##
##      share
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 1.000000000 0.000000000
##
##      shd
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 1.000000000 0.000000000
##
##      ship
## sms_train_labels      No      Yes
##      ham 0.99889043 0.00110957
##      spam 1.00000000 0.00000000
##
##      shirt
## sms_train_labels      No      Yes
##      ham 0.998335645 0.001664355
##      spam 1.000000000 0.000000000
##
##      shit
## sms_train_labels      No      Yes
##      ham 0.992787795 0.007212205
##      spam 1.000000000 0.000000000
##
##      shop
## sms_train_labels      No      Yes
##      ham 0.99334258 0.00665742
##      spam 0.98226950 0.01773050
##

```

```

##          short
## sms_train_labels      No      Yes
##          ham  0.997226075  0.002773925
##          spam 0.994680851  0.005319149
##
##          show
## sms_train_labels      No      Yes
##          ham  0.992787795  0.007212205
##          spam 0.959219858  0.040780142
##
##          shower
## sms_train_labels      No      Yes
##          ham  0.99778086  0.00221914
##          spam 1.00000000  0.00000000
##
##          shuhui
## sms_train_labels      No      Yes
##          ham  0.998335645  0.001664355
##          spam 1.00000000  0.00000000
##
##          sick
## sms_train_labels      No      Yes
##          ham  0.997226075  0.002773925
##          spam 1.00000000  0.00000000
##
##          side
## sms_train_labels      No      Yes
##          ham  0.99778086  0.00221914
##          spam 1.00000000  0.00000000
##
##          sigh
## sms_train_labels      No      Yes
##          ham  0.998335645  0.001664355
##          spam 1.00000000  0.00000000
##
##          sight
## sms_train_labels      No      Yes
##          ham  0.9991678225  0.0008321775
##          spam 1.000000000  0.000000000
##
##          sign
## sms_train_labels      No      Yes
##          ham  0.998613037  0.001386963
##          spam 0.996453901  0.003546099
##
##          silent
## sms_train_labels      No      Yes
##          ham  0.997226075  0.002773925
##          spam 1.000000000  0.000000000
##
##          simpl
## sms_train_labels      No      Yes
##          ham  0.998058252  0.001941748
##          spam 1.000000000  0.000000000

```

```

##
##          sinc
## sms_train_labels      No          Yes
##          ham  0.994452150 0.005547850
##          spam 0.996453901 0.003546099
##
##          sing
## sms_train_labels      No          Yes
##          ham  0.9991678225 0.0008321775
##          spam 0.9982269504 0.0017730496
##
##          singl
## sms_train_labels      No          Yes
##          ham  0.998335645 0.001664355
##          spam 0.989361702 0.010638298
##
##          sir
## sms_train_labels      No          Yes
##          ham  0.991955617 0.008044383
##          spam 0.998226950 0.001773050
##
##          sis
## sms_train_labels      No          Yes
##          ham  0.996116505 0.003883495
##          spam 1.000000000 0.000000000
##
##          sister
## sms_train_labels      No          Yes
##          ham  0.996116505 0.003883495
##          spam 1.000000000 0.000000000
##
##          sit
## sms_train_labels      No          Yes
##          ham  0.997226075 0.002773925
##          spam 1.000000000 0.000000000
##
##          situat
## sms_train_labels      No          Yes
##          ham  0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          sky
## sms_train_labels      No          Yes
##          ham  0.9997226075 0.0002773925
##          spam 0.9964539007 0.0035460993
##
##          slave
## sms_train_labels      No          Yes
##          ham  0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          sleep
## sms_train_labels      No          Yes
##          ham  0.98474341 0.01525659

```



```

##          spam 1.00000000 0.00000000
##
##          slept
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          slow
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 0.998226950 0.001773050
##
##          slowli
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          small
## sms_train_labels      No      Yes
##          ham 0.99778086 0.00221914
##          spam 1.00000000 0.00000000
##
##          smile
## sms_train_labels      No      Yes
##          ham 0.990568655 0.009431345
##          spam 1.000000000 0.000000000
##
##          smoke
## sms_train_labels      No      Yes
##          ham 0.99556172 0.00443828
##          spam 1.00000000 0.00000000
##
##          sms
## sms_train_labels      No      Yes
##          ham 0.997226075 0.002773925
##          spam 0.960992908 0.039007092
##
##          smth
## sms_train_labels      No      Yes
##          ham 0.99778086 0.00221914
##          spam 1.00000000 0.00000000
##
##          snow
## sms_train_labels      No      Yes
##          ham 0.997503467 0.002496533
##          spam 1.000000000 0.000000000
##
##          sofa
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          solv
## sms_train_labels      No      Yes

```

```

##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          somebodi
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 0.996453901 0.003546099
##
##          someon
## sms_train_labels      No      Yes
##          ham 0.99112344 0.00887656
##          spam 0.97872340 0.02127660
##
##          someth
## sms_train_labels      No      Yes
##          ham 0.98613037 0.01386963
##          spam 1.00000000 0.00000000
##
##          sometim
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          somewher
## sms_train_labels      No      Yes
##          ham 0.99778086 0.00221914
##          spam 1.00000000 0.00000000
##
##          song
## sms_train_labels      No      Yes
##          ham 0.997780860 0.002219140
##          spam 0.996453901 0.003546099
##
##          soni
## sms_train_labels      No      Yes
##          ham 1.000000000 0.000000000
##          spam 0.991134752 0.008865248
##
##          sonyericsson
## sms_train_labels      No      Yes
##          ham 1.000000000 0.000000000
##          spam 0.991134752 0.008865248
##
##          soon
## sms_train_labels      No      Yes
##          ham 0.988904300 0.011095700
##          spam 0.996453901 0.003546099
##
##          sorri
## sms_train_labels      No      Yes
##          ham 0.969209431 0.030790569
##          spam 0.994680851 0.005319149
##
##          sort

```

```

## sms_train_labels      No      Yes
##      ham  0.996948682  0.003051318
##      spam 0.998226950  0.001773050
##
##      sound
## sms_train_labels      No      Yes
##      ham  0.994729542  0.005270458
##      spam 0.998226950  0.001773050
##
##      space
## sms_train_labels      No      Yes
##      ham  0.998335645  0.001664355
##      spam 0.998226950  0.001773050
##
##      speak
## sms_train_labels      No      Yes
##      ham  0.993897365  0.006102635
##      spam 0.985815603  0.014184397
##
##      special
## sms_train_labels      No      Yes
##      ham  0.99334258  0.00665742
##      spam 0.96808511  0.03191489
##
##      specialcal
## sms_train_labels      No      Yes
##      ham  1.0000000  0.0000000
##      spam 0.9893617  0.0106383
##
##      spend
## sms_train_labels      No      Yes
##      ham  0.997226075  0.002773925
##      spam 1.000000000  0.000000000
##
##      spent
## sms_train_labels      No      Yes
##      ham  0.998058252  0.001941748
##      spam 1.000000000  0.000000000
##
##      spoke
## sms_train_labels      No      Yes
##      ham  0.998613037  0.001386963
##      spam 1.000000000  0.000000000
##
##      sport
## sms_train_labels      No      Yes
##      ham  0.9997226075 0.0002773925
##      spam 0.9929078014 0.0070921986
##
##      spree
## sms_train_labels      No      Yes
##      ham  1.000000000  0.000000000
##      spam 0.991134752  0.008865248
##

```

```

##                stand
## sms_train_labels      No          Yes
##                ham  0.99778086  0.00221914
##                spam 1.00000000  0.00000000
##
##                star
## sms_train_labels      No          Yes
##                ham  0.9991678225  0.0008321775
##                spam 0.9946808511  0.0053191489
##
##                start
## sms_train_labels      No          Yes
##                ham  0.98862691  0.01137309
##                spam 0.98049645  0.01950355
##
##                statement
## sms_train_labels      No          Yes
##                ham  0.9997226075  0.0002773925
##                spam 0.9858156028  0.0141843972
##
##                station
## sms_train_labels      No          Yes
##                ham  0.998613037  0.001386963
##                spam 1.000000000  0.000000000
##
##                stay
## sms_train_labels      No          Yes
##                ham  0.993342580  0.006657420
##                spam 0.994680851  0.005319149
##
##                std
## sms_train_labels      No          Yes
##                ham  1.00000000  0.00000000
##                spam 0.98758865  0.01241135
##
##                still
## sms_train_labels      No          Yes
##                ham  0.96865465  0.03134535
##                spam 0.98936170  0.01063830
##
##                stock
## sms_train_labels      No          Yes
##                ham  0.998613037  0.001386963
##                spam 1.000000000  0.000000000
##
##                stop
## sms_train_labels      No          Yes
##                ham  0.99112344  0.00887656
##                spam 0.87765957  0.12234043
##
##                store
## sms_train_labels      No          Yes
##                ham  0.9991678225  0.0008321775
##                spam 0.9875886525  0.0124113475

```

```

##
##          stori
## sms_train_labels      No          Yes
##          ham  0.995839112 0.004160888
##          spam 0.998226950 0.001773050
##
##          str
## sms_train_labels      No          Yes
##          ham  0.9991678225 0.0008321775
##          spam 0.9964539007 0.0035460993
##
##          straight
## sms_train_labels      No          Yes
##          ham  0.9991678225 0.0008321775
##          spam 0.9964539007 0.0035460993
##
##          street
## sms_train_labels      No          Yes
##          ham  0.998890430 0.001109570
##          spam 0.996453901 0.003546099
##
##          strong
## sms_train_labels      No          Yes
##          ham  0.998613037 0.001386963
##          spam 0.998226950 0.001773050
##
##          student
## sms_train_labels      No          Yes
##          ham  0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          studi
## sms_train_labels      No          Yes
##          ham  0.996948682 0.003051318
##          spam 1.000000000 0.000000000
##
##          stuff
## sms_train_labels      No          Yes
##          ham  0.99334258 0.00665742
##          spam 0.99822695 0.00177305
##
##          stupid
## sms_train_labels      No          Yes
##          ham  0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          style
## sms_train_labels      No          Yes
##          ham  0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          sub
## sms_train_labels      No          Yes
##          ham  0.9997226075 0.0002773925

```

```

##          spam 0.9822695035 0.0177304965
##
##          subscrib
## sms_train_labels      No      Yes
##          ham 1.00000000 0.00000000
##          spam 0.98758865 0.01241135
##
##          success
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          summer
## sms_train_labels      No      Yes
##          ham 0.9997226075 0.0002773925
##          spam 0.9929078014 0.0070921986
##
##          sun
## sms_train_labels      No      Yes
##          ham 0.99667129 0.00332871
##          spam 0.99822695 0.00177305
##
##          sunday
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          sunshin
## sms_train_labels      No      Yes
##          ham 0.9997226075 0.0002773925
##          spam 0.9875886525 0.0124113475
##
##          support
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          suppos
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          sure
## sms_train_labels      No      Yes
##          ham 0.98391123 0.01608877
##          spam 1.00000000 0.00000000
##
##          surpris
## sms_train_labels      No      Yes
##          ham 0.997780860 0.002219140
##          spam 0.996453901 0.003546099
##
##          sweet
## sms_train_labels      No      Yes

```

```

##          ham 0.99223301 0.00776699
##          spam 1.00000000 0.00000000
##
##          swing
## sms_train_labels      No      Yes
##          ham 0.99778086 0.00221914
##          spam 1.00000000 0.00000000
##
##          system
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          take
## sms_train_labels      No      Yes
##          ham 0.97337032 0.02662968
##          spam 0.97517730 0.02482270
##
##          talk
## sms_train_labels      No      Yes
##          ham 0.988626907 0.011373093
##          spam 0.996453901 0.003546099
##
##          tampa
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          tcs
## sms_train_labels      No      Yes
##          ham 1.000000000 0.000000000
##          spam 0.95921986 0.04078014
##
##          teach
## sms_train_labels      No      Yes
##          ham 0.99778086 0.00221914
##          spam 1.00000000 0.00000000
##
##          team
## sms_train_labels      No      Yes
##          ham 0.9991678225 0.0008321775
##          spam 0.9946808511 0.0053191489
##
##          tear
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          teas
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          tel

```

```

## sms_train_labels      No      Yes
##      ham 0.99778086 0.00221914
##      spam 0.99822695 0.00177305
##
##      tell
## sms_train_labels      No      Yes
##      ham 0.97475728 0.02524272
##      spam 0.97695035 0.02304965
##
##      ten
## sms_train_labels      No      Yes
##      ham 0.996948682 0.003051318
##      spam 0.998226950 0.001773050
##
##      tenerif
## sms_train_labels      No      Yes
##      ham 1.00000000 0.00000000
##      spam 0.98758865 0.01241135
##
##      term
## sms_train_labels      No      Yes
##      ham 0.99889043 0.00110957
##      spam 0.98581560 0.01418440
##
##      test
## sms_train_labels      No      Yes
##      ham 0.994174757 0.005825243
##      spam 1.000000000 0.000000000
##
##      text
## sms_train_labels      No      Yes
##      ham 0.98252427 0.01747573
##      spam 0.84219858 0.15780142
##
##      thank
## sms_train_labels      No      Yes
##      ham 0.98196949 0.01803051
##      spam 0.97517730 0.02482270
##
##      thanx
## sms_train_labels      No      Yes
##      ham 0.993065187 0.006934813
##      spam 1.000000000 0.000000000
##
##      that
## sms_train_labels      No      Yes
##      ham 0.993065187 0.006934813
##      spam 1.000000000 0.000000000
##
##      thing
## sms_train_labels      No      Yes
##      ham 0.980305132 0.019694868
##      spam 0.996453901 0.003546099
##

```



```

##                think
## sms_train_labels      No          Yes
##                ham  0.96893204 0.03106796
##                spam 0.98226950 0.01773050
##
##                thinkin
## sms_train_labels      No          Yes
##                ham  0.998613037 0.001386963
##                spam 1.000000000 0.000000000
##
##                thk
## sms_train_labels      No          Yes
##                ham  0.98918169 0.01081831
##                spam 1.000000000 0.000000000
##
##                thnk
## sms_train_labels      No          Yes
##                ham  0.998058252 0.001941748
##                spam 1.000000000 0.000000000
##
##                tho
## sms_train_labels      No          Yes
##                ham  0.99667129 0.00332871
##                spam 1.000000000 0.000000000
##
##                though
## sms_train_labels      No          Yes
##                ham  0.994729542 0.005270458
##                spam 1.000000000 0.000000000
##
##                thought
## sms_train_labels      No          Yes
##                ham  0.99112344 0.00887656
##                spam 0.99822695 0.00177305
##
##                throw
## sms_train_labels      No          Yes
##                ham  0.998335645 0.001664355
##                spam 1.000000000 0.000000000
##
##                thru
## sms_train_labels      No          Yes
##                ham  0.998613037 0.001386963
##                spam 1.000000000 0.000000000
##
##                tht
## sms_train_labels      No          Yes
##                ham  0.998058252 0.001941748
##                spam 1.000000000 0.000000000
##
##                thur
## sms_train_labels      No          Yes
##                ham  0.9991678225 0.0008321775
##                spam 0.9964539007 0.0035460993

```

```

##
##          ticket
## sms_train_labels      No      Yes
##          ham  0.997503467 0.002496533
##          spam 0.994680851 0.005319149
##
##          til
## sms_train_labels      No      Yes
##          ham  0.995284327 0.004715673
##          spam 1.000000000 0.000000000
##
##          till
## sms_train_labels      No      Yes
##          ham  0.995561720 0.004438280
##          spam 0.994680851 0.005319149
##
##          time
## sms_train_labels      No      Yes
##          ham  0.95672677 0.04327323
##          spam 0.97872340 0.02127660
##
##          tire
## sms_train_labels      No      Yes
##          ham  0.997226075 0.002773925
##          spam 1.000000000 0.000000000
##
##          titl
## sms_train_labels      No      Yes
##          ham  1.000000000 0.000000000
##          spam 0.994680851 0.005319149
##
##          tmr
## sms_train_labels      No      Yes
##          ham  0.994174757 0.005825243
##          spam 1.000000000 0.000000000
##
##          tnccs
## sms_train_labels      No      Yes
##          ham  1.000000000 0.000000000
##          spam 0.991134752 0.008865248
##
##          today
## sms_train_labels      No      Yes
##          ham  0.97170596 0.02829404
##          spam 0.95035461 0.04964539
##
##          togeth
## sms_train_labels      No      Yes
##          ham  0.996393897 0.003606103
##          spam 1.000000000 0.000000000
##
##          told
## sms_train_labels      No      Yes
##          ham  0.98945908 0.01054092

```

```

##          spam 1.00000000 0.00000000
##
##          tomo
## sms_train_labels      No      Yes
##          ham 0.995284327 0.004715673
##          spam 1.000000000 0.000000000
##
##          tomorrow
## sms_train_labels      No      Yes
##          ham 0.98335645 0.01664355
##          spam 0.98581560 0.01418440
##
##          tone
## sms_train_labels      No      Yes
##          ham 1.00000000 0.00000000
##          spam 0.92907801 0.07092199
##
##          tonight
## sms_train_labels      No      Yes
##          ham 0.990568655 0.009431345
##          spam 0.994680851 0.005319149
##
##          tonit
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          took
## sms_train_labels      No      Yes
##          ham 0.995006935 0.004993065
##          spam 1.000000000 0.000000000
##
##          top
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 0.973404255 0.026595745
##
##          tot
## sms_train_labels      No      Yes
##          ham 0.99667129 0.00332871
##          spam 1.00000000 0.00000000
##
##          total
## sms_train_labels      No      Yes
##          ham 0.998890430 0.001109570
##          spam 0.996453901 0.003546099
##
##          touch
## sms_train_labels      No      Yes
##          ham 0.995839112 0.004160888
##          spam 0.998226950 0.001773050
##
##          tough
## sms_train_labels      No      Yes

```

```

##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          tour
## sms_train_labels      No      Yes
##          ham 0.999445215 0.000554785
##          spam 0.994680851 0.005319149
##
##          toward
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          town
## sms_train_labels      No      Yes
##          ham 0.994729542 0.005270458
##          spam 0.994680851 0.005319149
##
##          track
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          train
## sms_train_labels      No      Yes
##          ham 0.996393897 0.003606103
##          spam 1.000000000 0.000000000
##
##          transact
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          treat
## sms_train_labels      No      Yes
##          ham 0.99556172 0.00443828
##          spam 1.00000000 0.00000000
##
##          tri
## sms_train_labels      No      Yes
##          ham 0.98529820 0.01470180
##          spam 0.94680851 0.05319149
##
##          trip
## sms_train_labels      No      Yes
##          ham 0.997503467 0.002496533
##          spam 0.994680851 0.005319149
##
##          troubl
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          true

```

```

## sms_train_labels      No      Yes
##      ham 0.995561720 0.004438280
##      spam 0.996453901 0.003546099
##
##      trust
## sms_train_labels      No      Yes
##      ham 0.997503467 0.002496533
##      spam 1.000000000 0.000000000
##
##      truth
## sms_train_labels      No      Yes
##      ham 0.997226075 0.002773925
##      spam 1.000000000 0.000000000
##
##      tscs
## sms_train_labels      No      Yes
##      ham 1.000000000 0.000000000
##      spam 0.96985816 0.03014184
##
##      ttyl
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 1.000000000 0.000000000
##
##      tuesday
## sms_train_labels      No      Yes
##      ham 0.99889043 0.00110957
##      spam 1.00000000 0.00000000
##
##      turn
## sms_train_labels      No      Yes
##      ham 0.996948682 0.003051318
##      spam 1.000000000 0.000000000
##
##      twice
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 1.000000000 0.000000000
##
##      two
## sms_train_labels      No      Yes
##      ham 0.99334258 0.00665742
##      spam 1.00000000 0.00000000
##
##      txt
## sms_train_labels      No      Yes
##      ham 0.998058252 0.001941748
##      spam 0.796099291 0.203900709
##
##      txtting
## sms_train_labels      No      Yes
##      ham 0.9997226075 0.0002773925
##      spam 0.9875886525 0.0124113475
##

```

```

##          txts
## sms_train_labels      No      Yes
##          ham  1.0000000 0.0000000
##          spam 0.9822695 0.0177305
##
##          type
## sms_train_labels      No      Yes
##          ham  0.996948682 0.003051318
##          spam 0.998226950 0.001773050
##
##          ufind
## sms_train_labels      No      Yes
##          ham  1.0000000 0.0000000
##          spam 0.9893617 0.0106383
##
##          ugh
## sms_train_labels      No      Yes
##          ham  0.996948682 0.003051318
##          spam 1.000000000 0.000000000
##
##          umma
## sms_train_labels      No      Yes
##          ham  0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          uncl
## sms_train_labels      No      Yes
##          ham  0.997226075 0.002773925
##          spam 1.000000000 0.000000000
##
##          understand
## sms_train_labels      No      Yes
##          ham  0.99778086 0.00221914
##          spam 1.00000000 0.00000000
##
##          unless
## sms_train_labels      No      Yes
##          ham  0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          unlimit
## sms_train_labels      No      Yes
##          ham  0.99889043 0.00110957
##          spam 0.98758865 0.01241135
##
##          unredeem
## sms_train_labels      No      Yes
##          ham  1.00000000 0.00000000
##          spam 0.98404255 0.01595745
##
##          unsub
## sms_train_labels      No      Yes
##          ham  1.00000000 0.00000000
##          spam 0.98758865 0.01241135

```

```

##
##          unsubscrib
## sms_train_labels      No      Yes
##          ham  1.0000000 0.0000000
##          spam 0.9751773 0.0248227
##
##          updat
## sms_train_labels      No      Yes
##          ham  0.9991678225 0.0008321775
##          spam 0.9840425532 0.0159574468
##
##          ure
## sms_train_labels      No      Yes
##          ham  0.99778086 0.00221914
##          spam 1.00000000 0.00000000
##
##          urgent
## sms_train_labels      No      Yes
##          ham  0.99889043 0.00110957
##          spam 0.92021277 0.07978723
##
##          urself
## sms_train_labels      No      Yes
##          ham  0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          use
## sms_train_labels      No      Yes
##          ham  0.98918169 0.01081831
##          spam 0.98758865 0.01241135
##
##          usf
## sms_train_labels      No      Yes
##          ham  0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          usual
## sms_train_labels      No      Yes
##          ham  0.99667129 0.00332871
##          spam 1.00000000 0.00000000
##
##          uve
## sms_train_labels      No      Yes
##          ham  0.9997226075 0.0002773925
##          spam 0.9893617021 0.0106382979
##
##          valentin
## sms_train_labels      No      Yes
##          ham  0.997226075 0.002773925
##          spam 0.994680851 0.005319149
##
##          valid
## sms_train_labels      No      Yes
##          ham  1.00000000 0.00000000

```

```

##          spam 0.96985816 0.03014184
##
##          valu
## sms_train_labels      No      Yes
##          ham 0.99889043 0.00110957
##          spam 0.98581560 0.01418440
##
##          vari
## sms_train_labels      No      Yes
##          ham 1.000000000 0.000000000
##          spam 0.991134752 0.008865248
##
##          verifi
## sms_train_labels      No      Yes
##          ham 0.999445215 0.000554785
##          spam 0.994680851 0.005319149
##
##          via
## sms_train_labels      No      Yes
##          ham 0.99778086 0.00221914
##          spam 0.99822695 0.00177305
##
##          video
## sms_train_labels      No      Yes
##          ham 0.999445215 0.000554785
##          spam 0.964539007 0.035460993
##
##          visit
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 0.991134752 0.008865248
##
##          voic
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          voucher
## sms_train_labels      No      Yes
##          ham 1.000000000 0.000000000
##          spam 0.95035461 0.04964539
##
##          wait
## sms_train_labels      No      Yes
##          ham 0.97919556 0.02080444
##          spam 0.97517730 0.02482270
##
##          wake
## sms_train_labels      No      Yes
##          ham 0.993065187 0.006934813
##          spam 1.000000000 0.000000000
##
##          walk
## sms_train_labels      No      Yes

```



```

##          ham 0.995006935 0.004993065
##          spam 0.998226950 0.001773050
##
##          wan
## sms_train_labels      No      Yes
##          ham 0.989459085 0.010540915
##          spam 0.992907801 0.007092199
##
##          wana
## sms_train_labels      No      Yes
##          ham 0.997226075 0.002773925
##          spam 1.000000000 0.000000000
##
##          wanna
## sms_train_labels      No      Yes
##          ham 0.993897365 0.006102635
##          spam 0.985815603 0.014184397
##
##          want
## sms_train_labels      No      Yes
##          ham 0.95839112 0.04160888
##          spam 0.96276596 0.03723404
##
##          wap
## sms_train_labels      No      Yes
##          ham 1.00000000 0.00000000
##          spam 0.98758865 0.01241135
##
##          warm
## sms_train_labels      No      Yes
##          ham 0.997780860 0.002219140
##          spam 0.996453901 0.003546099
##
##          wast
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 1.000000000 0.000000000
##
##          wat
## sms_train_labels      No      Yes
##          ham 0.97836338 0.02163662
##          spam 1.00000000 0.00000000
##
##          watch
## sms_train_labels      No      Yes
##          ham 0.98668516 0.01331484
##          spam 1.00000000 0.00000000
##
##          water
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          way

```

```

## sms_train_labels      No      Yes
##      ham 0.98002774 0.01997226
##      spam 0.99822695 0.00177305
##
##      weak
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 1.000000000 0.000000000
##
##      wear
## sms_train_labels      No      Yes
##      ham 0.998058252 0.001941748
##      spam 1.000000000 0.000000000
##
##      weather
## sms_train_labels      No      Yes
##      ham 0.998335645 0.001664355
##      spam 1.000000000 0.000000000
##
##      wed
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 0.996453901 0.003546099
##
##      wednesday
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 1.000000000 0.000000000
##
##      weed
## sms_train_labels      No      Yes
##      ham 0.998058252 0.001941748
##      spam 1.000000000 0.000000000
##
##      week
## sms_train_labels      No      Yes
##      ham 0.98834951 0.01165049
##      spam 0.89361702 0.10638298
##
##      weekend
## sms_train_labels      No      Yes
##      ham 0.994174757 0.005825243
##      spam 0.987588652 0.012411348
##
##      weight
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 1.000000000 0.000000000
##
##      welcom
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 0.987588652 0.012411348
##

```

```

##                well
## sms_train_labels      No          Yes
##          ham 0.976699029 0.023300971
##          spam 0.994680851 0.005319149
##
##                wen
## sms_train_labels      No          Yes
##          ham 0.995284327 0.004715673
##          spam 1.000000000 0.000000000
##
##                went
## sms_train_labels      No          Yes
##          ham 0.98834951 0.01165049
##          spam 1.00000000 0.00000000
##
##                wer
## sms_train_labels      No          Yes
##          ham 0.999445215 0.000554785
##          spam 1.000000000 0.000000000
##
##                wet
## sms_train_labels      No          Yes
##          ham 0.9991678225 0.0008321775
##          spam 0.9964539007 0.0035460993
##
##                what
## sms_train_labels      No          Yes
##          ham 0.998058252 0.001941748
##          spam 0.998226950 0.001773050
##
##                whatev
## sms_train_labels      No          Yes
##          ham 0.996393897 0.003606103
##          spam 1.000000000 0.000000000
##
##                whenever
## sms_train_labels      No          Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##                whole
## sms_train_labels      No          Yes
##          ham 0.996393897 0.003606103
##          spam 1.000000000 0.000000000
##
##                wid
## sms_train_labels      No          Yes
##          ham 0.996393897 0.003606103
##          spam 0.996453901 0.003546099
##
##                wif
## sms_train_labels      No          Yes
##          ham 0.995006935 0.004993065
##          spam 1.000000000 0.000000000

```

```

##
##          wife
## sms_train_labels      No      Yes
##          ham  0.99556172 0.00443828
##          spam 1.00000000 0.00000000
##
##          wil
## sms_train_labels      No      Yes
##          ham  0.996948682 0.003051318
##          spam 1.000000000 0.000000000
##
##          will
## sms_train_labels      No      Yes
##          ham  0.93619972 0.06380028
##          spam 0.93794326 0.06205674
##
##          win
## sms_train_labels      No      Yes
##          ham  0.997503467 0.002496533
##          spam 0.911347518 0.088652482
##
##          wine
## sms_train_labels      No      Yes
##          ham  0.99778086 0.00221914
##          spam 1.00000000 0.00000000
##
##          winner
## sms_train_labels      No      Yes
##          ham  1.00000000 0.00000000
##          spam 0.97695035 0.02304965
##
##          wish
## sms_train_labels      No      Yes
##          ham  0.988072122 0.011927878
##          spam 0.996453901 0.003546099
##
##          wit
## sms_train_labels      No      Yes
##          ham  0.997503467 0.002496533
##          spam 1.000000000 0.000000000
##
##          within
## sms_train_labels      No      Yes
##          ham  0.998613037 0.001386963
##          spam 0.992907801 0.007092199
##
##          without
## sms_train_labels      No      Yes
##          ham  0.99556172 0.00443828
##          spam 1.00000000 0.00000000
##
##          wiv
## sms_train_labels      No      Yes
##          ham  0.998613037 0.001386963

```

```

##          spam 0.996453901 0.003546099
##
##          wkli
## sms_train_labels      No      Yes
##          ham 1.00000000 0.00000000
##          spam 0.98404255 0.01595745
##
##          wnt
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          woke
## sms_train_labels      No      Yes
##          ham 0.99778086 0.00221914
##          spam 1.00000000 0.00000000
##
##          won
## sms_train_labels      No      Yes
##          ham 1.00000000 0.00000000
##          spam 0.90070922 0.09929078
##
##          wonder
## sms_train_labels      No      Yes
##          ham 0.991678225 0.008321775
##          spam 1.000000000 0.000000000
##
##          wont
## sms_train_labels      No      Yes
##          ham 0.992787795 0.007212205
##          spam 1.000000000 0.000000000
##
##          word
## sms_train_labels      No      Yes
##          ham 0.992787795 0.007212205
##          spam 0.969858156 0.030141844
##
##          work
## sms_train_labels      No      Yes
##          ham 0.975034674 0.024965326
##          spam 0.994680851 0.005319149
##
##          workin
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          world
## sms_train_labels      No      Yes
##          ham 0.992787795 0.007212205
##          spam 0.996453901 0.003546099
##
##          worri
## sms_train_labels      No      Yes

```

```

##          ham 0.990291262 0.009708738
##          spam 1.000000000 0.000000000
##
##          worth
## sms_train_labels      No      Yes
##          ham 0.99889043 0.00110957
##          spam 0.98049645 0.01950355
##
##          wot
## sms_train_labels      No      Yes
##          ham 0.995839112 0.004160888
##          spam 1.000000000 0.000000000
##
##          wow
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 0.998226950 0.001773050
##
##          write
## sms_train_labels      No      Yes
##          ham 0.998613037 0.001386963
##          spam 1.000000000 0.000000000
##
##          wrong
## sms_train_labels      No      Yes
##          ham 0.996948682 0.003051318
##          spam 1.000000000 0.000000000
##
##          wun
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 1.000000000 0.000000000
##
##          wwwgetzedcouk
## sms_train_labels      No      Yes
##          ham 1.000000000 0.000000000
##          spam 0.98758865 0.01241135
##
##          xmas
## sms_train_labels      No      Yes
##          ham 0.998058252 0.001941748
##          spam 0.982269504 0.017730496
##
##          xxx
## sms_train_labels      No      Yes
##          ham 0.995284327 0.004715673
##          spam 0.978723404 0.021276596
##
##          yahoo
## sms_train_labels      No      Yes
##          ham 0.998335645 0.001664355
##          spam 0.996453901 0.003546099
##
##          yar

```

```

## sms_train_labels      No      Yes
##      ham 0.997226075 0.002773925
##      spam 1.000000000 0.000000000
##
##      yeah
## sms_train_labels      No      Yes
##      ham 0.98224688 0.01775312
##      spam 0.99822695 0.00177305
##
##      year
## sms_train_labels      No      Yes
##      ham 0.98751734 0.01248266
##      spam 0.97695035 0.02304965
##
##      yep
## sms_train_labels      No      Yes
##      ham 0.997503467 0.002496533
##      spam 1.000000000 0.000000000
##
##      yes
## sms_train_labels      No      Yes
##      ham 0.98335645 0.01664355
##      spam 0.98049645 0.01950355
##
##      yest
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 1.000000000 0.000000000
##
##      yesterday
## sms_train_labels      No      Yes
##      ham 0.995561720 0.004438280
##      spam 0.996453901 0.003546099
##
##      yet
## sms_train_labels      No      Yes
##      ham 0.989181692 0.010818308
##      spam 0.996453901 0.003546099
##
##      yoga
## sms_train_labels      No      Yes
##      ham 0.99889043 0.00110957
##      spam 1.000000000 0.000000000
##
##      yogasana
## sms_train_labels      No      Yes
##      ham 0.998613037 0.001386963
##      spam 1.000000000 0.000000000
##
##      yrs
## sms_train_labels      No      Yes
##      ham 0.99889043 0.00110957
##      spam 0.98936170 0.01063830
##

```

```
##                yun
## sms_train_labels      No      Yes
##                ham 0.998613037 0.001386963
##                spam 1.000000000 0.000000000
```

```
##                yup
## sms_train_labels      No      Yes
##                ham 0.991955617 0.008044383
##                spam 1.000000000 0.000000000
```

```
sms_test_pred <- predict(sms_classifier, sms_test)
```

```
library(gmodels)
CrossTable(sms_test_pred, sms_test_labels, prop.chisq = FALSE, prop.t = FALSE,
           dnn = c('predicted', 'actual'))
```

```
##
##
##      Cell Contents
## |-----|
## |                      N |
## |      N / Row Total |
## |      N / Col Total |
## |-----|
##
##
## Total Observations in Table: 1390
```

```
##
##      | actual
## predicted |      ham |      spam | Row Total |
## -----|-----|-----|-----|
##      ham |      1200 |        20 |      1220 |
##           |      0.984 |      0.016 |      0.878 |
##           |      0.993 |      0.110 |           |
## -----|-----|-----|-----|
##      spam |         9 |       161 |       170 |
##           |      0.053 |      0.947 |      0.122 |
##           |      0.007 |      0.890 |           |
## -----|-----|-----|-----|
## Column Total |      1209 |       181 |      1390 |
##           |      0.870 |      0.130 |           |
## -----|-----|-----|-----|
##
##
```

```
sms_classifier2 <- naiveBayes(sms_train, sms_train_labels, laplace = 1)
sms_test_pred2 <- predict(sms_classifier2, sms_test)
CrossTable(sms_test_pred2, sms_test_labels, prop.chisq = FALSE, prop.t = FALSE, prop.r = FALSE,
           dnn = c('predicted', 'actual'))
```

```
##
##
##      Cell Contents
## |-----|
## |                      N |
```



```

## |          N / Col Total |
## |-----|
##
##
## Total Observations in Table: 1390
##
##
##          | actual
## predicted |      ham |      spam | Row Total |
## -----|-----|-----|-----|
##          |      1202 |        28 |      1230 |
##          |      0.994 |      0.155 |           |
## -----|-----|-----|-----|
##          |         7 |       153 |       160 |
##          |      0.006 |      0.845 |           |
## -----|-----|-----|-----|
## Column Total |      1209 |       181 |      1390 |
##          |      0.870 |      0.130 |           |
## -----|-----|-----|-----|
##
##

```