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Visualizing Text Data Using Word Clouds

Visualizing Text Data Using Word Clouds

Earlier in the course, we used text analytics as a predictive tool, using word frequencies as independent variables in our models. However, sometimes our goal is to understand commonly occurring topics in text data instead of to predict the value of some dependent variable. In such cases, word clouds can be a visually appealing way to display the most frequent words in a body of text.

A word cloud arranges the most common words in some text, using size to indicate the frequency of a word. For instance, this is a word cloud for the complete works of Shakespeare, removing English stopwords:

Next, perform the following pre-processing tasks (like we did in Unit 5), noting that we don't stem the words in the document or remove sparse terms:

- 1) Create a corpus using the Tweet variable
- 2) Convert the corpus to lowercase
- 3) Remove punctuation from the corpus
- 4) Remove all English-language stopwords
- 5) Build a document-term matrix out of the corpus
- 6) Convert the document-term matrix to a data frame called allTweets

How many unique words are there across all the documents?

Answer: 3780

Explanation

We can complete the pre-processing steps with the following commands:

```
library(tm)
```

```
tweets = read.csv("tweets.csv", stringsAsFactors=FALSE)
```

```
corpus = VCorpus(VectorSource(tweets$Tweet))
```

```
corpus = tm_map(corpus, content_transformer(tolower))
```

```
corpus = tm_map(corpus, removePunctuation)
```

```
corpus = tm_map(corpus, removeWords, stopwords("english"))
```

```
frequencies = DocumentTermMatrix(corpus)
```

```
allTweets = as.data.frame(as.matrix(frequencies))
```

From the commands "frequencies", "str(allTweets)" or "ncol(allTweets)", we can read that there are 3780 unique words across all the tweets.

Submit

You have used 0 of 3 attempts

i Answers are displayed within the problem

Problem 1.2 - Preparing the Data

1 point possible (graded)

Although we typically stem words during the text preprocessing step, we did not do so here. What is the most compelling rationale for skipping this step when visualizing text data?

- ☐ It avoids the computational burden of stemming
- ☒ It will be easier to read and understand the word cloud if it includes full words instead of just the word stems ✓
- ☐ We would not be able to create a word cloud if we stemmed the document

Explanation

We want to create an interpretable display of a document's contents, and our results will be easier to read if they include full words instead of just the stems. Stemming has relatively minor computational burden, and we certainly could create a word cloud with a stemmed document.

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Problem 2.1 - Building a Word Cloud

1 point possible (graded)

Install and load the "wordcloud" package, which is needed to build word clouds.

Explanation

This can be done with:

```
install.packages("wordcloud")  
library(wordcloud)
```

As we can read from ?wordcloud, we will need to provide the function with a vector of words and a vector of word frequencies. Which function can we apply to allTweets to get a vector of the words in our dataset, which we'll pass as the first argument to wordcloud()?

☐ str

☐ rownames

☒ colnames ✓

Explanation

Each tweet represents a row of allTweets, and each word represents a column. We need the names of all the columns of allTweets, which is returned by colnames(allTweets). While str(allTweets) displays the names of the variables along with other information, it doesn't return a vector that we can use as the first argument to wordcloud().

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Problem 2.2 - Building a Word Cloud

1 point possible (graded)

Which function should we apply to allTweets to obtain the frequency of each word across all tweets?

☒ colSums ✓

☐ rowSums

☐ sum

Explanation

Each tweet represents a row in allTweets, and each word represents a column. Therefore, we need to access the sums of each column in allTweets, which is returned by colSums(allTweets).

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Problem 2.3 - Building a Word Cloud

1 point possible (graded)

Use allTweets to build a word cloud. Make sure to check out the help page for wordcloud if you are not sure how to do this.

Because we are plotting a large number of words, you might get warnings that some of the words could not be fit on the page and were therefore not plotted -- this is especially likely if you are using a smaller screen. You can address these warnings by plotting the words smaller. From ?wordcloud, we can see that the "scale" parameter controls the sizes of the plotted words. By default, the sizes range from 4 for the most frequent words to 0.5 for the least frequent, as denoted by the parameter "scale=c(4, 0.5)". We could obtain a much smaller plot with, for instance, parameter "scale=c(2, 0.25)".

What is the most common word across all the tweets (it will be the largest in the outputted word cloud)? Please type the word exactly how you see it in the word cloud. The most frequent word might not be printed if you got a warning about words being cut off -- if this happened, be sure to follow the instructions in the paragraph above.

Answer: apple

Explanation

We can output the word cloud with:

```
wordcloud(colnames(allTweets), colSums(allTweets))
```

For smaller words, we could have used:

```
wordcloud(colnames(allTweets), colSums(allTweets), scale=c(2, .25))
```

"apple" is by far the largest, and therefore most common, word.

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You have used 0 of 3 attempts

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Problem 2.4 - Building a Word Cloud

1 point possible (graded)

In the previous subproblem, we noted that there is one word with a much higher frequency than the other words. Repeat the steps to load and pre-process the corpus, this time removing the most frequent word in addition to all elements of stopwords("english") in the call to `tm_map` with `removeWords`. For a refresher on how to remove this additional word, see the Twitter text analytics lecture.

Replace `allTweets` with the document-term matrix of this new corpus -- we will use this updated corpus for the remainder of the assignment.

Create a word cloud with the updated corpus. What is the most common word in this new corpus (the largest word in the outputted word cloud)? The most frequent word might not be printed if you got a warning about words being cut off -- if this happened, be sure to follow the instructions in the previous problem.

Answer: iphone

Explanation

We can do the specified update with the following commands:

```
tweets = read.csv("tweets.csv", stringsAsFactors=FALSE)
corpus = Corpus(VectorSource(tweets$Tweet))
corpus = tm_map(corpus, tolower)
corpus = tm_map(corpus, removePunctuation)
corpus = tm_map(corpus, removeWords, c("apple", stopwords("english")))
frequencies = DocumentTermMatrix(corpus)
allTweets = as.data.frame(as.matrix(frequencies))
wordcloud(colnames(allTweets), colSums(allTweets))
```

For a much smaller plot, we could have used:

```
wordcloud(colnames(allTweets), colSums(allTweets), scale=c(2, 0.25))
```

The most common (largest) word is now "iphone".

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You have used 0 of 3 attempts

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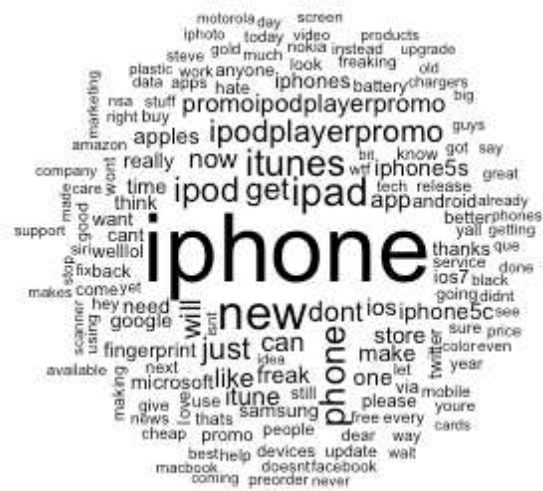
Problem 3 - Size and Color

So far, the word clouds we've built have not been too visually appealing -- they are crowded by having too many words displayed, and they don't take advantage

Below are four word clouds, each of which uses different parameter settings in the call to the `wordcloud()` function:

[illegible]

Word Cloud B:



Word Cloud C:



Word Cloud D:

- We will refer to these four word clouds in the next several problems.

Explanation

Word Cloud C is the only one with a different distribution of the most frequent words -- negative words (or censored versions of negative words) are much more common in this cloud.

It is quite simple to obtain a word cloud that is limited to a subset of the tweets using the subset function:

```
negativeTweets = subset(allTweets, tweets$Avg <= -1)
wordcloud(colnames(negativeTweets), colSums(negativeTweets))
```

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You have used 0 of 1 attempt

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Problem 3.2 - Size and Color

1 point possible (graded)

Only one word cloud was created without modifying parameters min.freq or max.words. Which word cloud is this?

☒ Word Cloud A ✓

☐ Word Cloud B

☐ Word Cloud C

☐ Word Cloud D

Explanation

min.freq and max.words are parameters that can be used to remove the least frequent words, resulting in a less cluttered word cloud. Word Cloud A is much more cluttered than the others because it did not use either of these parameters, and therefore is displaying every word that appears more than 3 times.

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Problem 3.3 - Size and Color

1 point possible (graded)

Which word clouds were created with parameter `random.order` set to `FALSE`?

☐ Word Cloud A

☒ Word Cloud B ✓

☐ Word Cloud C

☒ Word Cloud D ✓

Explanation

If `random.order` is set to `FALSE`, then the most frequent (largest) words will be plotted first, resulting in them being displayed together in the center of the word cloud. This is the case in Word Cloud B and Word Cloud D.

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You have used 0 of 2 attempts

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Problem 3.4 - Size and Color

1 point possible (graded)

Which word cloud was built with a non-default value for parameter `rot.per`?

☒ Word Cloud A ✓

☐ Word Cloud B

☐ Word Cloud C

☐ Word Cloud D

Explanation

rot.per controls the proportion of words that are rotated to be vertical in the word cloud. By default 10% of words are rotated. However in Word Cloud A a much higher proportion (50%) are rotated, which was achieved by setting rot.per=0.5.

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Problem 3.5 - Size and Color

1 point possible (graded)

In Word Cloud C and Word Cloud D, we provided a color palette ranging from light purple to dark purple as the parameter colors (you will learn how to make such a color palette later in this assignment). For which word cloud was the parameter random.color set to TRUE?

☐ Word Cloud C

☒ Word Cloud D ✓

Explanation

When random.color is set to TRUE, the words will be colored randomly. This is the case in Word Cloud D. Meanwhile, colors were assigned based on the number of appearances in Word Cloud C.

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Problem 4.1 - Selecting a Color Palette

1 point possible (graded)

The use of a palette of colors can often improve the overall effect of a visualization. We can easily select our own colors when plotting; for instance, we could pass `c("red", "green", "blue")` as the `colors` parameter to `wordcloud()`. The `RColorBrewer` package, which is based on the ColorBrewer project (colorbrewer.org), provides pre-selected palettes that can lead to more visually appealing images. Though these palettes are designed specifically for coloring maps, we can also use them in our word clouds and other visualizations.

Begin by installing and loading the "RColorBrewer" package. This package may have already been installed and loaded when you installed and loaded the "wordcloud" package, in which case you don't need to go through this additional installation step. If you obtain errors (for instance, "Error: lazy-load database 'P' is corrupt") after installing and loading the RColorBrewer package and running some of the commands, try closing and re-opening R.

The function `brewer.pal()` returns color palettes from the ColorBrewer project when provided with appropriate parameters, and the function `display.brewer.all()` displays the palettes we can choose from.

Explanation

We can install and load the package with:

```
install.packages("RColorBrewer")  
library(RColorBrewer)
```

Which color palette would be most appropriate for use in a word cloud for which we want to use color to indicate word frequency?

☐ Accent

☐ Set2

☒ YlOrRd ✓

Explanation

From `?brewer.pal` we read that `Accent` and `Set2` are both "qualitative palettes," which means color changes don't imply a change in magnitude (we can also see this in the output of `display.brewer.all()`). As a result, the colors selected would not visually identify the least and most frequent words.

On the other hand, `YlOrRd` is a "sequential palette," with earlier colors being lighter and later colors being darker. Therefore, it is a good palette choice for indicating low-frequency vs. high-frequency words.

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Problem 4.2 - Selecting a Color Palette

1 point possible (graded)

Which RColorBrewer palette name would be most appropriate to use when preparing an image for a document that must be in grayscale?

Answer: Greys

Explanation

As we can see from `display.brewer.all()`, palette "Greys" is the only one completely in grayscale.

Submit

You have used 0 of 2 attempts

i Answers are displayed within the problem

Problem 4.3 - Selecting a Color Palette

1 point possible (graded)

In sequential palettes, sometimes there is an undesirably large contrast between the lightest and darkest colors. You can see this effect when plotting a word cloud for allTweets with parameter `colors=brewer.pal(9, "Blues")`, which returns a sequential blue palette with 9 colors.

Which of the following commands addresses this issue by removing the first 4 elements of the 9-color palette of blue colors? Select all that apply.

☐ `brewer.pal(9, "Blues")[c(-5, -6, -7, -8, -9)]`

☒ `brewer.pal(9, "Blues")[c(-1, -2, -3, -4)]` ✓

☐ `brewer.pal(9, "Blues")[c(1, 2, 3, 4)]`

☒ `brewer.pal(9, "Blues")[c(5, 6, 7, 8, 9)]` ✓

Explanation

The fourth option limits to elements 5-9, which removes the first four. The second option uses negative indexes, which means remove elements 1-4. The first and third options actually keep colors 1-4, discarding the rest.

A shorthand for this indexing is:

`brewer.pal(9, "Blues")[-1:-4]`

`brewer.pal(9, "Blues")[5:9]`

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