LDA_Topic_Model_Code

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1 Laurie Cagney - Fanfiction Text Analysis

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1.1 Introduction

The purpose of this project is to examine fanfiction text and perform topic modeling to understand what the most popular authors are writing about. For this project, I chose to focus on one fandom: Doctor Who.

Datasource Details

Archive of Our Own (https://archiveofourown.org) is a volunteer run repository for fans to post fanworks about their favorite content. It is owned by the Organization of Transformative Works. It is organized by different fandoms, which is collection of people who are the fans of a particular person, series, character etc. The Doctor Who fandom refer to themselves as “Whovians”.

Dataset Details

- Scraped 05/07/2021
- Fics rated Teen and Below
- Completed Fics
- Sorted by the ones with the most “Kudos” (votes given by users)
- Metadata from 1400 fics including the text of each chapter 1

Outline

- Load Required Libraries & Dataset
- Explore Data
- Clean Fic Text
    - Stemming
    - Lemmatization
    - Nouns Only
- Word Cloud, BiGrams, TriGrams
- LDA
- Model Tuning
- Explore Topics
- Classify A New Fic
- References

1.1.1 Load Libraries & Dataset

[4]:
```
import matplotlib.pyplot as plt
import pandas as pd
%matplotlib inline
import html

import nltk as nltk
from nltk import pos_tag
from nltk import word_tokenize
from nltk.corpus import stopwords
from nltk import FreqDist
from wordcloud import WordCloud
import numpy as np
from PIL import Image, ImageOps

from sklearn.decomposition import LatentDirichletAllocation
from sklearn.cluster import KMeans
from sklearn.feature_extraction.text import TfidfVectorizer, CountVectorizer
from sklearn.model_selection import GridSearchCV

from datetime import date
```

[5]:
```
#Cleaned files for when I need to shut workbook down

#fic_reduced_lem = pd.read_csv('/Users/lcags/Documents/Practicum1/
 ↪fic_reduced_clean_lem_2021-05-28.csv')
#fic_reduced_stem = pd.read_csv('/Users/lcags/Documents/Practicum1/
 ↪fic_reduced_clean_stem_2021-05-28.csv')
#fic_lem_noun = pd.read_csv('/Users/lcags/Documents/Practicum1/
 ↪fic_lem_nounonly_tokens_2021-05-28.csv')
```

Load data. This data was scraped using a prebuilt scraper from: https://github.com/radiolarian/AO3Scraper

I modified the scraper to bring back less columns and there were two bugs that needed to be updated but other than that I kept the script as is. It was built to adhere to Ao3's TOS so I wanted to make sure I followed that.

[959]:
```
#Load dataset
fic_raw= pd.read_csv('/Users/lcags/Documents/Practicum1/AO3Scraper/
 ↪DoctorWho_Fics.csv')
```

[1382]:
```
#View first couple rows to ensure data loaded ok
fic_raw.head()
```

[1382]:
```
    work_id                                              title  \
0   4148136                              Of Wizards and Heroes
```

```
1  10608267  Someday You're Going to Realize (that I'm pass…
2    344392                                 The Boy Who Waited
3  12292116                                 My Fandom Needs Me
4    609625                                         Past Tense

                author                 rating  \
0  ['storyforsomeone']  Teen And Up Audiences
1              ['dls']      General Audiences
2            ['Lunik']              Not Rated
3          ['Riv_ika']  Teen And Up Audiences
4      ['Try2CatchMe']  Teen And Up Audiences

                           category  \
0                               M/M
1                               Gen
2                               Gen
3  F/M, Multi, M/M, Other, F/F, Gen
4                               Gen

                                              fandom  \
0  Harry Potter - J. K. Rowling, The Avengers (Ma…
1  Marvel Cinematic Universe, Daredevil (TV), Ele…
2  Doctor Who (2005), Thor (2011), The Avengers (…
3  Marvel Cinematic Universe, The Avengers (Marve…
4                           Supernatural, Doctor Who

                                        relationship  \
0                         Loki (Marvel)/Harry Potter
1                         Tony Stark & Avengers Team
2                                                NaN
3  Tony Stark/Reader, Tony Stark & Reader, Legola…
4                                                NaN

                                           character  \
0  Harry Potter, Tony Stark, Natasha Romanov, Cli…
1  Tony Stark, James "Rhodey" Rhodes, Hope Van Dy…
2  Auton Rory Williams, Phil Coulson, Avengers - …
3  Tony Stark, Legolas Greenleaf, Tom Hiddleston,…
4      Dean Winchester, Sam Winchester, Tenth Doctor

                                     additional tags language   published  \
0  Crossover, Powerful Harry, Tony Stark Needs a …  English  2015-06-16
1  Post-Captain America: Civil War (Movie), Civil…  English  2017-04-13
2  World without stars, Amnesia, Community: norse…  English  2012-02-21
3  XReader, one shots, collection, Reader-Insert,…  English  2017-10-07
4                                           Superwho  English  2012-12-26
```

```
      status status date   words chapters  comments  kudos  bookmarks    hits  \
0  Completed  2016-01-03   92331    22/22    1911.0  19933     6376.0  395605
1  Completed  2017-04-13    5280      1/1     437.0   8467     1737.0  117752
2  Completed  2012-02-21    6747      6/6     190.0   4569     1343.0   47356
3  Completed  2020-10-16  227340  163/163     679.0   3789      276.0  122502
4  Completed  2012-12-26    6851      1/1     191.0   3700      625.0   60723

                                                body
0  As I myself often listen to music whilst I rea…
1  \nOne.\n\n\nSam hadn't wanted the dubious hono…
2  "Maybe you should let the English kid talk to …
3  Hey there! Welcome to my collection of One-Sho…
4  Dean swallows around his tongue, which suddenl…
```

[4]:

```
#View total dimensions
fic_raw.shape
```

[4]:

```
(1400, 20)
```

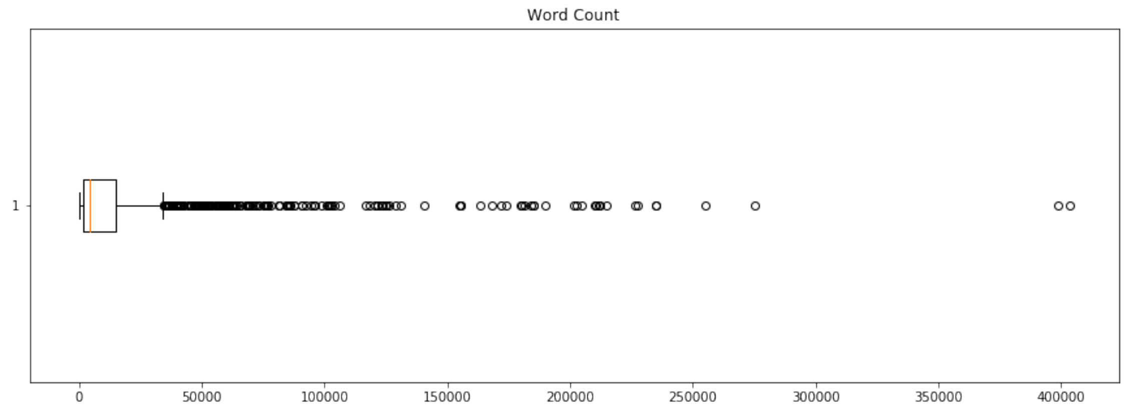
1400 rows by 20 columns of data.

1.1.2 Explore Numeric Data

Several descriptive fields were scraped as part of this dataset. The following code seeks to understand what the distribution of the different fields looks like.

[1482]:

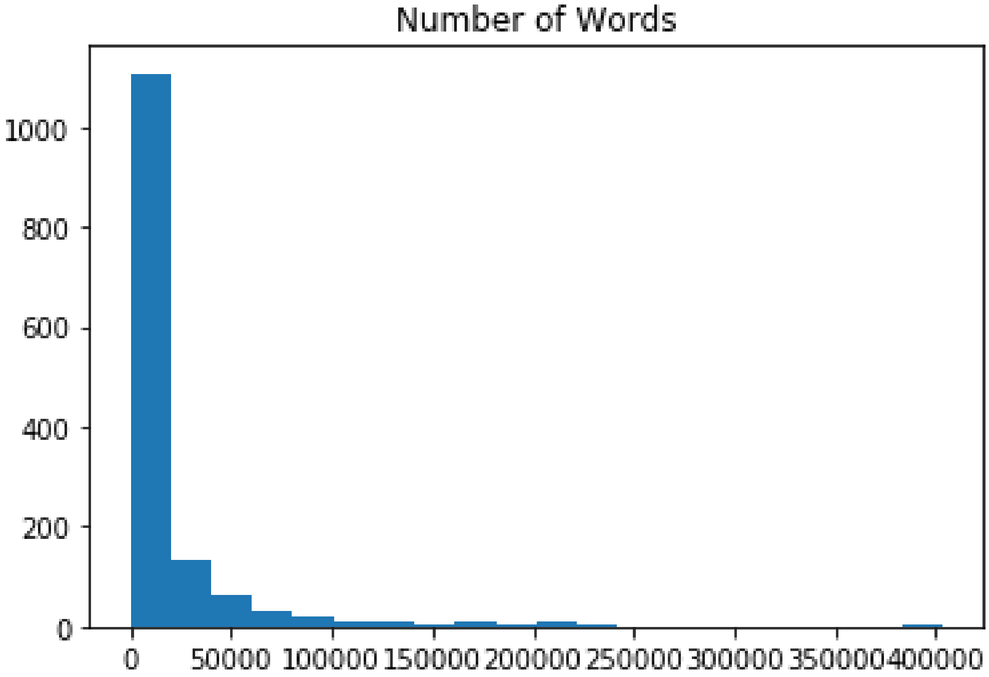
```
fig = plt.figure(figsize =(15, 5))
plt.boxplot(fic_raw.words, vert = 0)

plt.title('Word Count')
plt.show()
```



Lots of outliers in terms of length, two of the stories have over 400k words! This was why I was hesitant about scraping an entire story versus just chapter ones. The important words might've gotten biased towards the stories with more words. This could also go into the next version of this topic modeling using a more balanced version of this dataset.

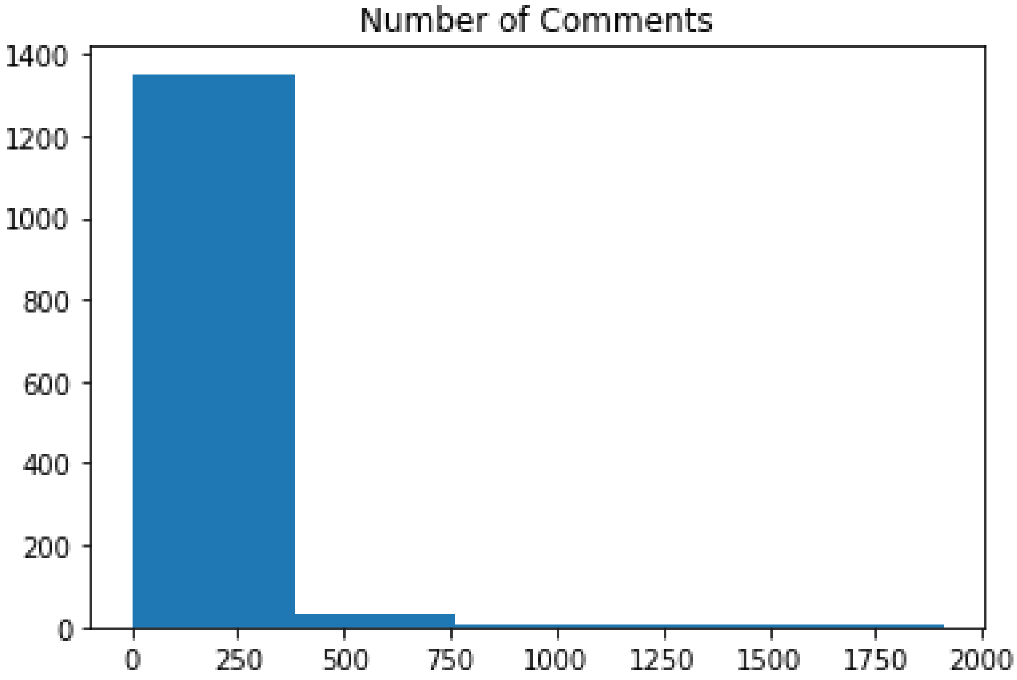
```
[1470]: fig=plt.figure()
        ax = fig.add_subplot(1,1,1)
        ax.hist(fic_raw.words, bins = 20)
        plt.title('Number of Words')
```

```
[1470]: Text(0.5, 1.0, 'Number of Words')
```



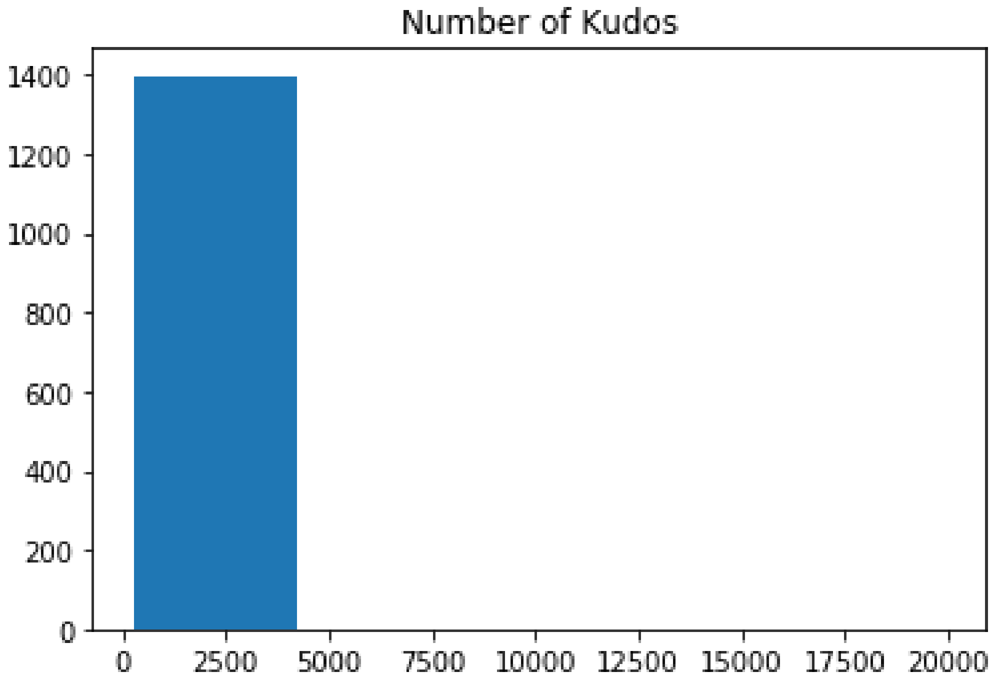
```
[883]: fig=plt.figure()
       ax = fig.add_subplot(1,1,1)
       ax.hist(fic_raw.comments, bins = 5)
       plt.title('Number of Comments')
```

```
[883]: Text(0.5, 1.0, 'Number of Comments')
```

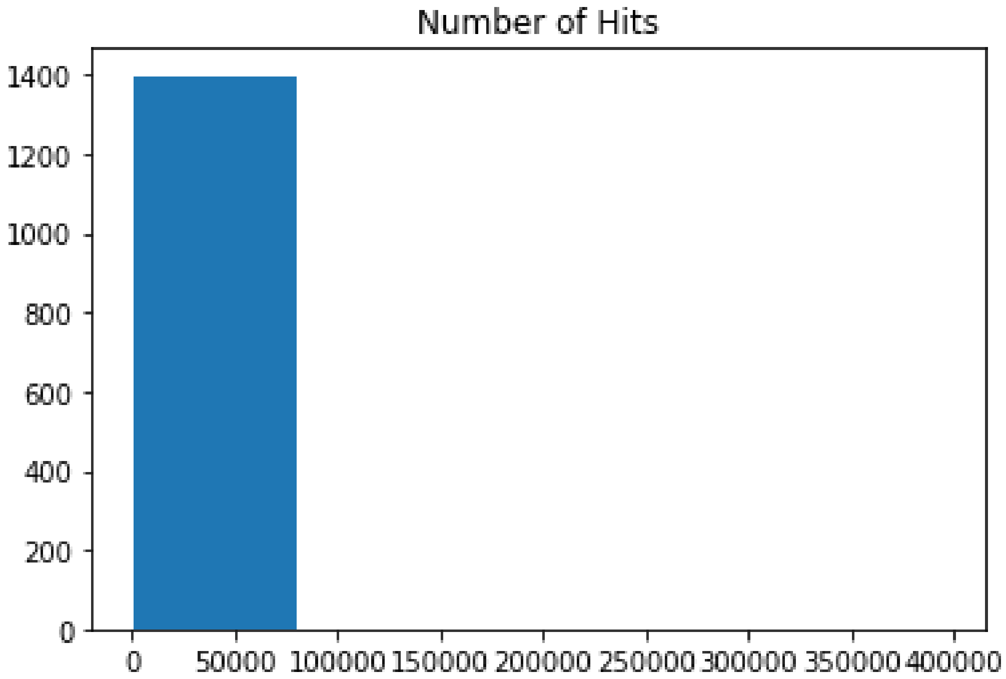


[885]:
```
fig=plt.figure()
ax = fig.add_subplot(1,1,1)
ax.hist(fic_raw['kudos'], bins = 5)
plt.title('Number of Kudos')
```

[885]:
```
Text(0.5, 1.0, 'Number of Kudos')
```



```
[887]: fig=plt.figure()
       ax = fig.add_subplot(1,1,1)
       ax.hist(fic_raw.hits, bins = 5)
       plt.title('Number of Hits')

[887]: Text(0.5, 1.0, 'Number of Hits')
```



It looks like there is a a group of fics that have a LOT of comments, hits, etc and then it drops off in true popularity. Using describe, I can see the mean versus the median and confirm.

```
[1381]: fic_raw.describe()
```

```
[1381]:            work_id          words     comments         kudos    bookmarks  \
        count  1.400000e+03    1400.000000  1396.000000   1400.000000  1397.000000
        mean   9.950502e+06   17571.670000    79.966332    501.610714    69.993558
        std    7.823156e+06   36792.863873   158.756077    664.650427   194.664900
        min    4.915000e+03       6.000000     1.000000    258.000000     1.000000
        25%    1.898000e+06    1999.000000    17.000000    301.000000    27.000000
        50%    9.346382e+06    4322.000000    35.000000    368.000000    43.000000
        75%    1.664361e+07   15013.750000    72.000000    513.250000    70.000000
        max    2.833252e+07  403206.000000  1911.000000  19933.000000  6376.000000

                        hits
        count    1400.000000
        mean     6015.800000
        std     12629.891235
        min       653.000000
        25%      2854.500000
        50%      4112.500000
        75%      6180.250000
        max    395605.000000
```

[1471]:
```
#How many fics have less than 90000 words?
fic_raw.work_id[fic_raw.words>90000].count()
```

[1471]:
```
57
```

[598]:
```
#How many fics have less than 1000 words?
fic_raw.work_id[fic_raw.words<1000].count()
```

[598]:
```
102
```

[1483]:
```
#How many are outside of the 75th percentile
fic_raw.work_id[fic_raw.words>15013].count()
```

[1483]:
```
350
```

There is a pretty big disparity between the mean and median for popularity indicators. This doesn't matter for the purposes of this project but maybe a future iteration can look at the components that comprise of popular.

[1394]:
```
fic_raw['published']= pd.to_datetime(fic_raw['published'])
pub_dates = fic_raw["published"].groupby(fic_raw.published.dt.year).agg('count')
```

[1404]:
```
pd.set_option('display.max_rows',20)
pub_dates
```

[1404]:
```
published
2007      4
2008     11
2009     11
2010     28
2011     44
2012     69
2013    114
2014    151
2015    131
2016    128
2017    161
2018    275
2019    151
2020    122
Name: published, dtype: int64
```

The bulk of the most popular fics were published >2013.

[890]:
```
#Rating Groups
fic_raw['rating'].value_counts()
```

```
[890]: Teen And Up Audiences    712
       General Audiences        613
       Not Rated                 75
       Name: rating, dtype: int64
```

```
[891]: #Relationship Pairings
       fic_raw['relationship'].value_counts()
```

```
[891]: Tenth Doctor/Rose Tyler
       187
       Thirteenth Doctor/Yasmin Khan
       52
       Thirteenth Doctor/River Song
       34
       The Doctor/River Song, Thirteenth Doctor/River Song
       27
       Eleventh Doctor/River Song, The Doctor/River Song
       23
                                           …
       Eleventh Doctor/Rose Tyler, Eleventh Doctor & River Song
       1
       Draco Malfoy/Harry Potter, Harry Potter/Severus Snape, Harry Potter/Voldemort,
       Lucius Malfoy/Harry Potter      1
       Amy Pond/Rory Williams, Eleventh Doctor/Rose Tyler
       1
       Tenth Doctor (duplicate)/Rose Tyler, Tenth Doctor/Rose Tyler
       1
       Thirteenth Doctor & Yasmin Khan
       1
       Name: relationship, Length: 615, dtype: int64
```

```
[1543]: ships = fic_raw['relationship'].str.split(",").explode().reset_index(drop=True)

        ships = pd.DataFrame(ships, columns = ['relationship'])
        #ships['relationship'].value_counts()
```

```
[1541]: #Export to CSV
        ships.to_csv(r'/Users/lcags/Documents/Practicum1/ships.csv'
                                ,index = False
                                , header=True)
```

1.1.3 Cleaning

This next sections iterates through different versions of cleaning: stemming, lemmatizing, and nouns only lemmatized.

```
[1405]: fic_raw.isnull().sum()
```

```
[1405]: work_id              0
        title                0
        author               0
        rating               0
        category            41
        fandom               0
        relationship       112
        character           24
        additional tags    153
        language             0
        published            0
        status               0
        status date          0
        words                0
        chapters             0
        comments             4
        kudos                0
        bookmarks            3
        hits                 0
        body                 0
        dtype: int64
```

There are nulls but not in any of the columns I will use.

```
[391]: #Reduce dataset to just ID, Title, and Body

       fic_reduced = fic_raw[['work_id','title','body']]
```

```
[392]: #View first couple rows
       fic_reduced.head()
```

```
[392]:     work_id                                              title  \
       0   4148136                               Of Wizards and Heroes
       1  10608267  Someday You're Going to Realize (that I'm pass…
       2    344392                                  The Boy Who Waited
       3  12292116                                  My Fandom Needs Me
       4    609625                                          Past Tense

                                                        body
       0  As I myself often listen to music whilst I rea…
       1  \nOne.\n\n\nSam hadn't wanted the dubious hono…
       2  "Maybe you should let the English kid talk to …
       3  Hey there! Welcome to my collection of One-Sho…
       4  Dean swallows around his tongue, which suddenl…
```

```
[394]: fic_reduced_cleanHTML = fic_reduced.copy()
       #Remove HTML characters
```

```
fic_reduced_cleanHTML.body = html.unescape(fic_reduced.body)
```

[396]:
```
#Remove \n characters
fic_reduced_cleanEscape = fic_reduced_cleanHTML.copy()
fic_reduced_cleanEscape.body = fic_reduced_cleanHTML.body.replace('\n', '',␣
 ↪regex=True)
```

[1409]:
```
stopwords = stopwords.words('english')
```

[1413]:
```
#stem words
root = nltk.stem.snowball.PorterStemmer(ignore_stopwords=False).stem
#lemmatizer
lemmatizer = nltk.stem.WordNetLemmatizer()
```

[345]:
```
#Function to clean the text and stem it
def clean_text_stemming(text):
    tokens = word_tokenize(text)
    tokens_lower = [w.lower() for w in tokens]
    tokens_alpha = [w for w in tokens_lower if w.isalpha()]
    tokens_stopwords = [w for w in tokens_alpha if not w in stopwords]
    tokens_stem = [root(w) for w in tokens_stopwords]

    final =' '.join(tokens_stem)
    return final
```

[363]:
```
#Function to clean text and lemmatize
def clean_text_lemmatizer(text):
    tokens = word_tokenize(text)
    tokens_lower = [w.lower() for w in tokens]
    tokens_alpha = [w for w in tokens_lower if w.isalpha()]
    tokens_stopwords = [w for w in tokens_alpha if not w in stopwords]
    tokens_lemm = [lemmatizer.lemmatize(w) for w in tokens_stopwords]

    final =' '.join(tokens_lemm)
    return final
```

[347]:
```
#Prior to cleaning
fic_reduced
```

[347]:
```
       work_id                                              title  \
0      4148136                              Of Wizards and Heroes
1     10608267  Someday You're Going to Realize (that I'm pass…
2       344392                                  The Boy Who Waited
3     12292116                                  My Fandom Needs Me
4       609625                                          Past Tense
…          …                                                  …
1395  14497917                                        Star Crossed
```

```
1396   5206328                               He Gave Me the World
1397   1506440                                     Responsibility
1398  12862200                                      Happy Endings
1399   5260541                                     After the Void

                                                   body
0     As I myself often listen to music whilst I rea…
1     One.Sam hadn't wanted the dubious honor of gua…
2     "Maybe you should let the English kid talk to …
3     Hey there! Welcome to my collection of One-Sho…
4     Dean swallows around his tongue, which suddenl…
…                                                  …
1395  It was late autumn when the star senior of the…
1396      "Love looks not with the eyes, but with th…
1397  She hasn't seen him for months. Six months, an…
1398  Travelling the universe with Heather was amazi…
1399  He had thought that if they succeeded, if they…

[1400 rows x 3 columns]
```

[399]:

```
#Create stemmed
fic_reduced_stem = fic_reduced_cleanEscape.copy()
fic_reduced_stem.body = fic_reduced_stem.body.apply(clean_text_stemming)
```

[407]:

```
#Create lemmatized
fic_reduced_lem = fic_reduced_cleanEscape.copy()
fic_reduced_lem.body = fic_reduced_lem.body.apply(clean_text_lemmatizer)
```

[412]:

```
#View Stemmed
fic_reduced_stem
```

[412]:

```
       work_id                                              title  \
0      4148136                              Of Wizards and Heroes
1     10608267  Someday You're Going to Realize (that I'm pass…
2       344392                                 The Boy Who Waited
3     12292116                                 My Fandom Needs Me
4       609625                                         Past Tense
…         …                                                 …
1395  14497917                                       Star Crossed
1396   5206328                               He Gave Me the World
1397   1506440                                     Responsibility
1398  12862200                                      Happy Endings
1399   5260541                                     After the Void

                                                   body
0     often listen music whilst read write notic inc…
1     want dubiou honor guard stark one air support …
```

```
2     mayb let english kid talk coulson glanc file t…
3     hey welcom collect know want get chapter make …
4     dean swallow around tongu suddenli feel dri sw…
…                                                 …
1395  late autumn star senior physic depart john nob…
1396  love look eye mind therefor wing cupid paint b…
1397  seen month six month know exact date without c…
1398  travel univers heather need tardi get anywher …
1399  thought succeed could bring back matter happen…

[1400 rows x 3 columns]
```

```
[413]: #View lemmatized
       fic_reduced_lem
```

```
[413]:        work_id                                              title  \
       0      4148136                              Of Wizards and Heroes
       1     10608267  Someday You're Going to Realize (that I'm pass…
       2       344392                                 The Boy Who Waited
       3     12292116                                 My Fandom Needs Me
       4       609625                                         Past Tense
       …          …                                                …
       1395  14497917                                       Star Crossed
       1396   5206328                               He Gave Me the World
       1397   1506440                                     Responsibility
       1398  12862200                                      Happy Endings
       1399   5260541                                     After the Void

                                                         body
       0     often listen music whilst read write notice in…
       1     wanted dubious honor guarding stark one air su…
       2     maybe let english kid talk coulson glanced fil…
       3     hey welcome collection know want get chapter m…
       4     dean swallow around tongue suddenly feel dry s…
       …                                                …
       1395  late autumn star senior physic department john…
       1396  love look eye mind therefore winged cupid pain…
       1397  seen month six month know exact date without c…
       1398  travelling universe heather need tardis get an…
       1399  thought succeeded could bring back matter happ…

       [1400 rows x 3 columns]
```

1.1.4 Only nouns

After working through the first iterations of the topic modeling, I decided that a noun only version would be useful.

[870]:

```
def noun_only(text):
    tokenized = word_tokenize(text)
    nouns = [word for (word, pos) in pos_tag(tokenized) if pos in ['NN']]
    final = ' '.join(nouns)
    return final
```

[1407]:

```
test = "clara waved him over to the car"

noun_only(test)
```

[1407]:

```
'clara car'
```

[ ]:

```
#Noun only cleaning
fic_lem_noun = fic_reduced_lem.copy()
fic_lem_noun.body = fic_lem_noun.body.apply(noun_only)
```

Export cleaned text to CSV so I don't have to run code to clean it continuously since it took several minutes at each step.

[1267]:

```
today = str(date.today())
```

[403]:

```
fic_reduced_stem.to_csv(r'/Users/lcags/Documents/Practicum1/
 ↪fic_reduced_clean_stem_' +today+'.csv'
                        ,index = False
                        , header=True)
```

[410]:

```
fic_reduced_lem.to_csv(r'/Users/lcags/Documents/Practicum1/
 ↪fic_reduced_clean_lem_'+today+'.csv'
                       ,index = False
                       ,header=True)
```

[416]:

```
fic_lem_noun.to_csv(r'/Users/lcags/Documents/Practicum1/
 ↪fic_lem_nounonly_tokens_'+today+'.csv'
                    ,index = False
                    ,header=True)
```

Created flattened version of the files with all the words combined together. This will make it easier to get the word counts and word clouds.

[425]:

```
fic_lem_flatten = ' '.join(fic_reduced_lem['body'])
```

[426]:

```
fic_stem_flatten = ' '.join(fic_reduced_stem['body'])
```

[6]:

```
noun_flatten = ' '.join(fic_lem_noun['body'])
```

Word Clouds - Stemmed

This next section will look at word clouds of the most common individual words, bigrams, and trigrams. It will also split out the parts of speech to further split the data.

```
[427]: retokenize = word_tokenize(fic_stem_flatten)
```

```
[433]: retokenize[:10]
```

```
[433]: ['often',
        'listen',
        'music',
        'whilst',
        'read',
        'write',
        'notic',
        'includ',
        'soundtrack',
        'suggest']
```

```
[434]: mostcommon = FreqDist(retokenize)
```

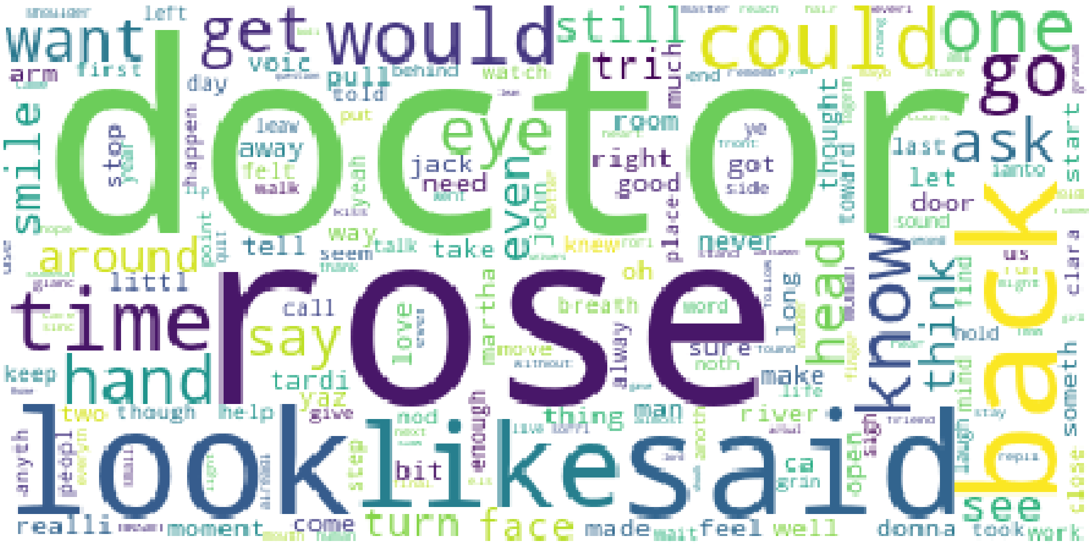
```
[438]: #What are the top 10 words?
       mostcommon.most_common(10)
```

```
[438]: [('doctor', 202441),
        ('rose', 171629),
        ('look', 108066),
        ('said', 103715),
        ('back', 92332),
        ('like', 84354),
        ('time', 82311),
        ('could', 82210),
        ('one', 73866),
        ('would', 71637)]
```

```
[439]: wc = WordCloud(background_color ="White")
       img = wc.generate_from_frequencies(mostcommon)
```

```
[440]: plt.figure(figsize=(8,6))
       plt.imshow(img)
       plt.axis("off")
```

```
[440]: (-0.5, 399.5, 199.5, -0.5)
```



Bigrams

[442]:

```
cv = CountVectorizer(ngram_range=(2,2))
counts = cv.fit_transform([fic_stem_flatten])
```

[443]:

```
bgnames = []
bgcounts = []
for w in cv.get_feature_names(): bgnames.append(w)
for c in counts.toarray().flatten(): bgcounts.append(c)
bigrams = pd.DataFrame({'word':bgnames,'count':bgcounts})
```

[757]:

```
topBigrams = bigrams.sort_values(ascending=False,by="count")[:25]
```

[244]:

```
topBigrams
```

[244]:

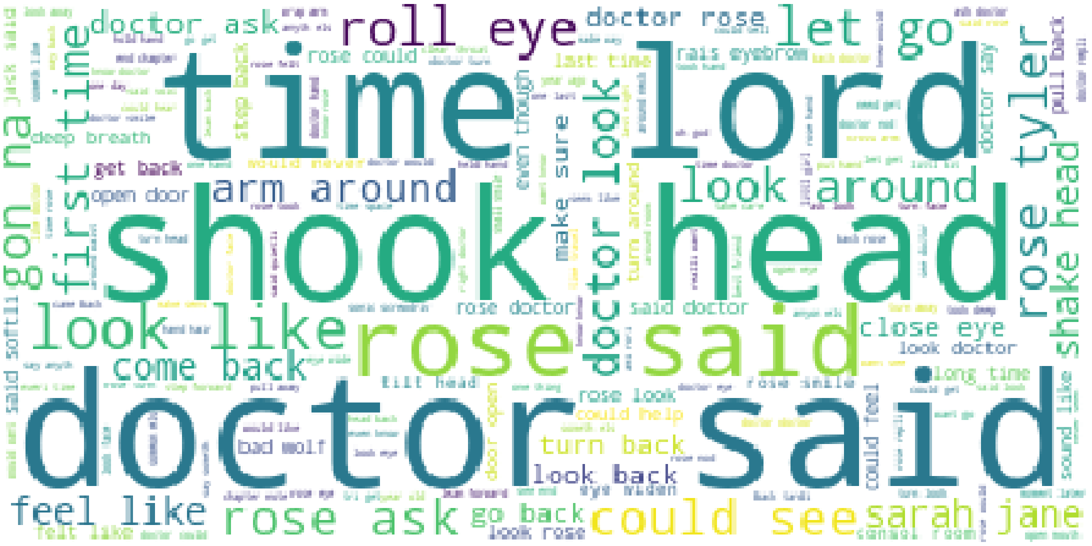
```
                    word  count
947177       doctor said  10014
3662565        time lord   9231
3129410       shook head   9099
2942090        rose said   8586
741746         could see   4877
2943670       rose tyler   4789
1985037           let go   4755
2936431       rose asked   4746
1470444           gon na   4674
1269336       first time   4143
176761        arm around   4063
2066611        look like   3974
```

```
2988162      sarah jane   3897
947103      doctor rose   3576
2923526      rolled eye   3566
2937589      rose could   3200
853032      deep breath   3108
1218116       feel like   3104
940145     doctor asked   3030
2071776     looked like   2996
739913       could help   2917
1226307       felt like   2853
651020        come back   2828
944816    doctor looked   2828
1938182       last time   2799
1456138         go back   2791
263657         bad wolf   2761
2974357     said doctor   2761
1416237        get back   2741
1106009     even though   2679
2131126       make sure   2677
739469       could feel   2593
2060612       long time   2591
2938102     rose doctor   2591
2978890     said softly   2500
947238       doctor say   2454
2069613   looked around   2414
2940236     rose looked   2405
2755897  raised eyebrow   2375
701845     console room   2305
4054219     would never   2224
623219       closed eye   2212
1821984       jack said   2190
941584     doctor could   2154
742411       could tell   2151
3770133     turned back   2146
2429866          oh god   2142
739699        could get   2100
739895       could hear   2088
3049584         see end   2044
```

[450]:
```
wc_bigram = WordCloud(background_color="white").
 ↪generate_from_frequencies(frequencies=dict(bigrams.values))
```

[451]:
```
plt.figure(figsize=(8,6))
plt.imshow(wc_bigram)
plt.axis("off")
```

[451]:
```
(-0.5, 399.5, 199.5, -0.5)
```



Trigram

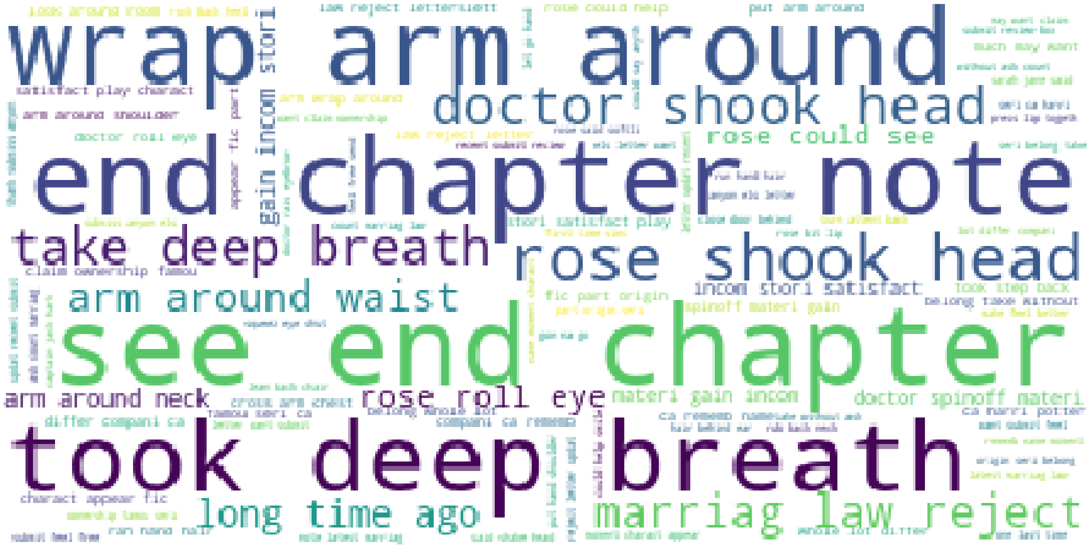
[452]:
```
cv_tri = CountVectorizer(ngram_range=(3,3))
counts_tri = cv_tri.fit_transform([fic_stem_flatten])
```

[454]:
```
tgnames = []
tgcounts = []
for w in cv_tri.get_feature_names(): tgnames.append(w)
for c in counts_tri.toarray().flatten(): tgcounts.append(c)
trigrams = pd.DataFrame({'word':tgnames,'count':tgcounts})
```

[455]:
```
wc_trigram = WordCloud(background_color="white").
 ↪generate_from_frequencies(frequencies=dict(trigrams.values))
```

[456]:
```
plt.figure(figsize=(8,6))
plt.imshow(wc_trigram)
plt.axis("off")
```

[456]:
```
(-0.5, 399.5, 199.5, -0.5)
```



```
[758]: topTrigrams = trigrams.sort_values(ascending=False,by="count")[:20]
```

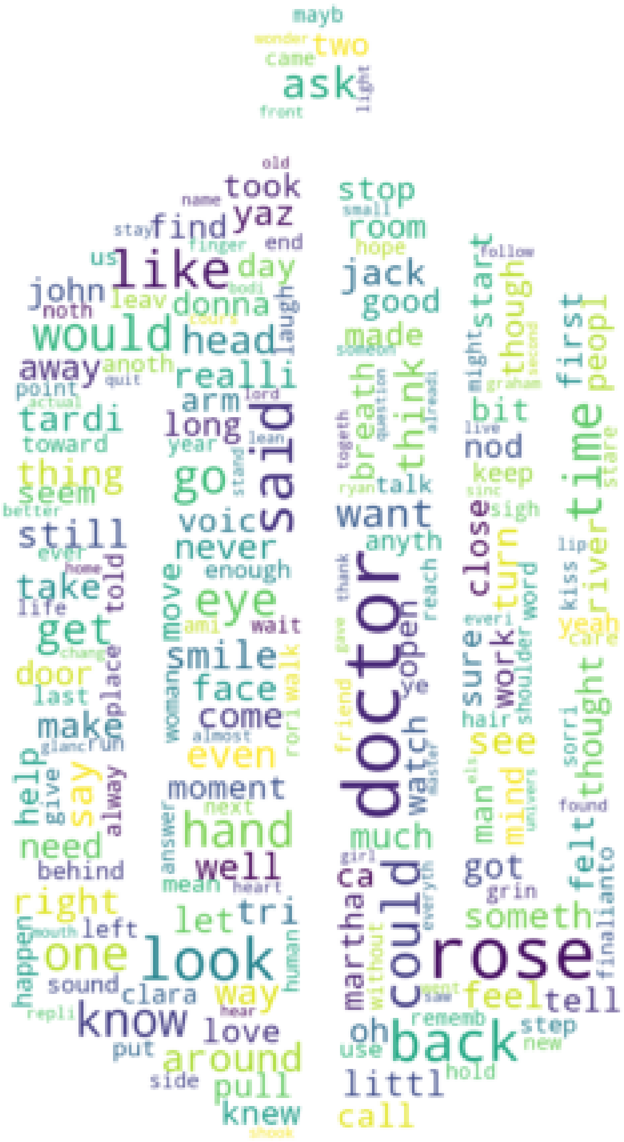
```
[759]: topTrigrams
```

```
[759]:                           word  count
        7310917        see end chapter   1985
        2373729       end chapter note   1984
        9786522        wrap arm around   1898
        8880754       took deep breath   1723
        6994875        rose shook head   1043
        2116131      doctor shook head    909
        8405247       take deep breath    782
        5154971     marriag law reject    726
        382839        arm around waist    645
        4874161          long time ago    555
        6988752          rose roll eye    528
        6939053         rose could see    473
        382566         arm around neck    450
        3168019       gain incom stori    450
        8199890   stori satisfact play    444
        2123318  doctor spinoff materi    444
        4098200  incom stori satisfact    444
        5192975      materi gain incom    444
        7986722     spinoff materi gain    444
        7173090 satisfact play charact    444
```

Image

```
[460]: dw_mask = np.array(Image.open("/Users/lcags/Documents/Practicum1/DoctorWhoLogo.
        ↪png"))



       dw_wc = WordCloud(mask=dw_mask, background_color = "White").
        ↪generate_from_frequencies(mostcommon)
       plt.figure(figsize=(10,8))
       plt.imshow(dw_wc, interpolation='bilinear')
       plt.axis('off')
```

```
[460]: (-0.5, 899.5, 1279.5, -0.5)
```



1.1.5 Words Clouds - Lemmatizer

[462]:
```
fic_lem_flatten  = ' '.join(fic_reduced_lem['body'])
```

[463]:
```
retokenize_lem = word_tokenize(fic_lem_flatten)
```

[225]:
```
mostcommon_lem = FreqDist(retokenize_lem)
```

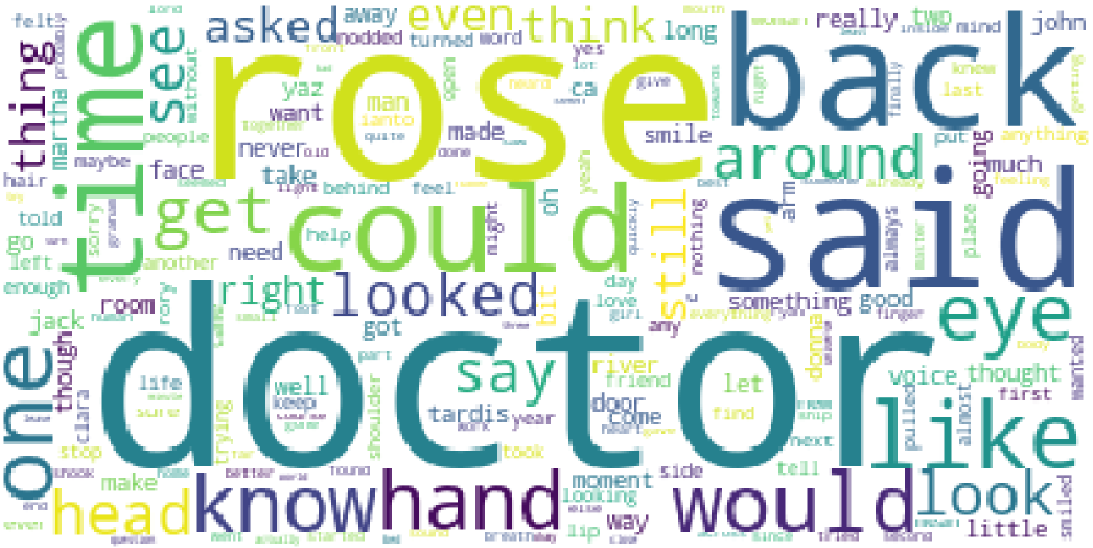
[464]:
```
mostcommon_lem.most_common(25)
```

[464]:
```
[('doctor', 202338),
 ('rose', 171626),
 ('said', 103715),
 ('back', 91061),
 ('could', 82210),
 ('time', 81957),
 ('like', 78821),
 ('one', 73864),
 ('would', 71637),
 ('know', 66617),
 ('hand', 66561),
 ('eye', 65410),
 ('get', 48675),
 ('around', 45935),
 ('look', 44277),
 ('head', 43992),
 ('looked', 41335),
 ('say', 41038),
 ('see', 40242),
 ('asked', 40127),
 ('even', 39893),
 ('still', 39679),
 ('thing', 38366),
 ('think', 38345),
 ('right', 38203)]
```

[465]:
```
wc_lem = WordCloud(background_color ="White")
img_lem = wc_lem.generate_from_frequencies(mostcommon_lem)
```

[466]:
```
plt.figure(figsize=(8,6))
plt.imshow(img_lem)
plt.axis("off")
```

[466]:
```
(-0.5, 399.5, 199.5, -0.5)
```



The word clouds for both lemmatizing and stemming the words look pretty much the same from a top words perspective.

1.1.6 Bigrams - Lemmatizer

[467]:
```
cv_lem = CountVectorizer(ngram_range=(2,2))
counts_lem = cv_lem.fit_transform([fic_lem_flatten])
```

[468]:
```
bgnames_l = []
bgcounts_l = []
for w in cv_lem.get_feature_names(): bgnames_l.append(w)
for c in counts_lem.toarray().flatten(): bgcounts_l.append(c)
bigrams_lem = pd.DataFrame({'word':bgnames_l,'count':bgcounts_l})
```

[469]:
```
bigrams_lem.sort_values(ascending=False,by="count")[:50]
```

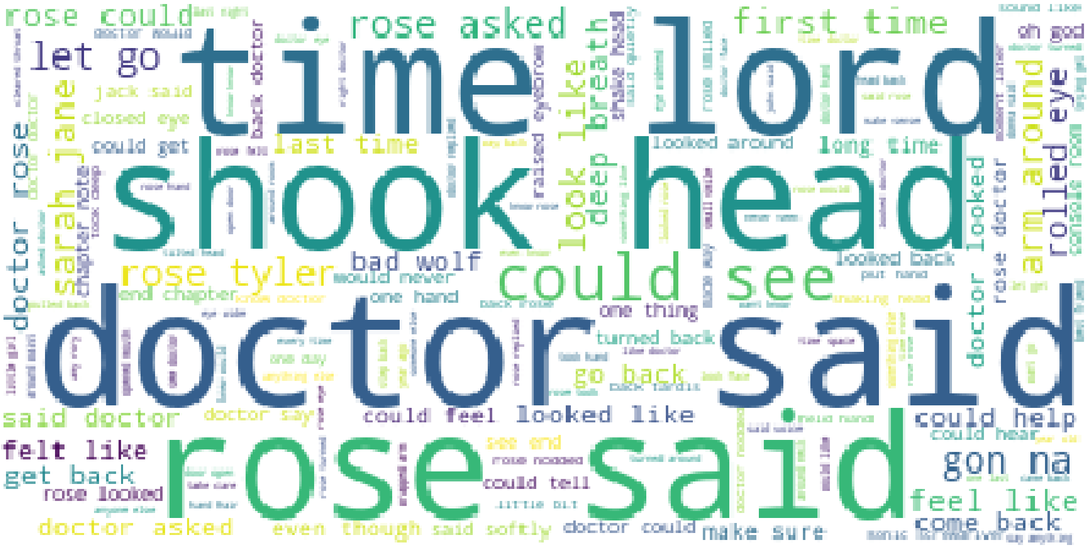
[469]:
```
                     word  count
947177        doctor said  10014
3662565         time lord   9231
3129410        shook head   9099
2942090         rose said   8586
741746         could see   4877
2943670        rose tyler   4789
1985037            let go   4755
2936431        rose asked   4746
1470444            gon na   4674
1269336        first time   4143
176761         arm around   4063
```

```
2066611       look like   3974
2988162      sarah jane   3897
947103      doctor rose   3576
2923526      rolled eye   3566
2937589      rose could   3200
853032      deep breath   3108
1218116       feel like   3104
940145     doctor asked   3030
2071776     looked like   2996
739913       could help   2917
1226307       felt like   2853
651020        come back   2828
944816    doctor looked   2828
1938182       last time   2799
1456138         go back   2791
263657         bad wolf   2761
2974357     said doctor   2761
1416237        get back   2741
1106009     even though   2679
2131126       make sure   2677
739469       could feel   2593
2060612       long time   2591
2938102     rose doctor   2591
2978890     said softly   2500
947238       doctor say   2454
2069613   looked around   2414
2940236     rose looked   2405
2755897  raised eyebrow   2375
701845     console room   2305
4054219     would never   2224
623219       closed eye   2212
1821984       jack said   2190
941584     doctor could   2154
742411       could tell   2151
3770133     turned back   2146
2429866          oh god   2142
739699        could get   2100
739895       could hear   2088
3049584         see end   2044
```

```
[470]: wc_l_bigram = WordCloud(background_color="white").
        ↪generate_from_frequencies(frequencies=dict(bigrams_lem.values))
```

```
[471]: plt.figure(figsize=(8,6))
       plt.imshow(wc_l_bigram)
       plt.axis("off")
```

```
[471]: (-0.5, 399.5, 199.5, -0.5)
```



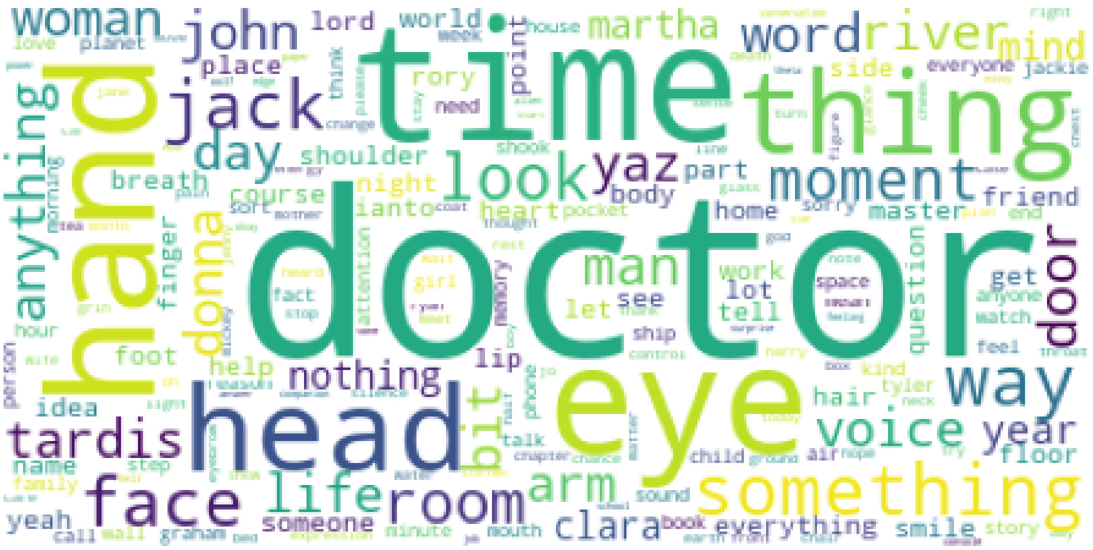
1.2 Nouns

```
[8]: retokenize_noun = word_tokenize(noun_flatten)
     mostcommon_noun = FreqDist(retokenize_noun)
     mostcommon_noun.most_common(15)
```

```
[8]: [('doctor', 189549),
      ('time', 81957),
      ('hand', 66561),
      ('eye', 65410),
      ('head', 39460),
      ('thing', 38366),
      ('something', 38126),
      ('way', 37246),
      ('jack', 35109),
      ('face', 34746),
      ('look', 29930),
      ('room', 28445),
      ('moment', 26409),
      ('door', 24412),
      ('man', 23928)]
```

```
[9]: wc = WordCloud(background_color ="White")
     img = wc.generate_from_frequencies(mostcommon_noun)
     plt.figure(figsize=(8,6))
     plt.imshow(img)
plt.axis("off")
```

```
[9]: (-0.5, 399.5, 199.5, -0.5)
```



1.3 Topic Modeling - First Iteration

In this first version, I just wanted to get a feel of how the topic model works and what the results are without touching any of the parameters. This will guide my process for further models.

```
[930]: cv = CountVectorizer(analyzer = 'word',max_df=0.5, min_df=25, token_pattern =␣
        ↪'[a-zA-Z]{3,}')
```

```
[931]: tf_tm_l = cv.fit_transform(fic_reduced_lem.body).toarray()
       tf_feature_names_tm_l = cv.get_feature_names()
       model = LatentDirichletAllocation(n_components=10, random_state=0,n_jobs =␣
        ↪-1,learning_method= 'online')
       model.fit(tf_tm_l)

       #online versus batch (subset versus full amount)
```

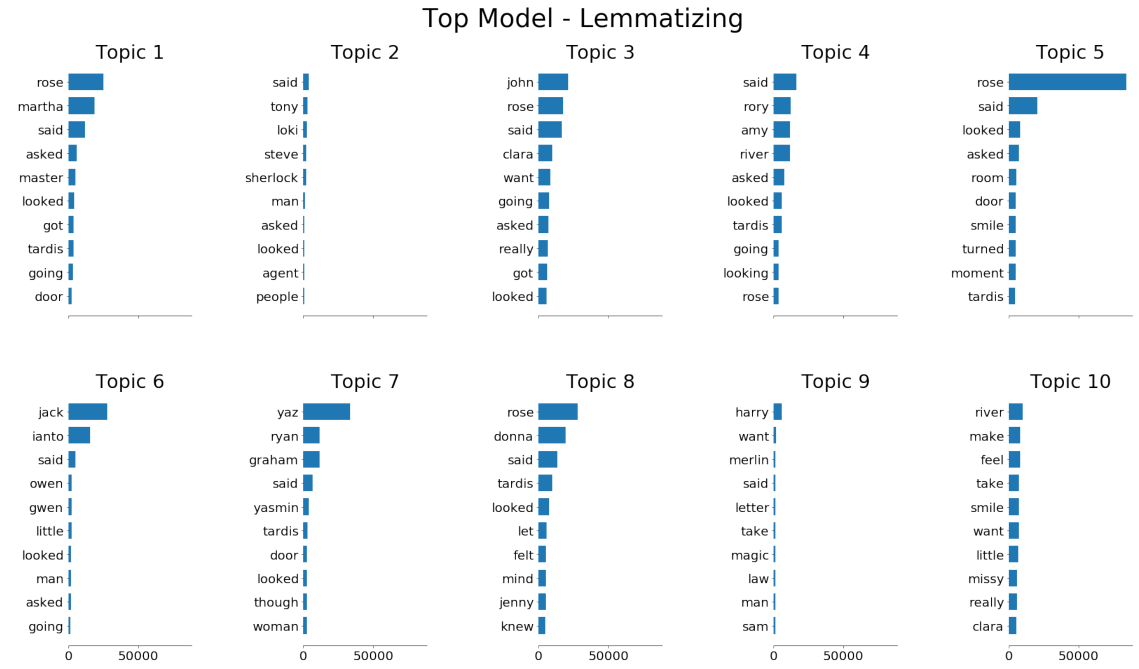
```
[931]: LatentDirichletAllocation(batch_size=128, doc_topic_prior=None,
                                 evaluate_every=-1, learning_decay=0.7,
                                 learning_method='online', learning_offset=10.0,
                                 max_doc_update_iter=100, max_iter=10,
                                 mean_change_tol=0.001, n_components=10, n_jobs=-1,
                                 perp_tol=0.1, random_state=0, topic_word_prior=None,
                                 total_samples=1000000.0, verbose=0)
```

[532]:

```
#from sci-kit learn website
def plot_top_words(model, feature_names, n_top_words, title):
    fig, axes = plt.subplots(2, 5, figsize=(30, 15), sharex=True)
    axes = axes.flatten()
    for topic_idx, topic in enumerate(model.components_):
        top_features_ind = topic.argsort()[:-n_top_words - 1:-1]
        top_features = [feature_names[i] for i in top_features_ind]
        weights = topic[top_features_ind]

        ax = axes[topic_idx]
        ax.barh(top_features, weights, height=0.7)
        ax.set_title(f'Topic {topic_idx +1}',
                     fontdict={'fontsize': 30})
        ax.invert_yaxis()
        ax.tick_params(axis='both', which='major', labelsize=20)
        for i in 'top right left'.split():
            ax.spines[i].set_visible(False)
        fig.suptitle(title, fontsize=40)

    plt.subplots_adjust(top=0.90, bottom=0.05, wspace=0.90, hspace=0.3)
    plt.show()


#https://scikit-learn.org/stable/auto_examples/applications/
 ↪plot_topics_extraction_with_nmf_lda.html
```

[609]:

```
plot_top_words(model,tf_feature_names_tm_l,10, "Top Model - Lemmatizing" )
```



[932]:

```
print("Log Likelihood: ", model.score(tf_tm_l))
print("Perplexity: ", model.perplexity(tf_tm_l))
```

```
Log Likelihood:  -43320793.63854103
Perplexity:  3926.571797676025
```

Lemmatization uses nouns only unless the POS is specified, so this first iteration only had nouns lemmatized while retaining all the other words that passed the stopwords point. I felt that nouns made more sense to include and exclude everything else.

1.4 Tuning

Look at the words broken up by each story and understand the top words in each.

[639]:

```
#Tokenize each fic but contain the words to the fic itself
wordtoken_fic = [word_tokenize(fic) for fic in fic_lem_noun.body]
freqdist_fic = [FreqDist(fic_token) for fic_token in wordtoken_fic]
```

[655]:

```
#For the first 5 fics, the top 10 words
for x in freqdist_fic[:5]:
    print(x.most_common(10))
    print('\n')
```

```
[('harry', 1172), ('eye', 445), ('loki', 391), ('hand', 313), ('time', 255),
('voice', 230), ('something', 196), ('tony', 187), ('fury', 180), ('thor', 168)]


[('stark', 29), ('man', 21), ('clint', 19), ('hand', 15), ('eye', 12), ('wanda',
12), ('thor', 12), ('sam', 11), ('voice', 11), ('natasha', 11)]


[('rory', 41), ('coulson', 35), ('time', 21), ('something', 18), ('thing', 18),
('pandorica', 17), ('arthur', 16), ('hand', 16), ('tony', 16), ('richard', 15)]


[('time', 586), ('eye', 575), ('hand', 534), ('day', 392), ('way', 391),
('thing', 386), ('head', 381), ('something', 351), ('face', 330), ('friend',
294)]


[('doctor', 78), ('dean', 71), ('eye', 27), ('time', 25), ('thing', 21),
('something', 19), ('hand', 19), ('look', 16), ('science', 15), ('way', 14)]
```

[1003]:

```
#Top Words from previous ngrams/model
top_words = ['doctor','time','hand','eye','head','thing','something','room'
            ␣
 ↪,'way','jack','face','look','room','woman','man','moment','door','man'
             ,'voice','arm']
```

[1004]:

```
#What percent of fics do these words show up in?
percent_total = []
for word in top_words:
    print("------------\nWord: " + word)
    temp = sum(1 for text in wordtoken_fic if word in text)
    print("Fic Count:{} ".format(str(temp)))
    temp2 = round((temp/1400)*100,2)
    print("Total:{}%".format(str(temp2)))
    percent_total.append(temp2)
```

```
------------
Word: doctor
Fic Count:1311
Total:93.64%
------------
Word: time
Fic Count:1376
Total:98.29%
------------
Word: hand
Fic Count:1355
Total:96.79%
------------
Word: eye
Fic Count:1343
Total:95.93%
------------
Word: head
Fic Count:1285
Total:91.79%
------------
Word: thing
Fic Count:1300
Total:92.86%
------------
Word: something
Fic Count:1306
Total:93.29%
------------
Word: room
```

```
Fic Count:1120
Total:80.0%
------------
Word: way
Fic Count:1307
Total:93.36%
------------
Word: jack
Fic Count:525
Total:37.5%
------------
Word: face
Fic Count:1305
Total:93.21%
------------
Word: look
Fic Count:1267
Total:90.5%
------------
Word: room
Fic Count:1120
Total:80.0%
------------
Word: woman
Fic Count:1035
Total:73.93%
------------
Word: man
Fic Count:1095
Total:78.21%
------------
Word: moment
Fic Count:1233
Total:88.07%
------------
Word: door
Fic Count:1103
Total:78.79%
------------
Word: man
Fic Count:1095
Total:78.21%
------------
Word: voice
Fic Count:1166
Total:83.29%
------------
Word: arm
```

```
Fic Count:1168
Total:83.43%
```

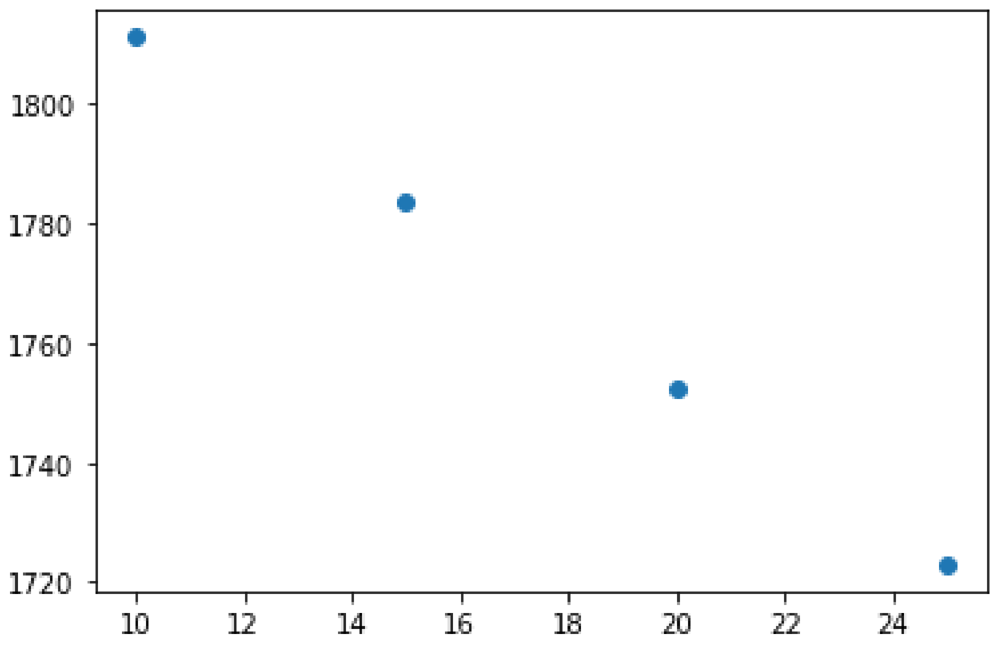
Specific Model Tuning Using different combinations of max_df and n_components, which models had the best perplexity scores?

[1114]:
```
## Tuning 30%
cv = CountVectorizer(analyzer = 'word',max_df=0.3, min_df=25, token_pattern =␣
↪'[a-zA-Z]{3,}')
tf_nouns = cv.fit_transform(fic_lem_noun.body).toarray()
tf_feature_names_nouns = cv.get_feature_names()

perplexity_scores = []
num_topic = [20,25,30,35]
for n in num_topic:
    model = LatentDirichletAllocation(n_components=n, random_state=0,n_jobs =␣
↪-1,learning_method= 'online')
    model.fit(tf_nouns)
    perplexity_scores.append(model.perplexity(tf_nouns))
    print(n)
```

```
10
15
20
25
```

[1115]:
```
plt.scatter(num_topic, perplexity_scores)
```

[1115]:
```
<matplotlib.collections.PathCollection at 0x1a88d48310>
```

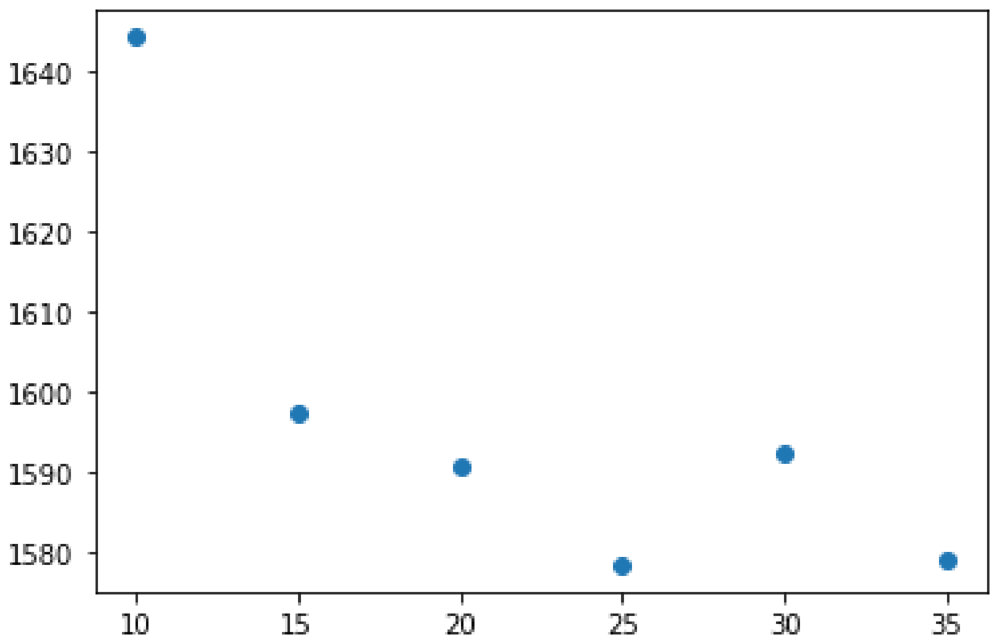


[984]:
```
## Tuning 50%
cv = CountVectorizer(analyzer = 'word',max_df=0.5, min_df=25, token_pattern =␣
↪'[a-zA-Z]{3,}')
tf_nouns = cv.fit_transform(fic_lem_noun.body).toarray()
tf_feature_names_nouns = cv.get_feature_names()

perplexity_scores = []
num_topic = [10,15,20,25,30,35]
for n in num_topic:
    model = LatentDirichletAllocation(n_components=n, random_state=0,n_jobs =␣
↪-1,learning_method= 'online')
    model.fit(tf_nouns)
    perplexity_scores.append(model.perplexity(tf_nouns))
    print(n)
```

```
10
15
20
25
30
35
```

[985]:
```
plt.scatter(num_topic, perplexity_scores)
```

[985]:
```
<matplotlib.collections.PathCollection at 0x1d619c7bd0>
```

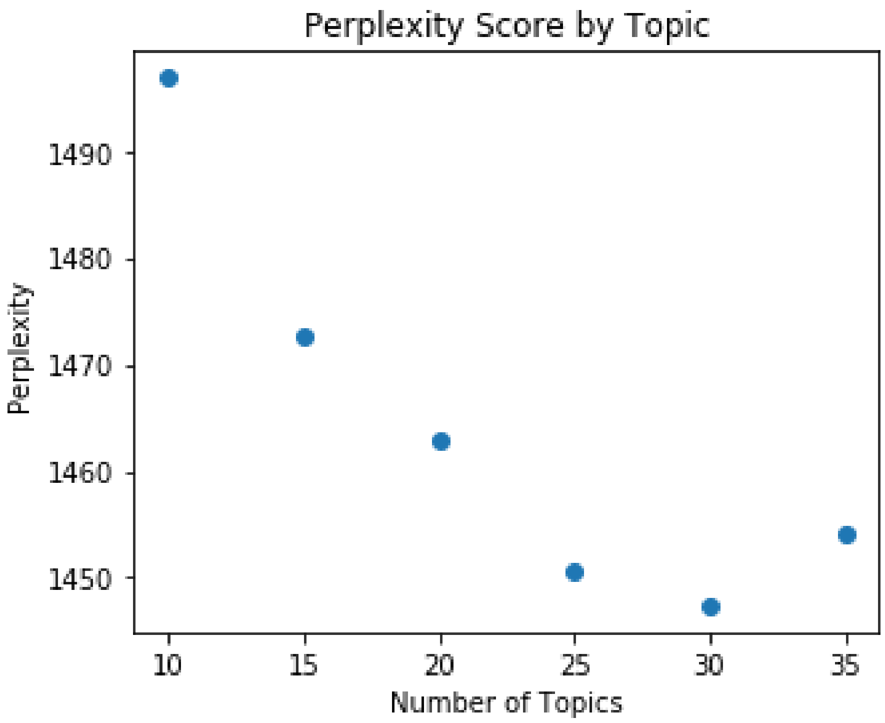


[1194]:
```
## Tuning 60%
cv = CountVectorizer(analyzer = 'word',max_df=0.7, min_df=25, token_pattern =␣
↪'[a-zA-Z]{3,}')
tf_nouns = cv.fit_transform(fic_lem_noun.body).toarray()
tf_feature_names_nouns = cv.get_feature_names()

perplexity_scores = []
num_topic = [10,15,20,25,30,35]

for n in num_topic:
    model = LatentDirichletAllocation(n_components=n, random_state=0,n_jobs =␣
↪-1,learning_method= 'online')
    model.fit(tf_nouns)
    perplexity_scores.append(model.perplexity(tf_nouns))
    print(n)
```

```
10
15
20
25
30
35
```

[1264]:
```
plt.rcParams['figure.figsize'] = [5, 4]
plt.ylabel("Perplexity ")
plt.xlabel("Number of Topics")
plt.title("Perplexity Score by Topic")
plt.scatter(num_topic, perplexity_scores)
```

```
[1264]: <matplotlib.collections.PathCollection at 0x1a81e11b10>
```



```
[1265]: #Best Score was 70% max_df and 30 Topics

cv = CountVectorizer(analyzer = 'word',max_df=.7, min_df=25, token_pattern =␣
 ↪'[a-zA-Z]{3,}')
tf_nouns = cv.fit_transform(fic_lem_noun.body)
tf_feature_names_noun = cv.get_feature_names()
model = LatentDirichletAllocation(n_components = 30 ,random_state=875,n_jobs =␣
 ↪-1,learning_method= 'online')
model.fit(tf_nouns)
```

```
[1265]: LatentDirichletAllocation(batch_size=128, doc_topic_prior=None,
                          evaluate_every=-1, learning_decay=0.7,
                          learning_method='online', learning_offset=10.0,
                          max_doc_update_iter=100, max_iter=10,
                          mean_change_tol=0.001, n_components=30, n_jobs=-1,
                          perp_tol=0.1, random_state=875, topic_word_prior=None,
                          total_samples=1000000.0, verbose=0)
```

[1430]:

```
tf_nouns.shape
```

[1430]:

```
(1400, 5935)
```

5,935 unique words used for the modeling.

[1266]:

```
#Code From OurCodingClub
def display_topics(model, feature_names, no_top_words):
    topic_dict = {}
    for topic_idx, topic in enumerate(model.components_):
        topic_dict["Topic %d words" % (topic_idx)]= ['{}'.
 ↪format(feature_names[i])
                        for i in topic.argsort()[:-no_top_words - 1:-1]]
        topic_dict["Topic %d weights" % (topic_idx)]= ['{:.1f}'.format(topic[i])
                        for i in topic.argsort()[:-no_top_words - 1:-1]]
    return pd.DataFrame(topic_dict)
```

[1431]:

```
#Top 15 words for each Topic
no_top_words = 15
topics_by_fic = display_topics(model, tf_feature_names_nouns, no_top_words)
topics_by_fic
```

[1431]:

```
   Topic 0 words Topic 0 weights Topic 1 words Topic 1 weights Topic 2 words  \
0            yaz         17619.0         river         18017.9          joan
1         graham          7000.6          wife          2129.0     gallifrey
2           ryan          5301.8          song          1321.9          lord
3         yasmin          1935.3       husband           434.3         smith
4           feel          1088.0       sweetie           430.8        romana
5           yeah           990.4           gun           359.0         dream
6           help           941.1       eyebrow           357.9          john
7            lot           935.9          body           351.4         child
8        chapter           925.0       century           340.9           boy
9           body           883.1     companion           332.7           son
10          foot           853.3          name           329.8         watch
11      question           838.6     professor           323.4      rassilon
12         floor           833.5          ship           322.5        mother
13           doc           784.5        anyone           306.4        school
14          step           777.5         story           296.4    expression

   Topic 2 weights Topic 3 words Topic 3 weights Topic 4 words  \
0           1058.3         donna             0.1          beta
1            947.5          king             0.1         alpha
2            731.3          john             0.1           sex
3            660.5        martha             0.1          heat
4            563.4          jack             0.1        gender
5            549.7          body             0.1          male
6            505.6         world             0.1         child
```

```
7            423.1        anyone             0.1          case
8            341.7          name             0.1       society
9            289.8          help             0.1  presentation
10           250.2          work             0.1       partner
11           232.4         think             0.1        female
12           228.6          ship             0.1       chapter
13           216.3          yeah             0.1         world
14           201.0          home             0.1        couple

   Topic 4 weights  … Topic 25 words Topic 25 weights Topic 26 words  \
0            173.1  …         martha              0.1         letter
1            100.8  …          donna              0.1            law
2             94.1  …         mickey              0.1       marriage
3             86.9  …       everyone              0.1         series
4             49.1  …           work              0.1      rejection
5             46.9  …           home              0.1         anyone
6             42.9  …           john              0.1         potter
7             37.5  …           step              0.1            lot
8             33.1  …           jane              0.1      character
9             32.2  …           sort              0.1           note
10            30.9  …          point              0.1       ministry
11            30.7  …           yeah              0.1          claim
12            29.0  …       question              0.1          count
13            27.9  …           idea              0.1        company
14            25.8  …           name              0.1           send

   Topic 26 weights Topic 27 words Topic 27 weights Topic 28 words  \
0            1408.5         martha          13639.6         merlin
1            1132.3           jack           2141.1         arthur
2             914.7         master           1552.7         reader
3             713.8          watch            949.7       everyone
4             685.8            tim            844.3            sky
5             429.3         family            756.7            boy
6             390.0       everyone            623.9      professor
7             389.4          world            612.2          carol
8             389.2           work            601.4          sword
9             369.5      professor            529.1        hostess
10            369.1          story            515.9           name
11            359.0           yeah            497.6          magic
12            355.7           wolf            490.4           help
13            350.2           name            488.4        brother
14            337.6          month            474.2          world

   Topic 28 weights Topic 29 words Topic 29 weights
0            1099.1      detective            174.2
1             611.7           john            124.3
2             223.2            box             25.2
```

```
3            150.6        watson         19.1
4            137.0           tea         19.0
5            107.3         space         15.4
6            101.1          wall         12.1
7            100.3         crack         11.9
8             97.2     telephone         10.6
9             94.0       control          8.4
10            87.9         sugar          7.7
11            77.7       kitchen          7.0
12            74.5         crash          7.0
13            71.5          name          6.8
14            69.3         magic          6.2

[15 rows x 60 columns]
```

1.4.1 Explore

Explore the fics assigned to each topic

[1268]:

```
#Export topics to CSV
topics = display_topics(model, tf_feature_names_nouns, no_top_words)
topics.to_csv(r'/Users/lcags/Documents/Practicum1/topics_' +today+'.csv'
                        ,index = False
                        ,header=True)
```

The below code maps each fic to the dominant topic with the highest score (or the topic that's the most similar to). Even though 30 topics were created, not every topic had a fic with it as the highest topic.

[1269]:

```
#adapted from stackoverflow
#Doc to Topic Mapping
doc_topic = model.transform(tf_nouns)
doc_to_topic = pd.DataFrame(columns = ["fic","topic"])

for n in range(doc_topic.shape[0]):
    topic_most_pr = doc_topic[n].argmax()
    doc_to_topic = doc_to_topic.append({'fic': n, 'topic': topic_most_pr},␣
 ↪ignore_index = True)
```

[1464]:

```
#Which was the dominant topic for story number 3?
doc_topic[3].argmax()
```

[1464]: 18

[1450]:

```
#No fic had the dominator topic of 3
doc_to_topic.loc[doc_to_topic["topic"] == 3]
```

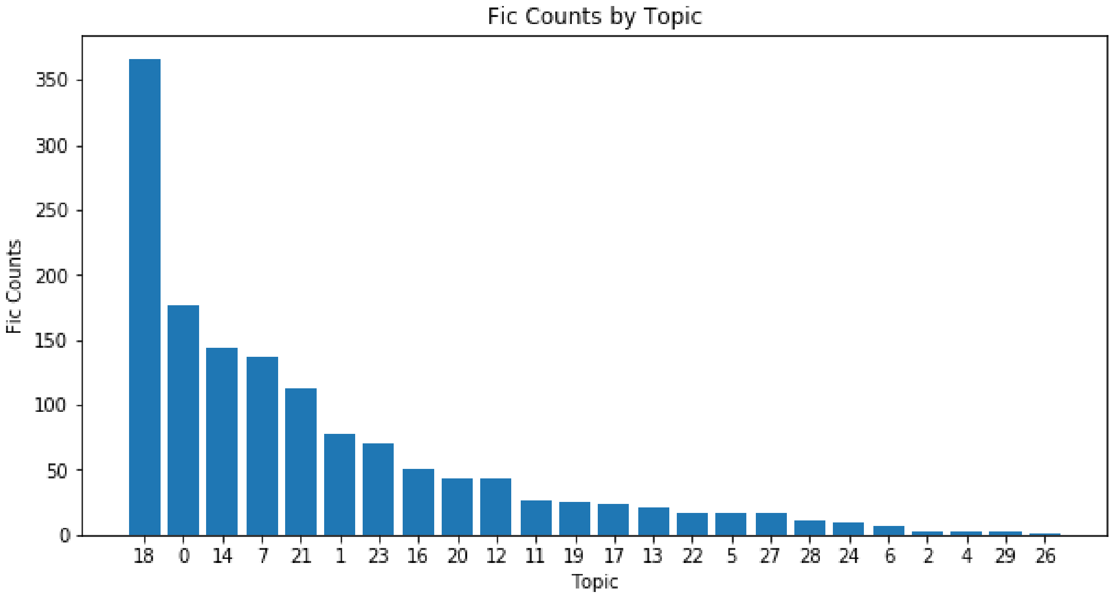
```
[1450]: Empty DataFrame
        Columns: [fic, topic]
        Index: []
```

```
[1437]: #How many fics were assigned to each topic?

        fics = fic_lem_noun[['work_id','title']].copy()
        fics['author'] = fic_raw.author
        fics['topic'] = doc_to_topic['topic']

        ficcounts = fics["topic"].value_counts().reset_index()
        ficcounts.columns=['topic', 'counts']
```

```
[1438]: pd.set_option('display.max_rows',35)
        ficcounts
```

```
[1438]:     topic  counts
        0      18     366
        1       0     176
        2      14     144
        3       7     137
        4      21     113
        5       1      77
        6      23      71
        7      16      51
        8      20      43
        9      12      43
        10     11      26
        11     19      25
        12     17      24
        13     13      21
        14     22      16
        15      5      16
        16     27      16
        17     28      11
        18     24       9
        19      6       7
        20      2       3
        21      4       2
        22     29       2
        23     26       1
```

```
[1379]: plt.rcParams['figure.figsize'] = [10, 5]
        plt.bar(range(len(ficcounts.topic)), ficcounts.counts, align='center')
        plt.xticks(range(len(ficcounts.topic)), ficcounts.topic);
        plt.xlabel("Topic")
        plt.ylabel("Fic Counts")
        plt.title("Fic Counts by Topic")

        plt.show()
```



[1548]:
```
#Top 10 Topics
top_topics = ["18","0","14","7","21","1","13","16","20","12"]
topics_by_fic.loc[:,topics_by_fic.columns.str.contains(top_topics[0])]
```

[1548]:
```
   Topic 18 words Topic 18 weights
0            body           4622.1
1            foot           2844.9
2        question           2697.2
3          memory           2499.1
4            help           2471.8
5            ship           2424.0
6           mouth           2386.0
7            sort           2376.7
8            feel           2296.9
9          planet           2246.6
10            air           2245.0
11           lord           2233.0
12          world           2229.3
13           hour           2211.8
14          floor           2183.4
```

[1549]:
```
#Explore each topics fics
fics[fics["topic"]==18]
```

[1549]:

```
       work_id                                              title  \
3     12292116                                 My Fandom Needs Me
4       609625                                         Past Tense
7      6218785                                   Connect-the-Dots
9      9448043                                 Fantastic Humanity
13    10707144                          Stars Spell Out Your Name
…        …                                                  …
1376    941799                          Prolonging the Inevitable
1379  11523594  This Reminds Me of Those RomComs Jackie Always…
1380  20424674                                             Reverb
1385  17175596                                          Polyphony
1389  23044168                                          Dusk/Dawn

                         author topic
3                   ['Riv_ika']    18
4               ['Try2CatchMe']    18
7     ['fingersfallingupwards']    18
9                     ['esama']    18
13                      ['dls']    18
…                         …   …
1376                ['Aeolist']    18
1379      ['TimeLadyoftheSith']    18
1380           ['sciencebutch']    18
1385             ['stcrmpilot']    18
1389    ['Raindropsonwhiskers']    18

[366 rows x 4 columns]
```

1.5 Categorizing a new Fic

Testing with the text of a new story the model hasn't seen - but has the same characteristics of the model data.

[1353]:

```
new_Fic = pd.read_csv('/Users/lcags/Documents/Practicum1/new_fic1.csv', header␣
 ↪= None)
```

[1354]:

```
new_Fic.columns =␣
 ↪['work_id','title','author','rating','category','fandom','relationship','character'
                   ,'additional tags','language','published','status','status␣
 ↪date','words'
                   ,'chapters','comments','kudos','bookmarks','hits','body']
```

[1355]:

```
#Clean fic
new_Fic.body = html.unescape(new_Fic.body)
new_Fic.body = new_Fic.body.replace('\n', '', regex=True)
new_fic_lem = new_Fic.body.apply(clean_text_lemmatizer)
new_fic_nouns = new_fic_lem.apply(noun_only)
```

[1366]:

```
#Clean fic
new_Fic.body = html.unescape(new_Fic.body)
new_Fic.body = new_Fic.body.replace('\n', '', regex=True)
new_fic_lem = new_Fic.body.apply(clean_text_lemmatizer)
new_fic_nouns = new_fic_lem.apply(noun_only)

#Apply Model
new_fic_tf = cv.transform(new_fic_nouns)
new_fic_topics = model.transform(new_fic_tf)
```

[1376]:

```
#Topic this fic fits in
new_fic_topics.argmax()
```

[1376]:

```
7
```

The new fic was sorted into Topic 7

1.6 References

Chen, Yanlin. (2018). How to generate an LDA topic model for text analysis. Retrieved from https://medium.com/@yanlinc/how-to-build-a-lda-topic-model-using-from-text-601cdcbfd3a6<br>

Ganesan, K. (n.d.). 10+ examples for using CountVectorizer. Retrieved from https://kavita-ganesan.com/how-to-use-countvectorizer/#.YMJZGJNKgl4.

James. (n.d). Topic modeling in python. Retrieved from https://ourcodingclub.github.io/tutorials/topic-modelling-python/#apply.

Li, Jingyi. (2016). AO3 scraper. Retrieved from https://github.com/radiolarian/AO3Scraper

scikit-learn. (n.d.). Topic extraction with Non-negative Matrix Factorization and Latent Dirichlet Allocation. Retrieved from https://scikit-learn.org/stable/auto_examples/applications/plot_topics_extraction_with_nmf_lda.html.

sophros.https://stackoverflow.com/questions/65817456/lda-topic-model-gensim-gives-same-set-of-topics

Marcel. (2017). python scikit learn, get documents per topic in LDA. Retrieved from https://stackoverflow.com/questions/45145368/python-scikit-learn-get-documents-per-topic-in-lda

[ ]:

```

```