clustering-Text-K-MEANS-NLP

March 23, 2024

[1]:
```
 from sklearn.datasets import fetch_20newsgroups
from nltk.tokenize import word_tokenize #Used to extract words from documents
from nltk.stem import WordNetLemmatizer #Used to lemmatize words
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.pipeline import make_pipeline
from sklearn.preprocessing import Normalizer
from sklearn import metrics

from sklearn.cluster import KMeans

import sys
from time import time

import pandas as pd
import numpy as np
```

[2]:
```
# Selected 3 categories from the 20 newsgroups dataset

categories = [
    'talk.religion.misc',
    'comp.graphics',
    'sci.space',
]

print("Loading 20 newsgroups dataset for categories:")
print(categories)
```

```
Loading 20 newsgroups dataset for categories:
['talk.religion.misc', 'comp.graphics', 'sci.space']
```

[3]:
```
df = fetch_20newsgroups(subset='all', categories=categories,
                             shuffle=False, remove=('headers', 'footers',␣
 ↪'quotes'))
```

[4]:
```
labels = df.target
true_k = len(np.unique(labels)) ## This should be 3 in this example
print(true_k)
```

```
3
```

[5]:

```
#Perform Lemmatization
```

[6]:

```
lemmatizer = WordNetLemmatizer()
for i in range(len(df.data)):
    word_list = word_tokenize(df.data[i])
    lemmatized_doc = ""
    for word in word_list:
        lemmatized_doc = lemmatized_doc + " " + lemmatizer.lemmatize(word)
    df.data[i] = lemmatized_doc
```

[7]:

```
print(df.data[1])
```

```
 In regard to fractal commpression , I have seen 2 fractal compressed `` movie
'' . They were both fairly impressive . The first one wa a 64 gray scale ``
movie '' of Casablanca , it wa 1.3MB and had 11 minute of 13 fps video . It wa a
little grainy but not bad at all . The second one I saw wa only 3 minute but it
had 8 bit color with 10fps and measured in at 1.2MB . I consider the fractal
movie a practical thing to explore . But unlike many other format out there ,
you do end up losing resolution . I do n't know what kind of software/hardware
wa used for creating the `` movie '' I saw but the guy that showed them to me
said it took 5-15 minute per frame to generate . But a I said above playback wa
10 or more frame per second . And how else could you put 11 minute on one floppy
disk ?
```

[8]:

```
#We next convert our corpus into tf-idf vectors. We remove common stop words,␣
 ↪terms with very low document frequency (many of them are numbers
#or misspells), accents.
```

[9]:

```
vectorizer = TfidfVectorizer(strip_accents='unicode', stop_words='english',␣
 ↪min_df=2) ## Corpus is in English
X = vectorizer.fit_transform(df.data)
```

[10]:

```
print(X.shape)
```

```
(2588, 14439)
```

[11]:

```
#Clustering using standard k-means¶
```

[12]:

```
#We choose a value that reflects our knowledge about the data
```

[13]:

```
#We may try several value, possibly in increasing order
```

[14]:

```
#we set  k=3
```

[15]:

```
km = KMeans(n_clusters=true_k, init='k-means++', max_iter=100)
t0 = time()
km.fit(X)
print("done in %0.3fs" % (time() - t0))
```

```
done in 0.162s
```

```
/home/nmit/anaconda3/lib/python3.11/site-
packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of
`n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init`
explicitly to suppress the warning
  warnings.warn(
```

[16]:

```
#Standard measures of cluster quality¶
```

[17]:

```
print("Homogeneity: %0.3f" % metrics.homogeneity_score(labels, km.labels_))
print("Completeness: %0.3f" % metrics.completeness_score(labels, km.labels_))
print("V-measure: %0.3f" % metrics.v_measure_score(labels, km.labels_))
print("Adjusted Rand-Index: %.3f"
      % metrics.adjusted_rand_score(labels, km.labels_))
print("Silhouette Coefficient: %0.3f"
      % metrics.silhouette_score(X, km.labels_, sample_size=1000))
```

```
Homogeneity: 0.293
Completeness: 0.401
V-measure: 0.339
Adjusted Rand-Index: 0.210
Silhouette Coefficient: 0.009
```

[18]:

```
#Identify the 10 most relevant terms in each cluster¶
```

[20]:

```
centroids = km.cluster_centers_.argsort()[:, ::-1] ## Indices of largest␣
 ↪centroids' entries in descending order
#vectorizer.get_feature_names use instead vectorizer.get_feature_names_out
terms = vectorizer.get_feature_names_out()
for i in range(true_k):
    print("Cluster %d:" % i, end='')
    for ind in centroids[i, :10]:
        print(' %s' % terms[ind], end='')
    print()
```

```
Cluster 0: god jesus christian bible wa people christians say christ did
Cluster 1: wa space just like think ha time know did people
Cluster 2: file image thanks format program know graphic ftp bit gif
```

[21]:

```
#Visualization
```

[22]:

```
from wordcloud import WordCloud
import matplotlib.pyplot as plt
```

[23]:

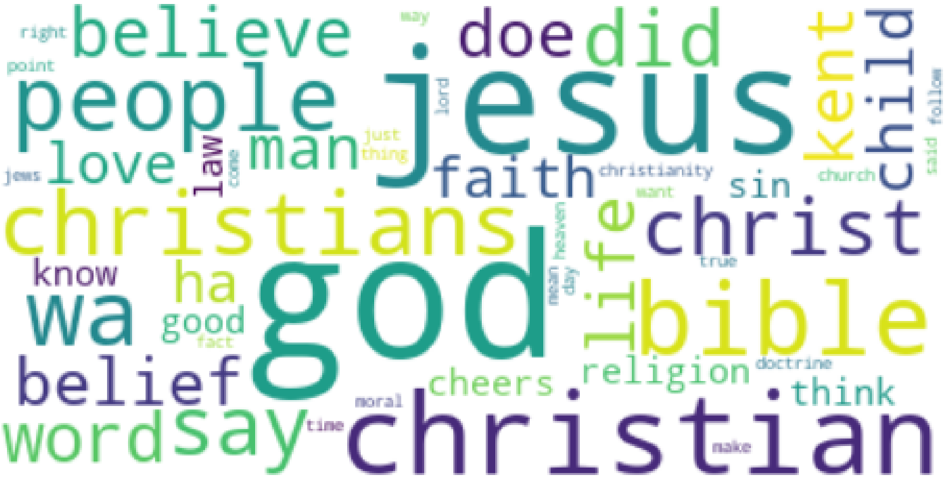
```
def frequencies_dict(cluster_index):
    if cluster_index > true_k - 1:
        return
    term_frequencies = km.cluster_centers_[cluster_index]
    sorted_terms = centroids[cluster_index]
    frequencies = {terms[i]: term_frequencies[i] for i in sorted_terms}
    return frequencies
```

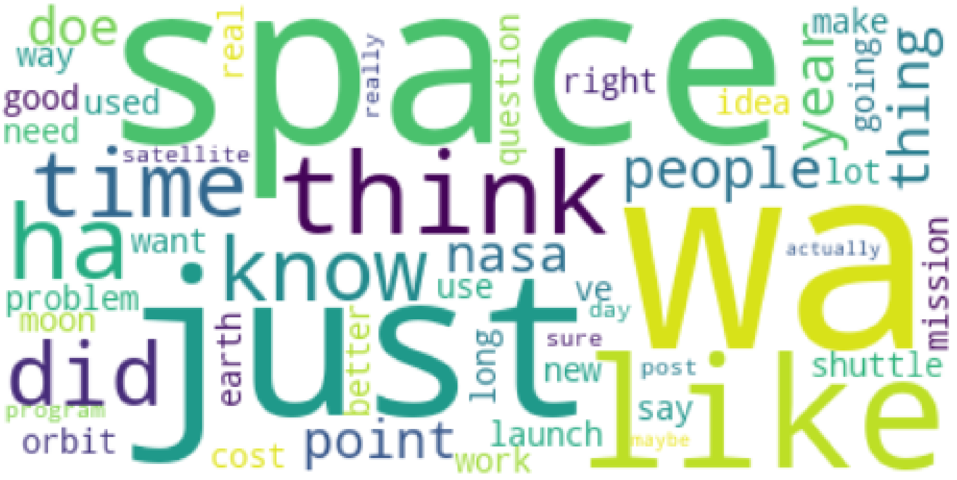
[24]:

```
def makeImage(frequencies):

    wc = WordCloud(background_color="white", max_words=50)
    # generate word cloud
    wc.generate_from_frequencies(frequencies)

    # show
    plt.imshow(wc, interpolation="bilinear")
    plt.axis("off")
    plt.show()
```

[25]:

```
for i in range(true_k):
    freq = frequencies_dict(i)
    makeImage(freq)
    print()
```

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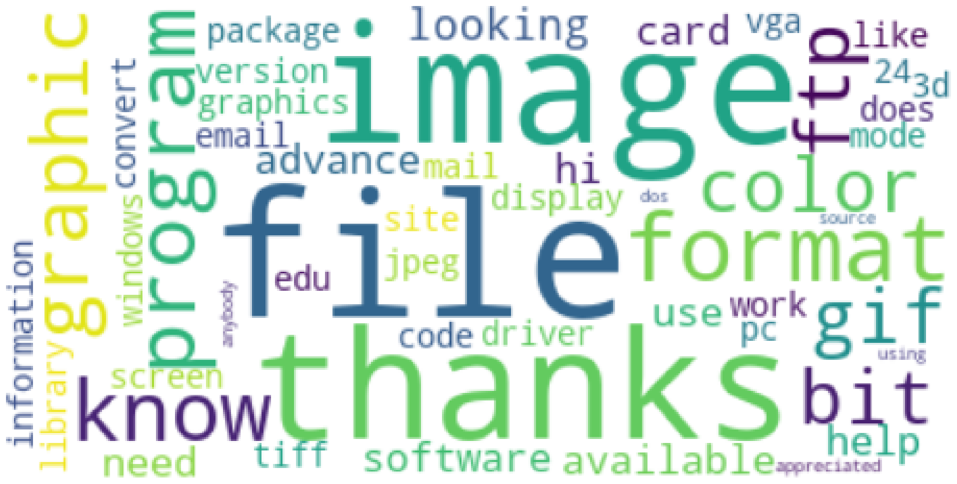
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