Lab 4: Feature Generation

Author: Xu Zhao

Module: INT104

Teacher: Xiaobo Jin

Date: 28/4/2021

Introduction

In the given dataset, it is required to generate the features of the txt in the files of the dataset.

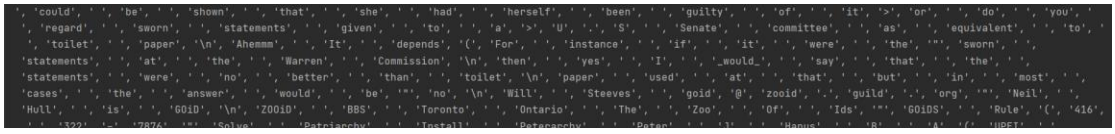
Design & Implementation

Dynamic Programming

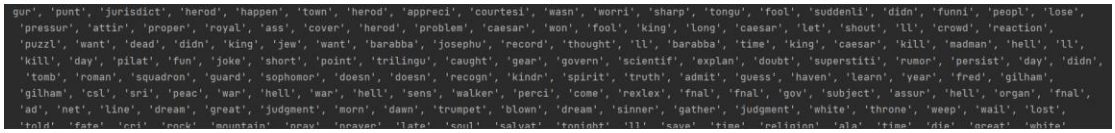
Design principles

1. Preprocessing

First, use the os.listdir() to read the files in the dataset. Next, use the dict() to store all the words in the dataset split by space like this:



Next, read the stopwords.txt and store these words in a set. Store the all words in the above dictionary in a new list. Use the code provided in the tasksheet to transform the words in the list into their lower case form and use an if to delete all non-alphabet characters and delete words which appears in the stopwords.txt. Finally, use the code provided in the tasksheet to perform word stemming to remove the word suffix. And the finally preprocessing result is like this:



2. TFIDF Representation

   To calculate fik, define a function. Read the document i from the dataset and process it in the same way above. This part of code is almost the same with the above. Use a for loop to get all the preprocessed words and use an if to check if it is the same with the given word k and calculate fik.

   N: the number of documents in the dataset. Use len() to calculate, which is 2726.

   Nk, the number of documents which contains word k. Also use a def to create a function to calculate.

   To get aik, use some math function as well as fik and nk .

   D, the number of unique words. Use a for loop to get all the words from the preprocessing data and put them into a new set. Because set() does not allow same words, we can use len() to calculate the length of the set, which is D. D is 23433

   Finally, use aik and some other math function to calculate Aik.

   Finally, put the document name into a list. The length is N 2726. The unique word, the length is D 23433. Create a N*D matrix and fill in values of Aik. Use the code provided to save it into a npz document.

Implementation

```
    import os
import math
import numpy as np
from nltk.stem.porter import *

# Read the folder
datasetname = {i: os.listdir("./dataset/" + i)for i in
os.listdir("./dataset")}
#print(datasetname)

# Store all the words in a dictionary
data = dict()
for dirs in datasetname:
    for i in datasetname.get(dirs):
        if os.path.isfile(os.path.join("./dataset/", dirs, i)):
            with open(os.path.join("./dataset/", dirs, i), 'r',
encoding='Latin1') as fp:
                data[os.path.join("./dataset/", dirs, i)] =
re.split(r'(\W)+', fp.read())
#print(data)

# Read stopwords.txt and store in a set
stopwords = set()
with open("./stopwords.txt", 'r', encoding='utf-8') as gp:
    stopwords = set(gp.read().split())

value = list()
for i in data.keys():
    value.append(data[i])
newdata = list()
for i in value:
    for w in i:
        # Delete all non-alphabet characters and transform characters
into lower case
        wd = re.sub(r'[^a-z]', '', w.lower()).strip()
        # Remove space and stopwords
        if wd != '' and wd not in stopwords:
            newdata.append(wd)
# Perform word stemming to remove the word suffix
stemmer = PorterStemmer()
plurals = newdata
singles = [stemmer.stem(plural) for plural in plurals]
```

```
#print(singles)
#print(len(singles))


# Define function fik
def fik(i, k):
    document = dict()
    #for dirs in datasetname:
        #for i in datasetname.get(dirs):
    with open(os.path.join(i), 'r', encoding="Latin1") as fp1:
        document[os.path.join(i)] = re.split(r'(\W)+', fp1.read())
        value1 = list()
        for j in document.keys():
            value1.append(document[j])
        ndata = list()
        for j in value1:
            for x in j:
                xd = re.sub(r'[^a-z]', '', x.lower()).strip()
                if xd != '' and xd not in stopwords:
                    ndata.append(xd)
        stemmer1 = PorterStemmer()
        plurals1 = ndata
        singles1 = [stemmer1.stem(plural) for plural in plurals1]
        count = 0
        for x in singles1:
            if x == k:
                count = count + 1
        return count

# Calculate the number of documents
N = len(data)
#print(N)

# Define function nk
def nk(k):
    count = 0
    for i in data.keys():
        if fik(i, k) != 0:
            count = count + 1
    return count

# Define function aik
def aik(i, k):
    return fik(i, k)*math.log(N/nk(k), 10)
```

```
# Calculate the number of unique words
unique = set()
for x in singles:
    unique.add(x)
D = len(unique)
#print(D)

# Define function Aik
def Aik(i, k):
    sum = 0
    for x in unique:
            sum = sum + math.pow(aik(i, x), 2)
    return aik(i, k)/math.pow(sum, 0.5)

# Store the document i in a list
address = list(data.keys())
#print(address)
#print(unique)


# Create the matrix
A = np.ones((N, D))
for i in address:
    for k in unique:
        A[i][k] = Aik(i, k)

# Save the matrix into npz document
np.savez('train-20ng.npz', X=A)
```

Test

Although it run a long time, the result is below.