practical-7-piyusha

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Practical 7 - Text Analytics 1. Extract Sample document and apply following document preprocessing methods: Tokenization, POS Tagging, stop words removal, Stemming and Lemmatization. 2. Create representation of document by calculating Term Frequency and Inverse Document Frequency

[5]:
```
import nltk
import re
import pandas as pd
from nltk.tokenize import word_tokenize, sent_tokenize
from nltk.corpus import stopwords
from nltk.stem import PorterStemmer, WordNetLemmatizer
from sklearn.feature_extraction.text import TfidfVectorizer

# Download necessary resources
nltk.download('punkt')
nltk.download('stopwords')
nltk.download('wordnet')
nltk.download('averaged_perceptron_tagger_eng')
```

```
[nltk_data] Downloading package punkt to /root/nltk_data…
[nltk_data]   Package punkt is already up-to-date!
[nltk_data] Downloading package stopwords to /root/nltk_data…
[nltk_data]   Package stopwords is already up-to-date!
[nltk_data] Downloading package wordnet to /root/nltk_data…
[nltk_data]   Package wordnet is already up-to-date!
[nltk_data] Downloading package averaged_perceptron_tagger_eng to
[nltk_data]     /root/nltk_data…
[nltk_data]   Unzipping taggers/averaged_perceptron_tagger_eng.zip.
```

[5]:
```
True
```

[6]:
```
# Sample text about whales (50 words)
text1 = """Whales are the largest marine mammals. They belong to the cetacean␣
 ↪family,
which includes dolphins and porpoises. Blue whales are the biggest, reaching up␣
 ↪to
```

```
100 feet in length. They communicate using low-frequency sounds. Whales migrate␣
 ↪long
distances for breeding and feeding. Their conservation is crucial for marine␣
 ↪biodiversity."""

# Sample text about goldfish (50 words)
text2 = """Goldfish are small freshwater fish commonly kept as pets. They␣
 ↪originate from East Asia
and belong to the carp family. Goldfish can recognize their owners and learn␣
 ↪feeding schedules.
They require clean water and proper nutrition to thrive. Some varieties grow up␣
 ↪to a foot in size."""

documents = [text1, text2]
```

[7]:
```
nltk.download("punkt_tab")
# Initialize tools
stop_words = set(stopwords.words("english"))
ps = PorterStemmer()
lemmatizer = WordNetLemmatizer()

# Function for text preprocessing
def preprocess_text(text):
    # Convert to lowercase
    text = text.lower()

    # Remove punctuation
    text = re.sub(r'[^a-z\s]', '', text)

    # Remove all punctuation
    cleaned_text = re.sub(f"[{re.escape(string.punctuation)}]", "", text)

    # Tokenization
    tokens = word_tokenize(text)

    # Remove stop words
    filtered_tokens = [word for word in tokens if word not in stop_words]

    # Perform POS tagging
    pos_tags = nltk.pos_tag(filtered_tokens)

    # Perform stemming
    stemmed_words = [ps.stem(word) for word in filtered_tokens]

    # Perform lemmatization
    lemmatized_words = [lemmatizer.lemmatize(word) for word in filtered_tokens]
```

```
    return {
        "tokens": tokens,
        "filtered_tokens": filtered_tokens,
        "pos_tags": pos_tags,
        "stemmed_words": stemmed_words,
        "lemmatized_words": lemmatized_words
    }

# Apply preprocessing
processed_text1 = preprocess_text(text1)
processed_text2 = preprocess_text(text2)
```

```
[nltk_data] Downloading package punkt_tab to /root/nltk_data…
[nltk_data]   Package punkt_tab is already up-to-date!
```

[8]:
```
print("\nPreprocessed Results for Text 1 (Whales):")
print("Tokens:", processed_text1["tokens"])
print("Filtered Tokens (Stopwords & Punctuation Removed):",␣
 ↪processed_text1["filtered_tokens"])
print("POS Tags:", processed_text1["pos_tags"])
print("Stemmed Words:", processed_text1["stemmed_words"])
print("Lemmatized Words:", processed_text1["lemmatized_words"])

print("\nPreprocessed Results for Text 2 (Goldfish):")
print("Tokens:", processed_text2["tokens"])
print("Filtered Tokens (Stopwords & Punctuation Removed):",␣
 ↪processed_text2["filtered_tokens"])
print("POS Tags:", processed_text2["pos_tags"])
print("Stemmed Words:", processed_text2["stemmed_words"])
print("Lemmatized Words:", processed_text2["lemmatized_words"])
```

```
Preprocessed Results for Text 1 (Whales):
Tokens: ['whales', 'are', 'the', 'largest', 'marine', 'mammals', 'they',
'belong', 'to', 'the', 'cetacean', 'family', 'which', 'includes', 'dolphins',
'and', 'porpoises', 'blue', 'whales', 'are', 'the', 'biggest', 'reaching', 'up',
'to', 'feet', 'in', 'length', 'they', 'communicate', 'using', 'lowfrequency',
'sounds', 'whales', 'migrate', 'long', 'distances', 'for', 'breeding', 'and',
'feeding', 'their', 'conservation', 'is', 'crucial', 'for', 'marine',
'biodiversity']
Filtered Tokens (Stopwords & Punctuation Removed): ['whales', 'largest',
'marine', 'mammals', 'belong', 'cetacean', 'family', 'includes', 'dolphins',
'porpoises', 'blue', 'whales', 'biggest', 'reaching', 'feet', 'length',
'communicate', 'using', 'lowfrequency', 'sounds', 'whales', 'migrate', 'long',
'distances', 'breeding', 'feeding', 'conservation', 'crucial', 'marine',
'biodiversity']
POS Tags: [('whales', 'NNS'), ('largest', 'JJS'), ('marine', 'NN'), ('mammals',
```

```
'NNS'), ('belong', 'JJ'), ('cetacean', 'JJ'), ('family', 'NN'), ('includes',
'VBZ'), ('dolphins', 'NNS'), ('porpoises', 'NNS'), ('blue', 'JJ'), ('whales',
'NNS'), ('biggest', 'JJS'), ('reaching', 'VBG'), ('feet', 'NNS'), ('length',
'JJ'), ('communicate', 'NN'), ('using', 'VBG'), ('lowfrequency', 'NN'),
('sounds', 'VBZ'), ('whales', 'NNS'), ('migrate', 'VBP'), ('long', 'JJ'),
('distances', 'NNS'), ('breeding', 'VBG'), ('feeding', 'VBG'), ('conservation',
'NN'), ('crucial', 'JJ'), ('marine', 'NN'), ('biodiversity', 'NN')]
Stemmed Words: ['whale', 'largest', 'marin', 'mammal', 'belong', 'cetacean',
'famili', 'includ', 'dolphin', 'porpois', 'blue', 'whale', 'biggest', 'reach',
'feet', 'length', 'commun', 'use', 'lowfrequ', 'sound', 'whale', 'migrat',
'long', 'distanc', 'breed', 'feed', 'conserv', 'crucial', 'marin', 'biodivers']
Lemmatized Words: ['whale', 'largest', 'marine', 'mammal', 'belong', 'cetacean',
'family', 'includes', 'dolphin', 'porpoise', 'blue', 'whale', 'biggest',
'reaching', 'foot', 'length', 'communicate', 'using', 'lowfrequency', 'sound',
'whale', 'migrate', 'long', 'distance', 'breeding', 'feeding', 'conservation',
'crucial', 'marine', 'biodiversity']

Preprocessed Results for Text 2 (Goldfish):
Tokens: ['goldfish', 'are', 'small', 'freshwater', 'fish', 'commonly', 'kept',
'as', 'pets', 'they', 'originate', 'from', 'east', 'asia', 'and', 'belong',
'to', 'the', 'carp', 'family', 'goldfish', 'can', 'recognize', 'their',
'owners', 'and', 'learn', 'feeding', 'schedules', 'they', 'require', 'clean',
'water', 'and', 'proper', 'nutrition', 'to', 'thrive', 'some', 'varieties',
'grow', 'up', 'to', 'a', 'foot', 'in', 'size']
Filtered Tokens (Stopwords & Punctuation Removed): ['goldfish', 'small',
'freshwater', 'fish', 'commonly', 'kept', 'pets', 'originate', 'east', 'asia',
'belong', 'carp', 'family', 'goldfish', 'recognize', 'owners', 'learn',
'feeding', 'schedules', 'require', 'clean', 'water', 'proper', 'nutrition',
'thrive', 'varieties', 'grow', 'foot', 'size']
POS Tags: [('goldfish', 'VB'), ('small', 'JJ'), ('freshwater', 'NN'), ('fish',
'NN'), ('commonly', 'RB'), ('kept', 'VBD'), ('pets', 'NNS'), ('originate',
'JJ'), ('east', 'JJ'), ('asia', 'NN'), ('belong', 'NN'), ('carp', 'VBP'),
('family', 'NN'), ('goldfish', 'JJ'), ('recognize', 'NN'), ('owners', 'NNS'),
('learn', 'VBP'), ('feeding', 'VBG'), ('schedules', 'NNS'), ('require', 'VBP'),
('clean', 'JJ'), ('water', 'NN'), ('proper', 'JJ'), ('nutrition', 'NN'),
('thrive', 'JJ'), ('varieties', 'NNS'), ('grow', 'VBP'), ('foot', 'NN'),
('size', 'NN')]
Stemmed Words: ['goldfish', 'small', 'freshwat', 'fish', 'commonli', 'kept',
'pet', 'origin', 'east', 'asia', 'belong', 'carp', 'famili', 'goldfish',
'recogn', 'owner', 'learn', 'feed', 'schedul', 'requir', 'clean', 'water',
'proper', 'nutrit', 'thrive', 'varieti', 'grow', 'foot', 'size']
Lemmatized Words: ['goldfish', 'small', 'freshwater', 'fish', 'commonly',
'kept', 'pet', 'originate', 'east', 'asia', 'belong', 'carp', 'family',
'goldfish', 'recognize', 'owner', 'learn', 'feeding', 'schedule', 'require',
'clean', 'water', 'proper', 'nutrition', 'thrive', 'variety', 'grow', 'foot',
'size']
```

[11]:
```
# Split documents into word lists (after removing punctuation and lowering case)
def clean_and_tokenize(doc):
    doc = doc.lower()
    doc = re.sub(r'[^a-z\s]', '', doc)
    return doc.split()

bagOfWords1 = clean_and_tokenize(text1)
bagOfWords2 = clean_and_tokenize(text2)

# Get the unique set of all words in both documents
uniqueWords = set(bagOfWords1).union(set(bagOfWords2))
```

[12]:
```
# Initialize word count dictionaries
numOfWords1 = dict.fromkeys(uniqueWords, 0)
numOfWords2 = dict.fromkeys(uniqueWords, 0)

for word in bagOfWords1:
    numOfWords1[word] += 1

for word in bagOfWords2:
    numOfWords2[word] += 1
```

[13]:
```
def computeTF(wordDict, bagOfWords):
    tfDict = {}
    totalWords = len(bagOfWords)
    for word, count in wordDict.items():
        tfDict[word] = count / totalWords
    return tfDict

tf1 = computeTF(numOfWords1, bagOfWords1)
tf2 = computeTF(numOfWords2, bagOfWords2)
```

[14]:
```
import math

def computeIDF(docList):
    N = len(docList)
    idfDict = dict.fromkeys(docList[0].keys(), 0)
    for doc in docList:
        for word, val in doc.items():
            if val > 0:
                idfDict[word] += 1
    for word, val in idfDict.items():
        idfDict[word] = math.log(N / float(val))
    return idfDict

idfs = computeIDF([numOfWords1, numOfWords2])
```

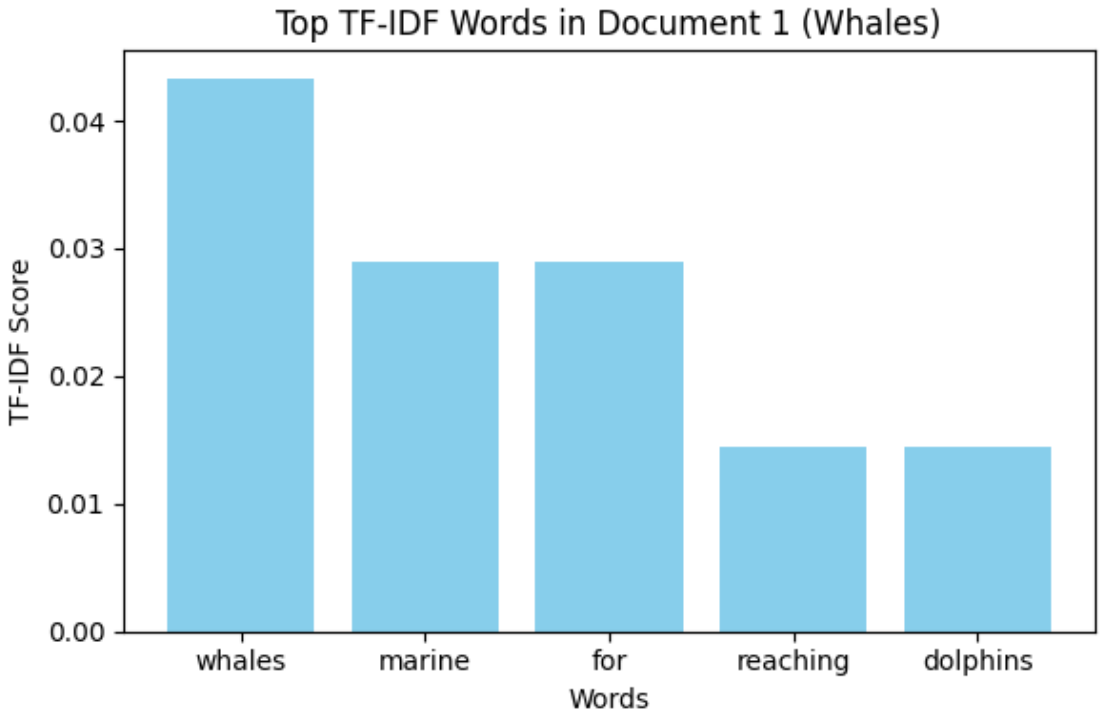
[15]:
```
def computeTFIDF(tf, idf):
    tfidf = {}
    for word, val in tf.items():
        tfidf[word] = val * idf[word]
    return tfidf

tfidf1 = computeTFIDF(tf1, idfs)
tfidf2 = computeTFIDF(tf2, idfs)
```

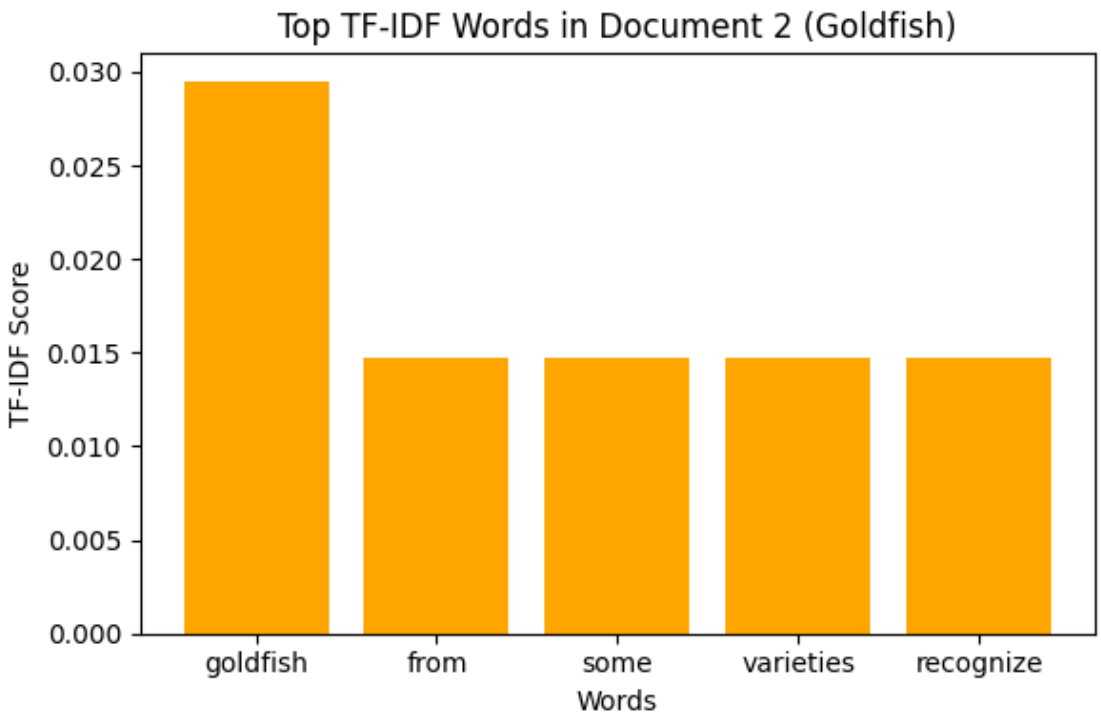
[16]:
```
import pandas as pd

df = pd.DataFrame([tfidf1, tfidf2])
df.index = ['Document 1 - Whales', 'Document 2 - Goldfish']

print("\nTF-IDF Representation:")
print(df)
```

```
TF-IDF Representation:
                       feeding    whales      from      some  reaching  \
Document 1 - Whales        0.0  0.043322  0.000000  0.000000  0.014441
Document 2 - Goldfish      0.0  0.000000  0.014748  0.014748  0.000000

                       varieties  dolphins  recognize     small       can  \
Document 1 - Whales     0.000000  0.014441   0.000000  0.000000  0.000000
Document 2 - Goldfish   0.014748  0.000000   0.014748  0.014748  0.014748

                       …  originate  freshwater  biodiversity  and  \
Document 1 - Whales    …   0.000000    0.000000      0.014441  0.0
Document 2 - Goldfish  …   0.014748    0.014748      0.000000  0.0

                           size       for      east     using  are   to
Document 1 - Whales    0.000000  0.028881  0.000000  0.014441  0.0  0.0
Document 2 - Goldfish  0.014748  0.000000  0.014748  0.000000  0.0  0.0

[2 rows x 68 columns]
```

[17]:
```
import matplotlib.pyplot as plt

# Get top 5 TF-IDF words from each document
top_words_doc1 = dict(sorted(tfidf1.items(), key=lambda item: item[1],␣
 ↪reverse=True)[:5])
top_words_doc2 = dict(sorted(tfidf2.items(), key=lambda item: item[1],␣
 ↪reverse=True)[:5])

# Plot for Document 1
plt.figure(figsize=(6, 4))
```

```
plt.bar(top_words_doc1.keys(), top_words_doc1.values(), color='skyblue')
plt.title("Top TF-IDF Words in Document 1 (Whales)")
plt.xlabel("Words")
plt.ylabel("TF-IDF Score")
plt.tight_layout()
plt.show()

# Plot for Document 2
plt.figure(figsize=(6, 4))
plt.bar(top_words_doc2.keys(), top_words_doc2.values(), color='orange')
plt.title("Top TF-IDF Words in Document 2 (Goldfish)")
plt.xlabel("Words")
plt.ylabel("TF-IDF Score")
plt.tight_layout()
plt.show()
```




Top TF-IDF Words in Document 2 (Goldfish)
TF-IDF Score
0.030
0.025
0.020
0.015
0.010
0.005
0.000
goldfish
from
some
varieties
recognize
Words

[ ]: