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Lab Assignment: 04

Subject: Natural Language Processing

```
# Analyse how TD-IDF differs between positive and negative reviews in python

import nltk
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.feature_extraction.text import TfidfVectorizer
from nltk.corpus import movie_reviews, stopwords
from nltk.tokenize import word_tokenize
import string
```

```
plt.style.use('seaborn-v0_8-darkgrid')
```

```
# Downloading Required NTLK data
nltk.download('movie_reviews')
nltk.download('punkt')
nltk.download('stopwords')
```

```
[nltk_data] Downloading package movie_reviews to /root/nltk_data...
[nltk_data]   Unzipping corpora/movie_reviews.zip.
[nltk_data] Downloading package punkt to /root/nltk_data...
[nltk_data]   Unzipping tokenizers/punkt.zip.
[nltk_data] Downloading package stopwords to /root/nltk_data...
[nltk_data]   Unzipping corpora/stopwords.zip.
True
```

```
# Load Movie Reviews
postid = movie_reviews.fileids('pos')
negid = movie_reviews.fileids('neg')

print(f'Number of positive reviews: {len(postid)}')
print(f'Number of negative reviews: {len(negid)}')
```

```
Number of positive reviews: 1000
Number of negative reviews: 1000
```

```
# Defining Pre-Processing function
def preprocess_text(text):
  text = text.lower()

  tokens = word_tokenize(text)

  # Remove Puncuation and Stop Words
  stop_words = set(stopwords.words('english'))
  tokens = [token for token in tokens
            if token not in string.punctuation
            and token not in stop_words
            and len(token) > 3]
  return ' '.join(tokens)
```

```
nltk.download('punkt_tab')
# Create positive corpus
print("Processing positive reviews...")
positive_reviews = []
for fileid in postid:
    raw_text = movie_reviews.raw(fileid)
    preprocessed_text = preprocess_text(raw_text)
    positive_reviews.append(preprocessed_text)
```

```
[nltk_data] Downloading package punkt_tab to /root/nltk_data...
[nltk_data]   Package punkt_tab is already up-to-date!
Processing positive reviews...
```

```
print("\nProcessing negative reviews...")
negative_reviews = []
for fileid in negid:
    raw_text = movie_reviews.raw(fileid)
    preprocessed_text = preprocess_text(raw_text)
    negative_reviews.append(preprocessed_text)
```

```
Processing negative reviews...
```

```
print(f"Processed {len(negative_reviews)} negative reviews")
print(f"Processed {len(positive_reviews)} positive reviews")
```

```
Processed 1000 negative reviews
Processed 1000 positive reviews
```

```
print("First 200 characters of positive reviews\n")
print(positive_reviews[0][:200] + "...\n")
print("First 200 characters of negative reviews \n")
print(negative_reviews[0][:200] + "...")
```

```
First 200 characters of positive reviews

films adapted comic books plenty success whether superheroes batman superman spawn geared toward kids casper arthouse crowd

First 200 characters of negative reviews

plot teen couples church party drink drive accident guys dies girlfriend continues life nightmares deal watch movie sorta fi
```

```
print("Computing TF-IDF for positive reviews...")
tfidf_vectorizer_pos = TfidfVectorizer(max_features=1000, min_df=2, max_df=0.8)
tfidf_matrix_pos = tfidf_vectorizer_pos.fit_transform(positive_reviews)


feature_names_pos = tfidf_vectorizer_pos.get_feature_names_out()

print(f"TF-IDF matrix shape: {tfidf_matrix_pos.shape}")
print(f"Number of unique terms: {len(feature_names_pos)}")
```

```
Computing TF-IDF for positive reviews...
TF-IDF matrix shape: (1000, 1000)
Number of unique terms: 1000
```

```
print("Computing TF-IDF for negative reviews...")
tfidf_vectorizer_neg = TfidfVectorizer(max_features=1000, min_df=2, max_df=0.8)
tfidf_matrix_neg = tfidf_vectorizer_neg.fit_transform(negative_reviews)
feature_names_neg = tfidf_vectorizer_neg.get_feature_names_out()

print(f"TF-IDF matrix shape: {tfidf_matrix_neg.shape}")
print(f"Number of unique terms: {len(feature_names_neg)}")
```

```
Computing TF-IDF for negative reviews...
TF-IDF matrix shape: (1000, 1000)
Number of unique terms: 1000
```

```
# Calculate mean TF-IDF scores for positive reviews
mean_tfidf_pos = np.array(tfidf_matrix_pos.mean(axis=0)).flatten()
top_indices_pos = mean_tfidf_pos.argsort()[-15:][::-1]
top_terms_pos = [(feature_names_pos[i], mean_tfidf_pos[i]) for i in top_indices_pos]

# Display top terms for positive reviews
print("Top 15 TF-IDF Terms in Positive Reviews: \n")
for i, (term, score) in enumerate(top_terms_pos, 1):
    print(f"{i:2d}. {term:20s} - Score: {score:.6f}")

# Create DataFrame for positive terms
df_pos = pd.DataFrame(top_terms_pos, columns=['Term', 'TF-IDF Score'])
df_pos['Rank'] = range(1, 16)
print("\n", df_pos)
```

```
Top 15 TF-IDF Terms in Positive Reviews:

 1. movie                - Score: 0.065428
 2. like                 - Score: 0.043895
 3. story                - Score: 0.036013
 4. good                 - Score: 0.035094
 5. life                 - Score: 0.034882
 6. time                 - Score: 0.033522
 7. also                 - Score: 0.033068
 8. well                 - Score: 0.032244
 9. character            - Score: 0.031756
10. even                 - Score: 0.031469
11. would                - Score: 0.030993
12. characters           - Score: 0.030914
13. much                 - Score: 0.029628
14. first                - Score: 0.028960
15. films                - Score: 0.027729

           Term  TF-IDF Score  Rank
```

```
0        movie      0.065428     1
1         like      0.043895     2
2        story      0.036013     3
3         good      0.035094     4
4         life      0.034882     5
5         time      0.033522     6
6         also      0.033068     7
7         well      0.032244     8
8    character      0.031756     9
9         even      0.031469    10
10       would      0.030993    11
11  characters      0.030914    12
12        much      0.029628    13
13       first      0.028960    14
14       films      0.027729    15
```

```python
# Calculate mean TF-IDF scores for negative reviews
mean_tfidf_neg = np.array(tfidf_matrix_neg.mean(axis=0)).flatten()
top_indices_neg = mean_tfidf_neg.argsort()[-15:][::-1]
top_terms_neg = [(feature_names_neg[i], mean_tfidf_neg[i]) for i in top_indices_neg]

# Display top terms for negative reviews
print("Top 15 TF-IDF Terms in Negative Reviews:")
print("="*50)
for i, (term, score) in enumerate(top_terms_neg, 1):
    print(f"{i:2d}. {term:20s} - Score: {score:.6f}")

# Create DataFrame for negative terms
df_neg = pd.DataFrame(top_terms_neg, columns=['Term', 'TF-IDF Score'])
df_neg['Rank'] = range(1, 16)
print("\n", df_neg)
```

```
Top 15 TF-IDF Terms in Negative Reviews:
==================================================
 1. like                 - Score: 0.048473
 2. even                 - Score: 0.038923
 3. would                - Score: 0.036593
 4. good                 - Score: 0.036422
 5. time                 - Score: 0.035171
 6. story                - Score: 0.033669
 7. much                 - Score: 0.032333
 8. plot                 - Score: 0.031488
 9. character            - Score: 0.031369
10. could                - Score: 0.030768
11. characters           - Score: 0.030731
12. make                 - Score: 0.028763
13. really               - Score: 0.028590
14. first                - Score: 0.028579
15. action               - Score: 0.028426

           Term  TF-IDF Score  Rank
0          like      0.048473     1
1          even      0.038923     2
2         would      0.036593     3
3          good      0.036422     4
4          time      0.035171     5
5         story      0.033669     6
6          much      0.032333     7
7          plot      0.031488     8
8     character      0.031369     9
9         could      0.030768    10
10   characters      0.030731    11
11         make      0.028763    12
12       really      0.028590    13
13        first      0.028579    14
14       action      0.028426    15
```

```python
# Create side-by-side bar charts
fig, (ax1, ax2) = plt.subplots(1, 2, figsize=(18, 8))

# Extract terms and scores
terms_pos = [term for term, _ in top_terms_pos]
scores_pos = [score for _, score in top_terms_pos]

terms_neg = [term for term, _ in top_terms_neg]
scores_neg = [score for _, score in top_terms_neg]

bars1 = ax1.barh(range(len(terms_pos)), scores_pos, color='#2ecc71', alpha=0.8, edgecolor='black')
ax1.set_yticks(range(len(terms_pos)))
ax1.set_yticklabels(terms_pos, fontsize=10)
ax1.invert_yaxis()
ax1.set_xlabel('Mean TF-IDF Score', fontsize=12, fontweight='bold')
ax1.set_title('Top 15 TF-IDF Terms in Positive Reviews', fontsize=14, fontweight='bold', pad=20)
ax1.grid(axis='x', alpha=0.3, linestyle='--')

# Add value labels on bars
```

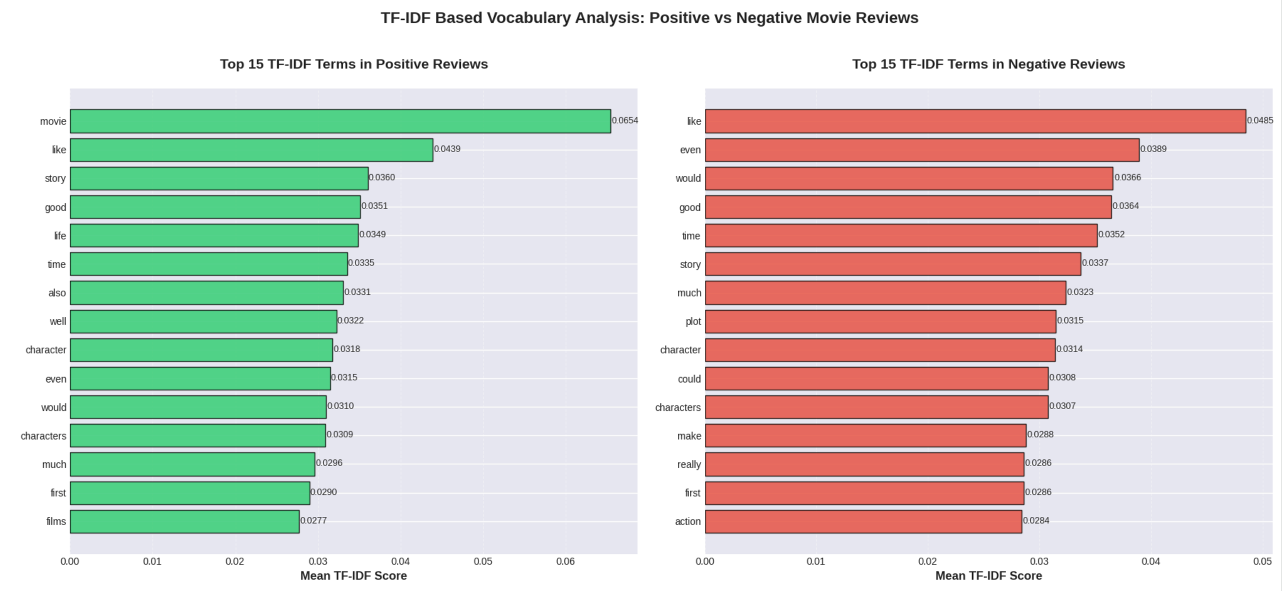
```
for i, (bar, score) in enumerate(zip(bars1, scores_pos)):
    ax1.text(score + 0.0001, i, f'{score:.4f}', va='center', fontsize=9)

# Negative reviews bar chart
bars2 = ax2.barh(range(len(terms_neg)), scores_neg, color='#e74c3c', alpha=0.8, edgecolor='black')
ax2.set_yticks(range(len(terms_neg)))
ax2.set_yticklabels(terms_neg, fontsize=10)
ax2.invert_yaxis()
ax2.set_xlabel('Mean TF-IDF Score', fontsize=12, fontweight='bold')
ax2.set_title('Top 15 TF-IDF Terms in Negative Reviews', fontsize=14, fontweight='bold', pad=20)
ax2.grid(axis='x', alpha=0.3, linestyle='--')

# Add value labels on bars
for i, (bar, score) in enumerate(zip(bars2, scores_neg)):
    ax2.text(score + 0.0001, i, f'{score:.4f}', va='center', fontsize=9)

plt.suptitle('TF-IDF Based Vocabulary Analysis: Positive vs Negative Movie Reviews',
             fontsize=16, fontweight='bold', y=1.02)
plt.tight_layout()
plt.show()

print("\n✓ Visualization complete!")
```



```
✓ Visualization complete!
```

```
# Compare Common and unique terms
common_terms = set(feature_names_pos) & set(feature_names_neg)
unique_terms_pos = set(feature_names_pos) - common_terms
unique_terms_neg = set(feature_names_neg) - common_terms

print(f"Number of common terms: {len(common_terms)}")
print(f"Number of unique terms in positive reviews: {len(unique_terms_pos)}")
print(f"Number of unique terms in negative reviews: {len(unique_terms_neg)}")
```

```
Number of common terms: 797
Number of unique terms in positive reviews: 203
Number of unique terms in negative reviews: 203
```