

Description:

- Dataset (Recommended): BBC News Dataset (Kaggle).
- Discover hidden topics or themes in a collection of news articles or blog posts
- Preprocess the text: tokenization, lowercasing, stopword removal
- Apply Latent Dirichlet Allocation (LDA) to extract dominant topics Display the most significant words per topic.

Double-click (or enter) to edit

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)

# Input data files are available in the read-only "../input/" directory
# For example, running this (by clicking run or pressing Shift+Enter) will list all files under the input directory

import os
for dirname, _, filenames in os.walk('/kaggle/input'):
    for filename in filenames:
        print(os.path.join(dirname, filename))

/kaggle/input/bbc-news/bbc_news.csv

df = pd.read_csv("/kaggle/input/bbc-news/bbc_news.csv")
df.head()
```

	title	pubDate	guid	link	description
0	Ukraine: Angry Zelensky vows to punish Russian...	Mon, 07 Mar 2022 08:01:56 GMT	https://www.bbc.co.uk/news/world-europe-60638042	https://www.bbc.co.uk/news/world-europe-606380...	The Ukrainian president says the country will ...
1	War in Ukraine: Taking cover in a town under a...	Sun, 06 Mar 2022 22:49:58 GMT	https://www.bbc.co.uk/news/world-europe-60641873	https://www.bbc.co.uk/news/world-europe-606418...	Jeremy Bowen was on the frontline in Irpin, as...
2	Ukraine war 'catastrophic for global food'	Mon, 07 Mar 2022 00:14:42 GMT	https://www.bbc.co.uk/news/business-60623941	https://www.bbc.co.uk/news/business-60623941?a...	One of the world's biggest fertiliser firms sa...
3	Manchester Arena bombing: Saffie Roussos's par...	Mon, 07 Mar 2022 00:05:40 GMT	https://www.bbc.co.uk/news/uk-60579079	https://www.bbc.co.uk/news/uk-60579079?at_medi...	The parents of the Manchester Arena bombing's ...

Next steps: [Generate code with df](#) [View recommended plots](#) [New interactive sheet](#)

```
#EDA
df.shape

(42115, 5)

df.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 42115 entries, 0 to 42114
Data columns (total 5 columns):
#   Column      Non-Null Count  Dtype
---  ---
0    title      42115 non-null  object
1    pubDate    42115 non-null  object
2    guid       42115 non-null  object
3    link       42115 non-null  object
4    description 42115 non-null  object
dtypes: object(5)
memory usage: 1.6+ MB

df.isnull().sum()
```

	0
title	0
pubDate	0
guid	0
link	0
description	0
dtype:	int64

```
df.duplicated().sum()
```

0

```
df.sample(4)
```

	title	pubDate	guid	link	description
2637	London election results 2022: What does it mea...	Fri, 06 May 2022 10:38:24 GMT	https://www.bbc.co.uk/news/uk-england-london-6...	https://www.bbc.co.uk/news/uk-england-london-6...	What does the loss of Westminster, Wandsworth ...
31443	Is my family still alive? The daily question f...	Sun, 31 Mar 2024 20:04:39 GMT	https://www.bbc.co.uk/news/world-latin-america...	https://www.bbc.co.uk/news/world-latin-america...	Haiti has endured crisis after crisis. Now the...
10236	Cancer care delays: How bad are they in your a...	Thu, 10 Nov 2022 11:35:06 GMT	https://www.bbc.co.uk/news/health-63573718	https://www.bbc.co.uk/news/health-63573718?at_...	BBC analysis shows delays have doubled in past...

```
df = df[['title','description']]
df.head()
```

	title	description
0	Ukraine: Angry Zelensky vows to punish Russian...	The Ukrainian president says the country will ...
1	War in Ukraine: Taking cover in a town under a...	Jeremy Bowen was on the frontline in Irpin, as...
2	Ukraine war 'catastrophic for global food'	One of the world's biggest fertiliser firms sa...
3	Manchester Arena bombing: Saffie Roussos's par...	The parents of the Manchester Arena bombing's ...
4	Ukraine conflict: Oil price soars to highest l...	Consumers are feeling the impact of higher ene...

Next steps:

[Generate code with df](#)

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[New interactive sheet](#)

```
df['text'] = df['title'].astype(str) + " " + df['description'].astype(str)
df = df[['text']]
df.head()
```

	text
0	Ukraine: Angry Zelensky vows to punish Russian...
1	War in Ukraine: Taking cover in a town under a...
2	Ukraine war 'catastrophic for global food' One...
3	Manchester Arena bombing: Saffie Roussos's par...
4	Ukraine conflict: Oil price soars to highest l...

Next steps:

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Preprocessing

```
import re
import nltk
```

```
nltk.download('stopwords')
nltk.download('punkt')
```

```
[nltk_data] Downloading package stopwords to /root/nltk_data...
[nltk_data] Package stopwords is already up-to-date!
[nltk_data] Downloading package punkt to /root/nltk_data...
[nltk_data] Package punkt is already up-to-date!
True
```

```
import spacy
import re
from nltk.corpus import stopwords
```

```
import en_core_web_sm


stop_words = set(stopwords.words('english'))
nlp = en_core_web_sm.load()
```

```
def preprocess(text):
    text = text.lower()
    text = re.sub(r'[^a-zA-Z\s]', '', text)
    doc = nlp(text)
    tokens = [token.lemma_ for token in doc
               if token.lemma_ not in stop_words and len(token) > 2]



    return tokens
```

```
df['tokens'] = df['text'].apply(preprocess)
```

```
df[['text', 'tokens']].head(10)
```



	text	tokens
0	Ukraine: Angry Zelensky vows to punish Russian...	[ukraine, angry, zelensky, vow, punish, russia...
1	War in Ukraine: Taking cover in a town under a...	[war, ukraine, take, cover, town, attack, jere...
2	Ukraine war 'catastrophic for global food' One...	[ukraine, war, catastrophic, global, food, one...
3	Manchester Arena bombing: Saffie Roussos's par...	[manchester, arena, bombing, saffie, roussoss,...
4	Ukraine conflict: Oil price soars to highest l...	[ukraine, conflict, oil, price, soar, high, le...
5	Ukraine war: PM to hold talks with world leade...	[ukraine, war, hold, talk, world, leader, sanc...
6	Ukraine war: UK grants 50 Ukrainian refugee vi...	[ukraine, war, grant, ukrainian, refugee, visa...
7	TikTok limits services as Netflix pulls out of...	[tiktok, limit, service, netflix, pull, russia...
8	Covid: Fourth jab for Scotland's vulnerable, a...	[covid, fourth, jab, scotland, vulnerable, tes...
9	Protests across Russia see thousands detained ...	[protest, across, russia, see, thousand, detai...



✓ **TfidfVectorizer**

```
from sklearn.feature_extraction.text import TfidfVectorizer

# Initialize TfidfVectorizer
tfidf_vectorizer = TfidfVectorizer(max_df=0.95, min_df=2, max_features=1000) # stop_words='english' is not needed as we removed stop words i

# Fit and transform the processed text
tfidf_matrix = tfidf_vectorizer.fit_transform(df['tokens'].astype(str)) # Use 'tokens' column and convert to string

print("TF-IDF matrix shape:", tfidf_matrix.shape)
```

 TF-IDF matrix shape: (42115, 1000)

✓ **LDA (Latent Dirichlet Allocation)**

```

from sklearn.decomposition import LatentDirichletAllocation

# Initialize LDA model
# You can adjust n_components (number of topics) as needed
lda_model = LatentDirichletAllocation(n_components=10, random_state=42)

# Fit LDA model to the TF-IDF matrix
lda_matrix = lda_model.fit_transform(tfidf_matrix)

print("LDA matrix shape:", lda_matrix.shape)

↩ LDA matrix shape: (42115, 10)

# Get the feature names (words) from the TF-IDF vectorizer
feature_names = tfidf_vectorizer.get_feature_names_out()

# Function to display the top words for each topic
def display_topics(model, feature_names, no_top_words):
    for topic_idx, topic in enumerate(model.components_): # Corrected attribute name
        print(f"Topic {topic_idx + 1}:")
        print(" ".join([feature_names[i]
                        for i in topic.argsort()[::-no_top_words - 1:-1]]))
    print("\n")

# Display the top 10 words for each topic
no_top_words = 10
display_topics(lda_model, feature_names, no_top_words)

```

```

↩ Topic 1:
  police man kill murder say die death find woman arrest
Topic 2:
  ukraine war strike russian russia say ukrainian putin attack israel
Topic 3:
  say school ban sell new firm online work use woman
Topic 4:
  rise cost price energy rate bill people say food high
Topic 5:
  storm weather image picture world climate year across around flood
Topic 6:
  cup world league england win manchester beat final united city
Topic 7:
  election minister say labour party sunak vote tory leader covid
Topic 8:
  paper medium social front page lead asylum say protest migrant
Topic 9:
  trump england win gold test paris president olympic south africa
Topic 10:
  star queen king die film show year say royal singer

```

```

import matplotlib.pyplot as plt

def plot_top_words(model, feature_names, no_top_words=10, title="Top Words per Topic"):
    """
    Plots the top words for each topic in a topic model.

    Parameters:
    - model: Fitted topic model (e.g., LDA, NMF)
    - feature_names: List of feature names (e.g., vocabulary)
    - no_top_words: Number of top words to display per topic
    - title: Overall plot title
    """
    n_topics = model.n_components
    n_rows = (n_topics + 1) // 2 # Arrange in 2 columns

    fig, axes = plt.subplots(
        n_rows, 2, figsize=(12, n_rows * 4), sharex=True
    )
    axes = axes.flatten()

    for topic_idx, topic in enumerate(model.components_):
        top_indices = topic.argsort()[::-no_top_words - 1:-1]
        top_features = [feature_names[i] for i in top_indices]
        weights = topic[top_indices]

        ax = axes[topic_idx]

```

```
ax.barh(top_features, weights, height=0.6, color='skyblue', edgecolor='black')
ax.set_title(f"Topic {topic_idx + 1}", fontsize=12, weight='bold')
ax.invert_yaxis()
ax.tick_params(axis='both', which='major', labelsize=10)
for spine in ["top", "right", "left"]:
    ax.spines[spine].set_visible(False)

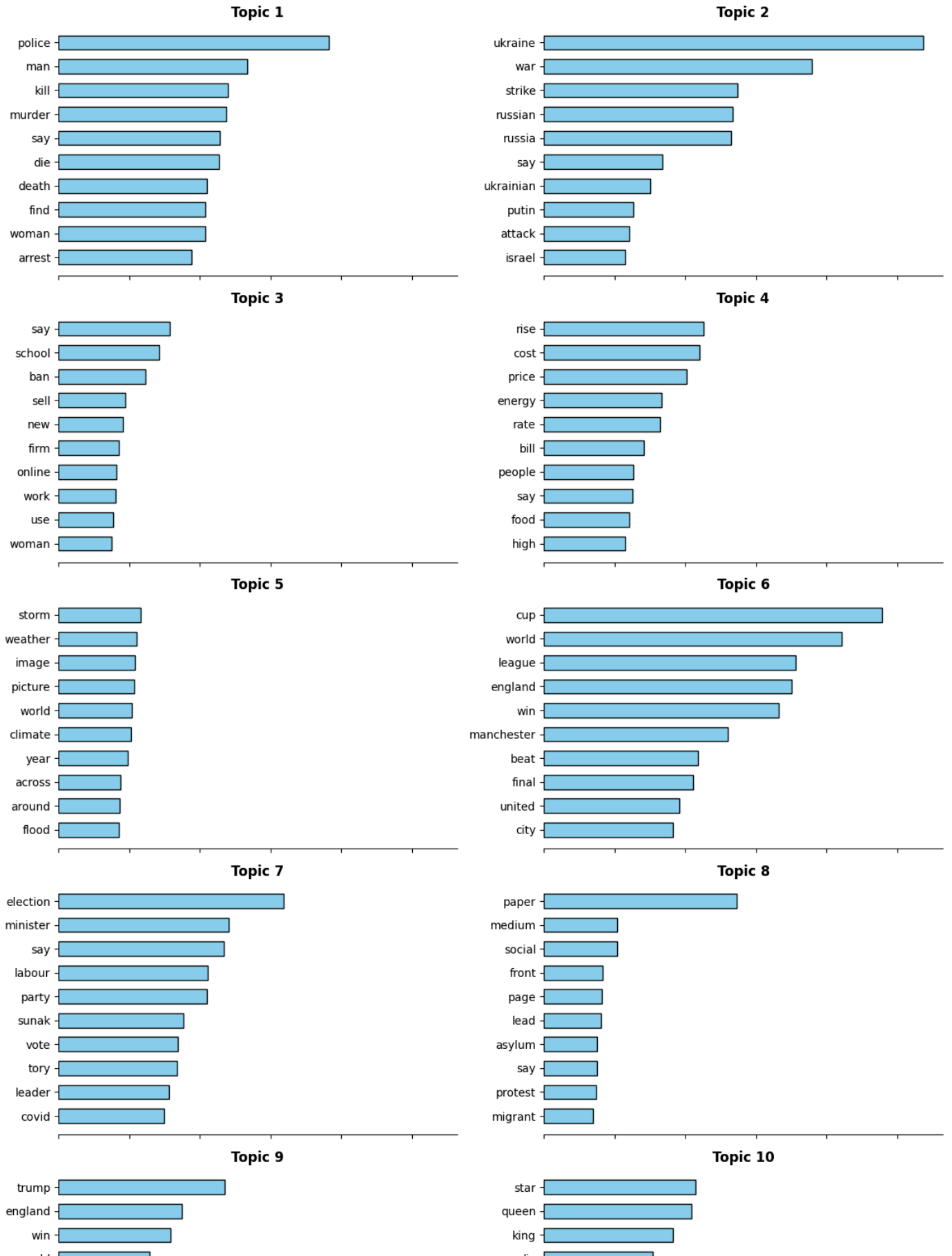
# Hide unused subplots
for i in range(topic_idx + 1, len(axes)):
    fig.delaxes(axes[i])

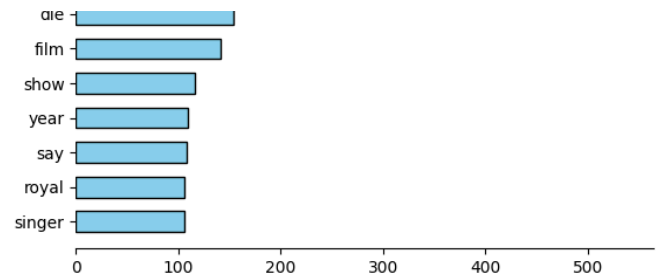
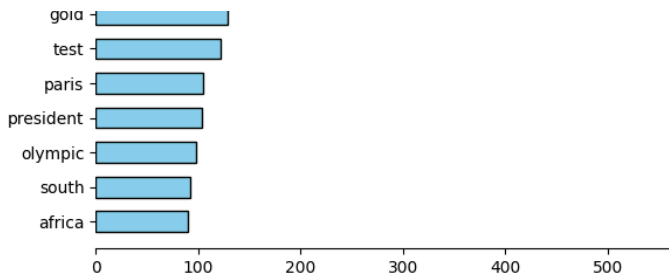
fig.suptitle(title, fontsize=16, weight='bold')
plt.tight_layout(rect=[0, 0.03, 1, 0.95])
plt.show()

# Example usage:
plot_top_words(lda_model, feature_names, no_top_words=10, title="Top 10 Words per LDA Topic")
```



Top 10 Words per LDA Topic





✓ Bonus:

1. Compare LDA vs. NMF performance
2. Use pyLDAvis or word clouds to visualize topic-word distributions

```
from sklearn.decomposition import NMF

# Initialize NMF model
# You can adjust n_components (number of topics) as needed, using the same number as LDA for comparison
nmf_model = NMF(n_components=lda_model.n_components, random_state=42, init='nndsvda', max_iter=200)

# Fit NMF model to the TF-IDF matrix
nmf_matrix = nmf_model.fit_transform(tfidf_matrix)

print("NMF matrix shape:", nmf_matrix.shape)

# Display the top 10 words for each NMF topic
print("\nTop 10 words per NMF Topic:")
display_topics(nmf_model, feature_names, no_top_words)

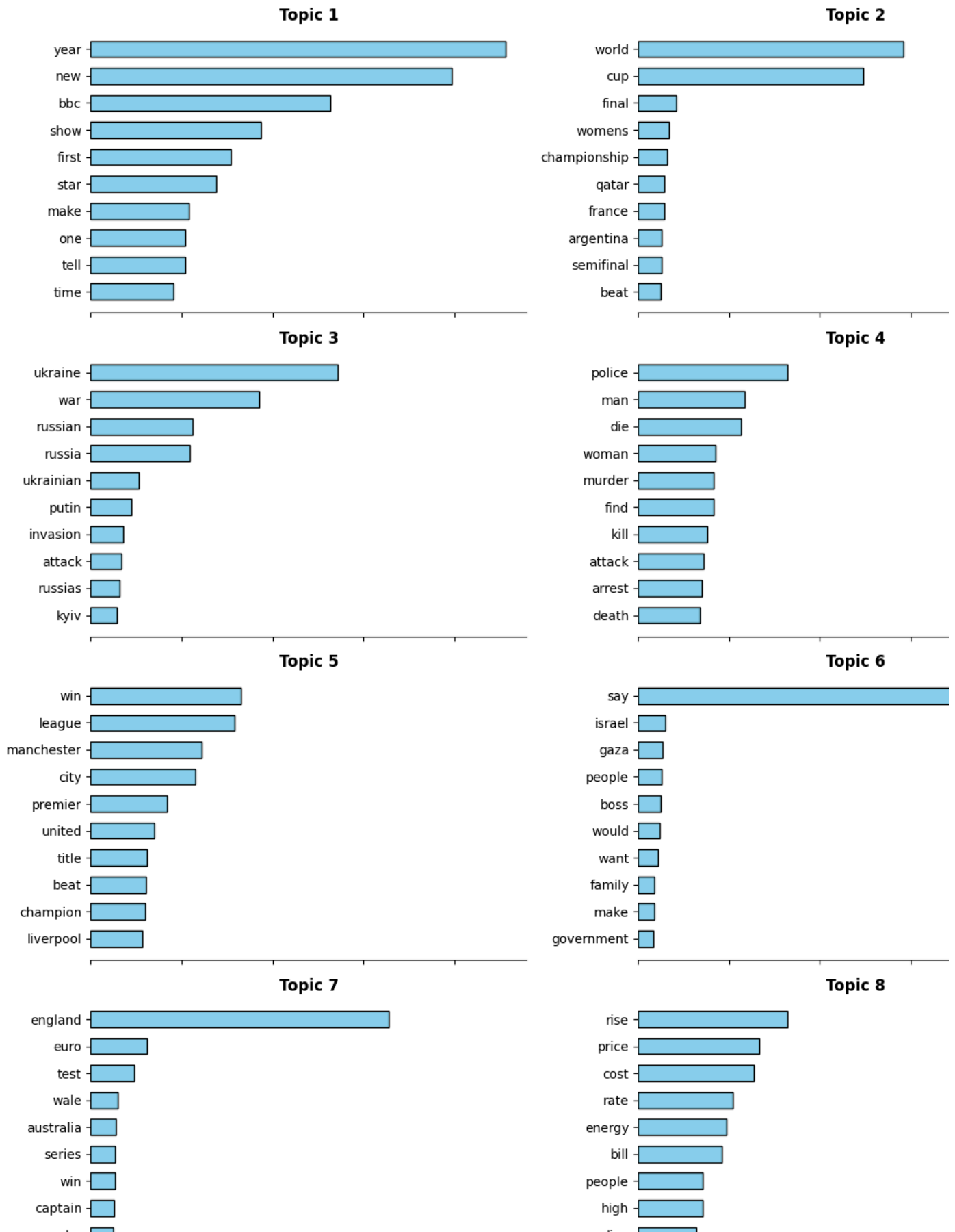
↔ NMF matrix shape: (42115, 10)

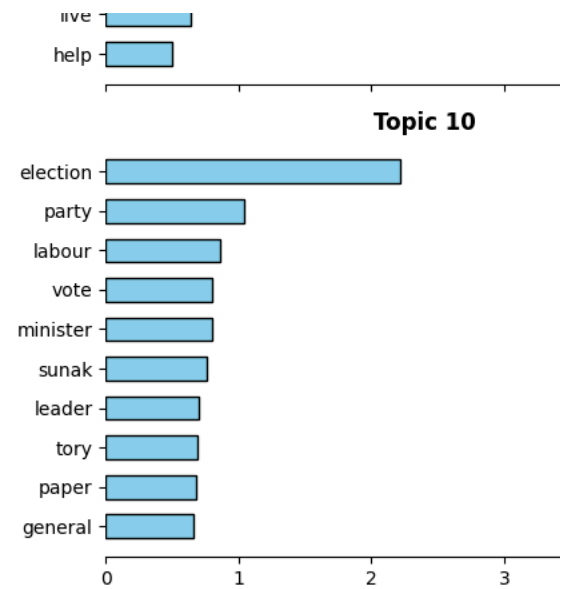
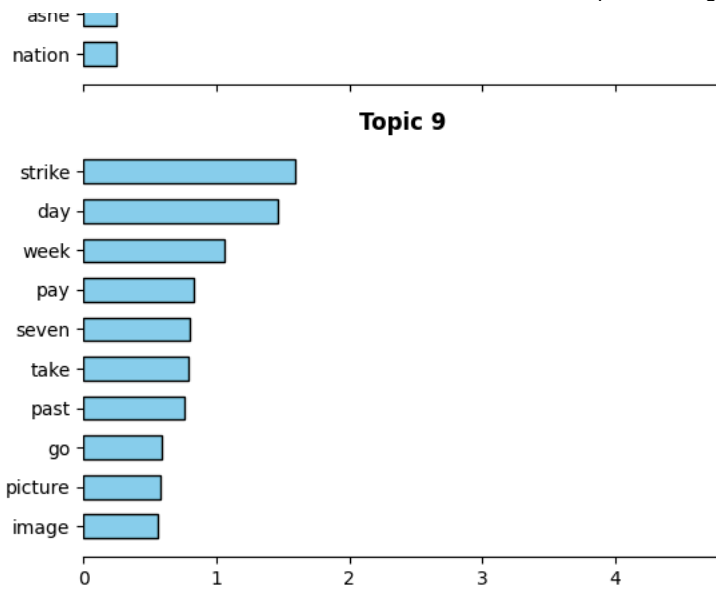
Top 10 words per NMF Topic:
Topic 1:
year new bbc show first star make one tell time
Topic 2:
world cup final womens championship qatar france argentina semifinal beat
Topic 3:
ukraine war russian russia ukrainian putin invasion attack russias kyiv
Topic 4:
police man die woman murder find kill attack arrest death
Topic 5:
win league manchester city premier united title beat champion liverpool
Topic 6:
say israel gaza people boss would want family make government
Topic 7:
england euro test wale australia series win captain ashe nation
Topic 8:
rise price cost rate energy bill people high live help
Topic 9:
strike day week pay seven take past go picture image
Topic 10:
election party labour vote minister sunak leader tory paper general

# Plot the top 10 words for each NMF topic
plot_top_words(nmf_model, feature_names, no_top_words, 'Top 10 words per NMF Topic')
```




Top 10 words per NMF Topic





```
print("Shape of TF-IDF matrix:", tfidf_matrix.shape)
print("Shape of LDA matrix:", lda_matrix.shape)
print("Shape of NMF matrix:", nmf_matrix.shape)
```

```
↗ Shape of TF-IDF matrix: (42115, 1000)
Shape of LDA matrix: (42115, 10)
Shape of NMF matrix: (42115, 10)
```

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

```
def generate_wordclouds(model, feature_names, num_topics, no_top_words=20):
    """
    Generates word clouds for each topic.

    Parameters:
    - model: Fitted topic model (e.g., LDA, NMF)
    - feature_names: List of feature names (e.g., vocabulary)
    - num_topics: Number of topics in the model
    - no_top_words: Number of top words to consider for the word cloud
    """
    for topic_idx, topic in enumerate(model.components_):
        # Get top words and their weights
        top_features_ind = topic.argsort()[::-no_top_words - 1:-1]
        top_features = [(feature_names[i], topic[i]) for i in top_features_ind]

        # Create a dictionary of word weights
        word_weights = dict(top_features)

        # Generate word cloud
        wordcloud = WordCloud(width=800, height=400, background_color='white').generate_from_frequencies(word_weights)

        # Display the word cloud
        plt.figure(figsize=(10, 5))
        plt.imshow(wordcloud, interpolation='bilinear')
        plt.axis("off")
        plt.title(f"Topic {topic_idx + 1} Word Cloud")
        plt.show()

# Generate word clouds for LDA topics
generate_wordclouds(lda_model, feature_names, lda_model.n_components)
```

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<https://colab.research.google.com/drive/1kqr-dVuiFZMzqjMbc04abkiOl7FYnbVP#scrollTo=FNyqYvUcskt3&printMode=true>

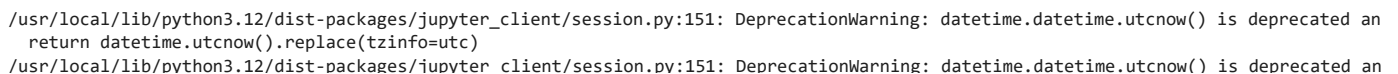
Topic 1 Word Cloud

[illegible]

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<https://colab.research.google.com/drive/1kgr-dVujFZMzgJMbC04abkiOI7FYnbVP#scrollTo=FNyqYvUcsk3&printMode=true>

Topic 2 Word Cloud



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<https://colab.research.google.com/drive/1kgr-dVujFZMzqjMbc04abkiOI7FYnbVP#scrollTo=FNyqYvUcskt3&printMode=true>

Topic 3 Word Cloud



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[illegible]

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```

return datetime.utcnow().replace(tzinfo=utc)
/usr/local/lib/python3.12/dist-packages/jupyter_client/session.py:151: DeprecationWarning: datetime.datetime.utcnow() is deprecated an
return datetime.utcnow().replace(tzinfo=utc)
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```

Topic 4 Word Cloud



```

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```

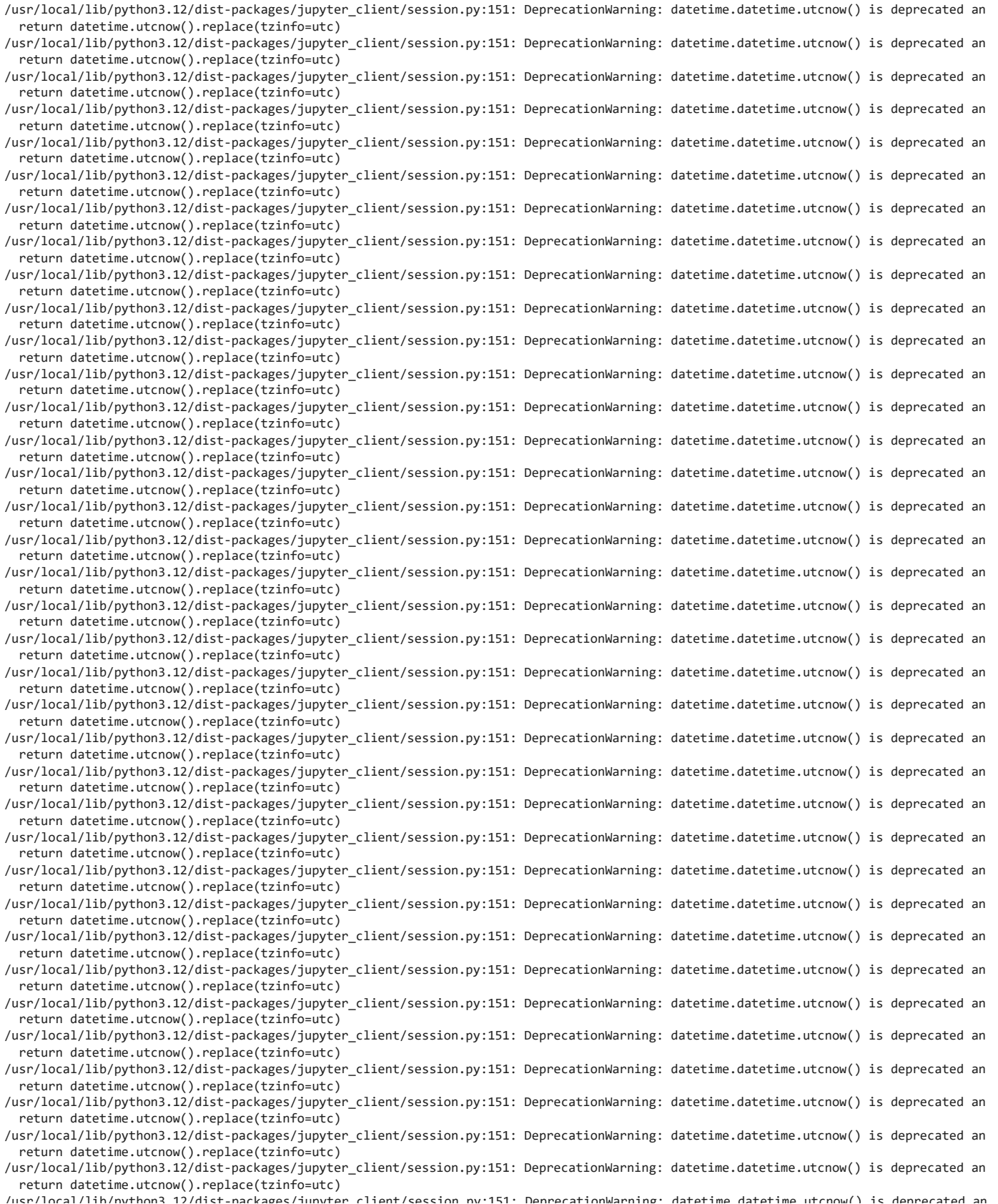

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<https://colab.research.google.com/drive/1kqr-dVujFZMzqjMbc04abkiOI7FYnbVP#scrollTo=FNyqYvUcskt3&printMode=true>

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Topic 5 Word Cloud





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[illegible]

Topic 6 Word Cloud



```

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Topic 7 Word Cloud



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```

Topic 8 Word Cloud



```

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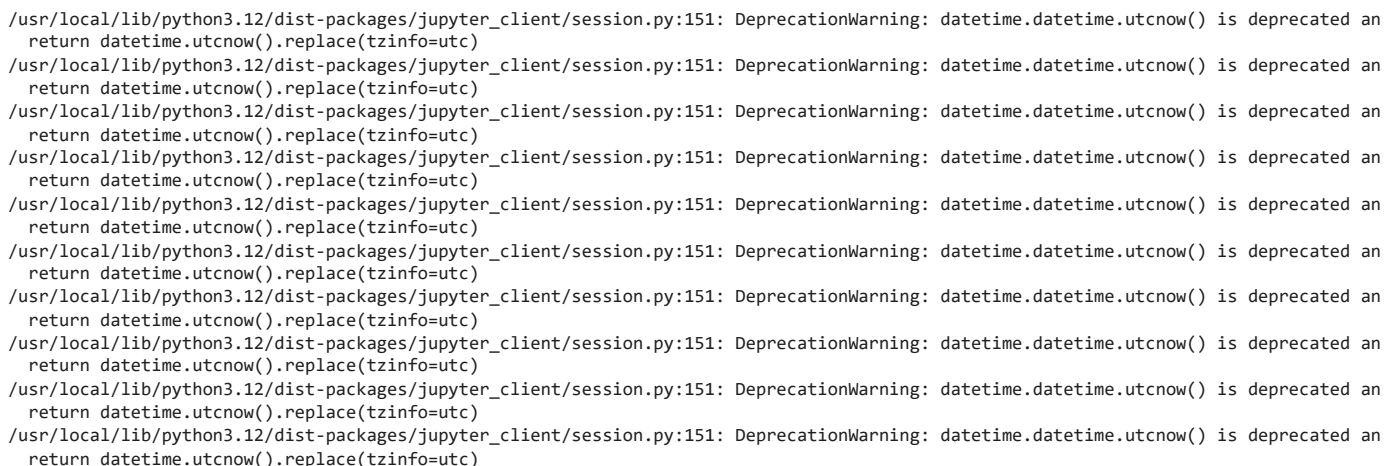
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Topic 9 Word Cloud



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