```
"""
This cell imports all required libraries for:
- Data loading and manipulation
- Text preprocessing
- TF-IDF feature extraction
- Visualization
"""

import pandas as pd               # For data handling
import re                         # For regular expressions
import nltk                       # For NLP preprocessing
import matplotlib.pyplot as plt   # For plotting graphs

from sklearn.feature_extraction.text import TfidfVectorizer  # TF-IDF
from nltk.corpus import stopwords                             # Stopwords
from nltk.tokenize import word_tokenize                       # Tokenization
from wordcloud import WordCloud                               # Word cloud
```

```
"""
Download NLTK resources needed for:
- Tokenization
- Stopword removal
"""

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

```
[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!
True
```

```
"""
Load the Twitter US Airline Sentiment dataset from CSV file
and display the first few records.
"""

# Load dataset
df = pd.read_csv('/content/Tweets.csv')

# Display first 5 rows
df.head()
```

	tweet_id	airline_sentiment	airline_sentiment_confidence	negativereason	nega
0	570306133677760513	neutral	1.0000	NaN	
1	570301130888122368	positive	0.3486	NaN	

```
"""
Select only the required columns:
- text: tweet content
- airline_sentiment: sentiment label
"""

df = df[['text', 'airline_sentiment']]

# Check for missing values
df.isnull().sum()
```

Next steps: Generate code with df | New interactive sheet

	0
text	0
airline_sentiment	0

dtype: int64

```
"""
This function preprocesses tweet text by:
1. Converting text to lowercase
2. Removing URLs
3. Removing mentions (@user)
4. Removing hashtags
5. Removing special characters
6. Tokenizing text
7. Removing stopwords
"""

# Load English stopwords
stop_words = set(stopwords.words('english'))

def clean_tweet(text):
    """
    Clean and preprocess a tweet.

    Parameters:
    text (str): Original tweet text

    Returns:
    str: Cleaned tweet text
    """

    # Convert text to lowercase
    text = text.lower()

    # Remove URLs
    text = re.sub(r'http\S+|www\S+', '', text)
```

```
    # Remove mentions
    text = re.sub(r'@\w+', '', text)

    # Remove hashtags
    text = re.sub(r'#\w+', '', text)

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

    # Tokenize text into words
    tokens = word_tokenize(text)

    # Remove stopwords
    tokens = [word for word in tokens if word not in stop_words]

    # Join tokens back into a sentence
    return ' '.join(tokens)
```

```
"""
Apply the clean_tweet() function to all tweets
and store the cleaned text in a new column.
"""

df['clean_text'] = df['text'].apply(clean_tweet)

# Display cleaned tweets
df.head()
```

Next steps: Generate code with df New interactive sheet

1 to 5 of 5 entries Filter

index	text	airline_sentiment	clean_text
0	@VirginAmerica What @dhepburn said.	neutral	said
1	@VirginAmerica plus you've added commercials to the experience... tacky.	positive	plus youve added commercials experience tacky
2	@VirginAmerica I didn't today... Must mean I need to take another trip!	neutral	didnt today must mean need take another trip
3	@VirginAmerica it's really aggressive to blast obnoxious "entertainment" in your guests' faces & they have little recourse	negative	really aggressive blast obnoxious entertainment guests faces amp little recourse
4	@VirginAmerica and it's a really big bad thing about it	negative	really big bad thing

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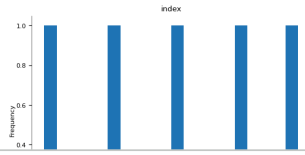
Distributions




```
"""
Filter the dataset to include only tweets
with negative sentiment.
"""

# Select negative sentiment tweets
negative_df = df[df['airline_sentiment'] == 'negative']

# Extract cleaned text
negative_text = negative_df['clean_text']

# Display number of negative tweets
len(negative_text)
```

```
9178
```

Values

```
"""
Convert negative sentiment tweets into
TF-IDF feature vectors.
"""

# Initialize TF-IDF Vectorizer
tfidf_vectorizer = TfidfVectorizer(max_features=1000)

# Fit and transform the cleaned negative tweets
tfidf_matrix = tfidf_vectorizer.fit_transform(negative_text)

# Convert matrix to DataFrame
tfidf_df = pd.DataFrame(
    tfidf_matrix.toarray(),
    columns=tfidf_vectorizer.get_feature_names_out()
)

# Display TF-IDF matrix
tfidf_df.head()
```

1 to 5 of 5 entries Filter

index	aa	able	absolute	absolutely	acceptable	access	accommodate	account	actual	actually	add	a
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Show 25 per page

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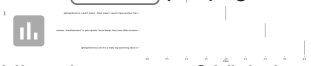
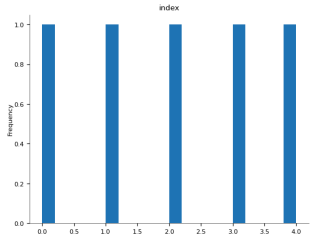
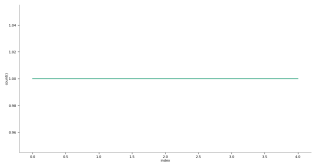
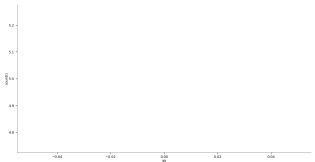


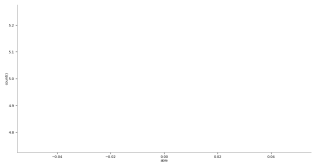
Distributions

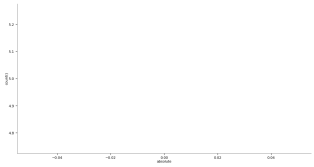


Time series





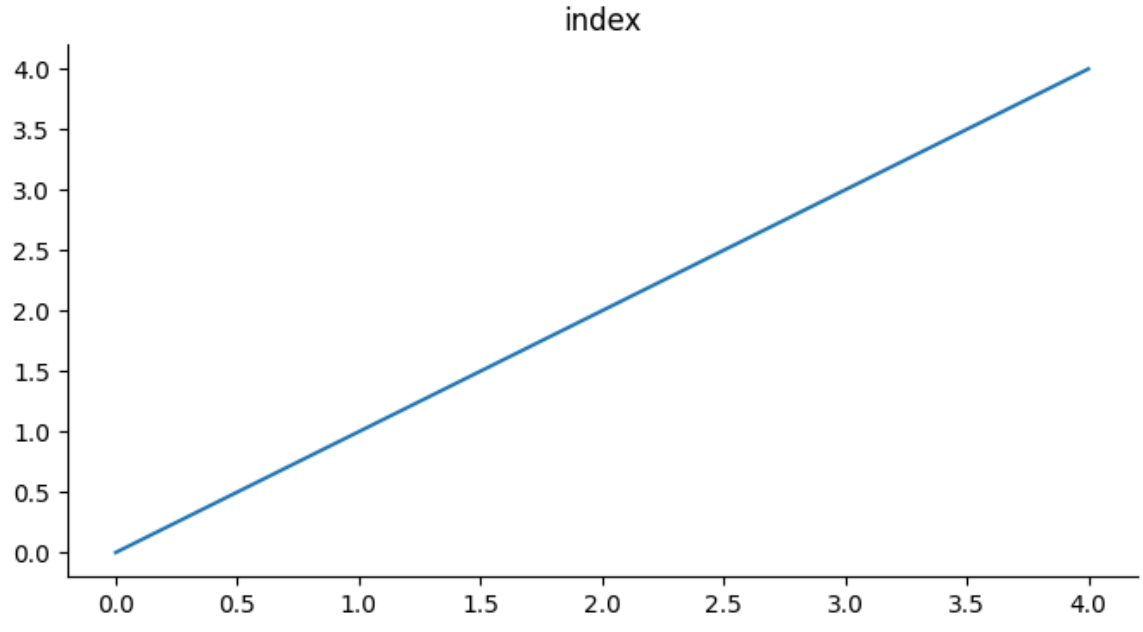




Values

```
<string>:5: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assi
Warning: Total number of columns (1000) exceeds max_columns (20) limiting to first (20) colu

<string>:5: FutureWarning:

ıt assigning `hue` is deprecated and will be removed in v0.14.0. Assi
```

```
from matplotlib import pyplot as plt
_df_18['index'].plot(kind='line', figsize=(8, 4), title='index')
plt.gca().spines[['top', 'right']].set_visible(False)
```

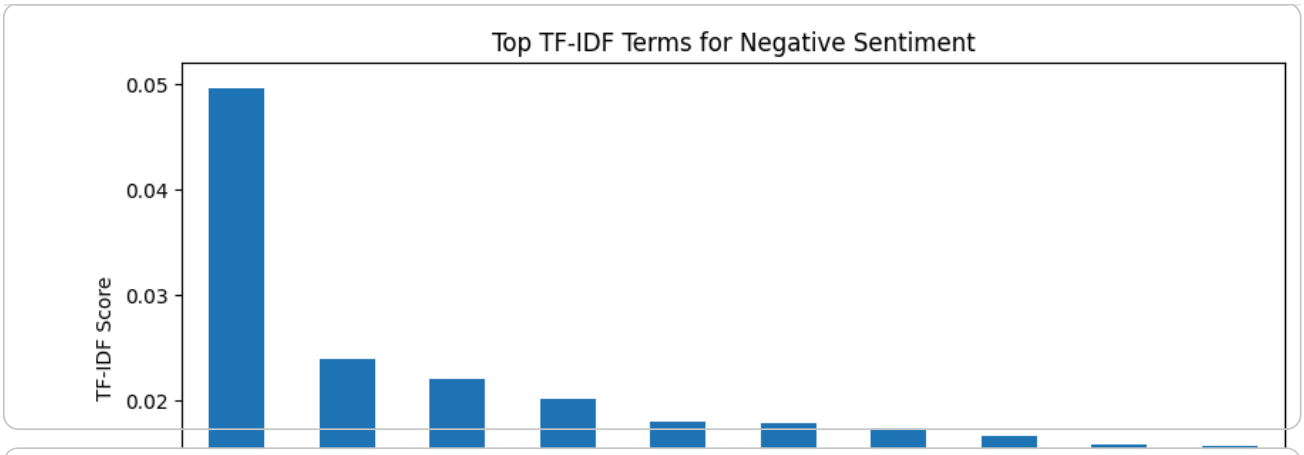


```
"""
Identify the most important words by
calculating average TF-IDF score for each term.
"""

# Calculate mean TF-IDF score for each term
tfidf_scores = tfidf_df.mean()

# Sort scores in descending order
tfidf_scores = tfidf_scores.sort_values(ascending=False)

# Select top 10 important terms
top_terms = tfidf_scores.head(10)

top_terms
```

	0
flight	0.049523
get	0.023843
cancelled	0.021949
service	0.020090
hours	0.017980
hold	0.017870
customer	0.017225
help	0.016579
time	0.015838
im	0.015664

dtype: float64

```
"""
Visualize the top TF-IDF terms for
negative sentiment using a bar chart.
"""

plt.figure(figsize=(10, 5))
top_terms.plot(kind='bar')
plt.title('Top TF-IDF Terms for Negative Sentiment')
plt.xlabel('Terms')
plt.ylabel('TF-IDF Score')
plt.xticks(rotation=45)
plt.show()
```




```
"""
Generate a word cloud directly from
cleaned negative sentiment tweets.
"""

def generate_text_wordcloud(text_series):
    """
    Generate and display a word cloud from text data.

    Parameters:
    text_series (pd.Series): Cleaned tweet text

    Returns:
    None
    """

    # Combine all tweets into one large text
    combined_text = " ".join(text_series)

    # Create WordCloud object
    wordcloud = WordCloud(
        width=800,
        height=400,
        background_color='white'
    ).generate(combined_text)

    # Display the word cloud
    plt.figure(figsize=(12, 6))
    plt.imshow(wordcloud, interpolation='bilinear')
    plt.axis('off')
    plt.title("Word Cloud of Negative Sentiment Tweets")
    plt.show()

# Call the function
generate_text_wordcloud(negative_text)
```