uage-detection-capstone-project-1

November 19, 2024

[62]:
```
import pandas as pd
import numpy as np
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.model_selection import train_test_split
from sklearn.naive_bayes import MultinomialNB
data = pd.read_csv("Language Detection.csv")
print(data.head())
```

```
                                                Text Language
0   Nature, in the broadest sense, is the natural…  English
1  "Nature" can refer to the phenomena of the phy…  English
2  The study of nature is a large, if not the onl…  English
3  Although humans are part of nature, human acti…  English
4  [1] The word nature is borrowed from the Old F…  English
```

[63]:
```
data.isnull().sum()
```

[63]:
```
Text        0
Language    0
dtype: int64
```

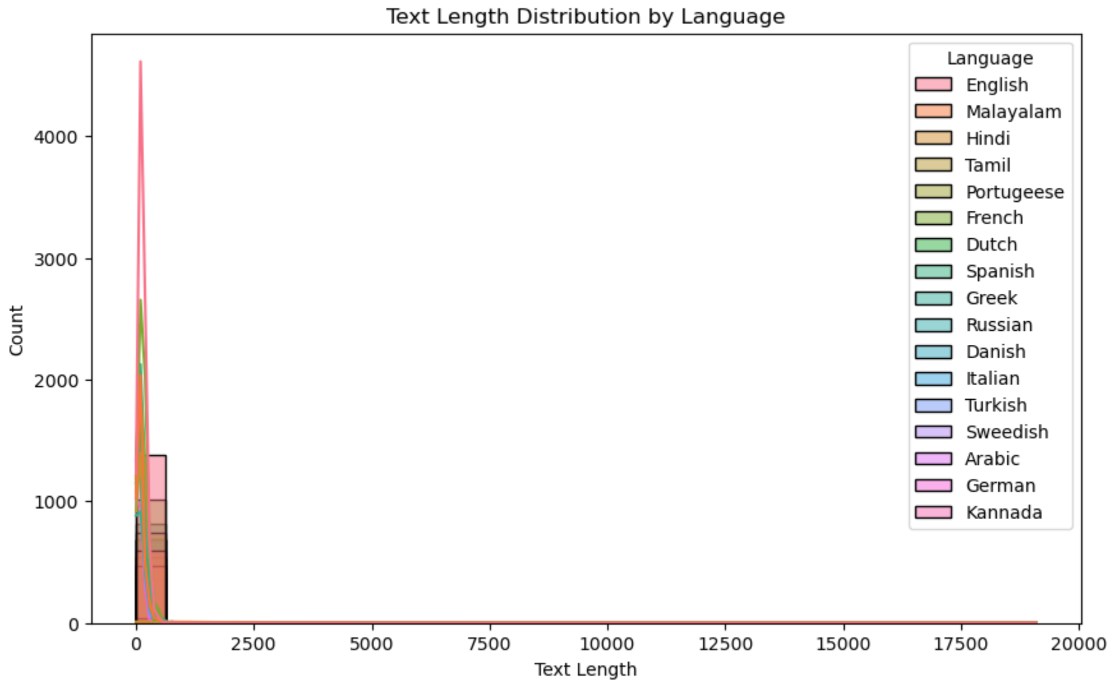
[64]:
```
data["Language"].value_counts()
```

[64]:
```
Language
English       1385
French        1014
Spanish        819
Portugeese     739
Italian        698
Russian        692
Sweedish       676
Malayalam      594
Dutch          546
Arabic         536
Turkish        474
German         470
Tamil          469
Danish         428
```

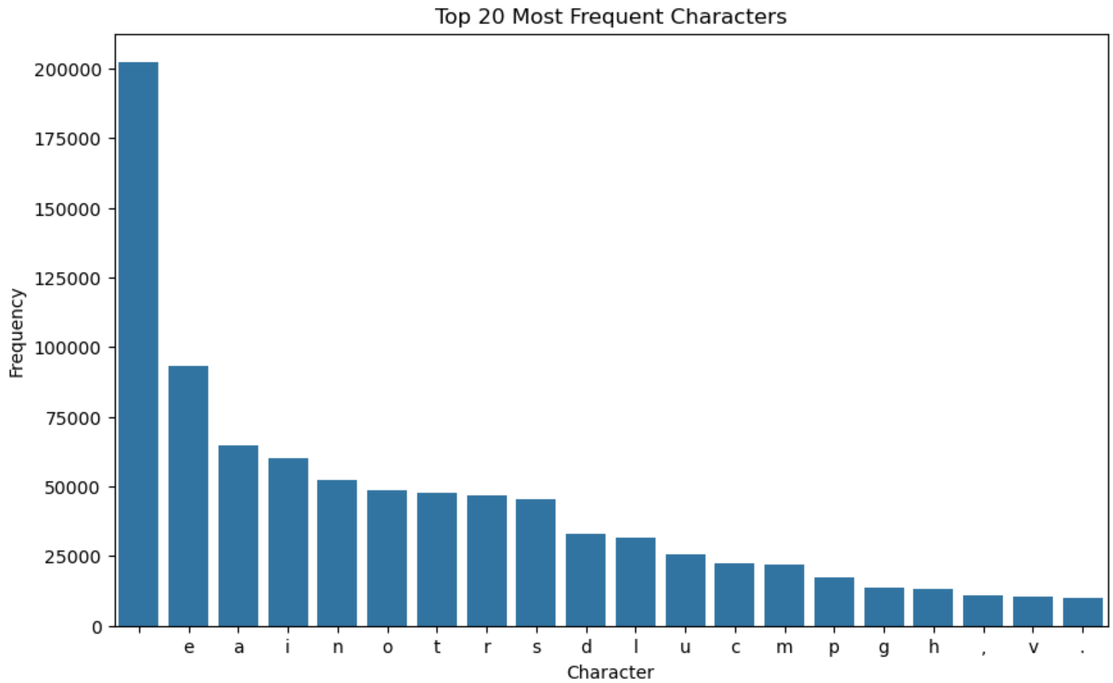
```
Kannada        369
Greek          365
Hindi           63
Name: count, dtype: int64
```

[65]:

```python
import matplotlib.pyplot as plt
import seaborn as sns

# Text Length Distribution
data['Text Length'] = data['Text'].apply(len)
plt.figure(figsize=(10, 6))
sns.histplot(data=data, x='Text Length', hue='Language', bins=30, kde=True)
plt.title('Text Length Distribution by Language')
plt.show()

# Word Frequency Analysis
from collections import Counter

# Combine all texts for analysis
all_text = " ".join(data['Text'])

# Tokenize text (split into words)
words = all_text.split()

# Count word frequencies
word_freq = Counter(words)

# Print the most common words
print("Most common words:")
for word, freq in word_freq.most_common(10):
    print(f"{word}: {freq}")

# Character Distribution
all_characters = " ".join(" ".join(data['Text']).split())

# Count character frequencies
char_freq = Counter(all_characters)

# Plot character frequencies
char_freq_df = pd.DataFrame.from_dict(char_freq, orient='index').reset_index()
char_freq_df.columns = ['Character', 'Frequency']
char_freq_df = char_freq_df.sort_values(by='Frequency', ascending=False)

plt.figure(figsize=(10, 6))
sns.barplot(data=char_freq_df.head(20), x='Character', y='Frequency')
plt.title('Top 20 Most Frequent Characters')
plt.show()
```




```
Most common words:
de: 3428
a: 1722
en: 1395
the: 1368
la: 1316
que: 1259
of: 1127
in: 1071
and: 836
du: 782
```



[66]:
```
from sklearn.model_selection import train_test_split, cross_val_score
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.naive_bayes import MultinomialNB

# Data Splitting
x = data["Text"]
y = data["Language"]

# Create CountVectorizer
cv = CountVectorizer()
X = cv.fit_transform(x)

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
↪random_state=42)

# Train a Multinomial Naive Bayes model
model = MultinomialNB()
model.fit(X_train, y_train)

# Perform cross-validation for evaluation
# You can change the number of folds (e.g., cv=5) as needed
cross_val_scores = cross_val_score(model, X, y, cv=10, scoring='accuracy')
```

```
# Print cross-validation results
print("Cross-validation scores:", cross_val_scores)
print("Mean accuracy:", cross_val_scores.mean())
```

```
Cross-validation scores: [0.98355899 0.99226306 0.99419729 0.99032882 0.98742747
0.98065764
 0.96518375 0.94191675 0.95159729 0.97967086]
Mean accuracy: 0.9766801919630904
```

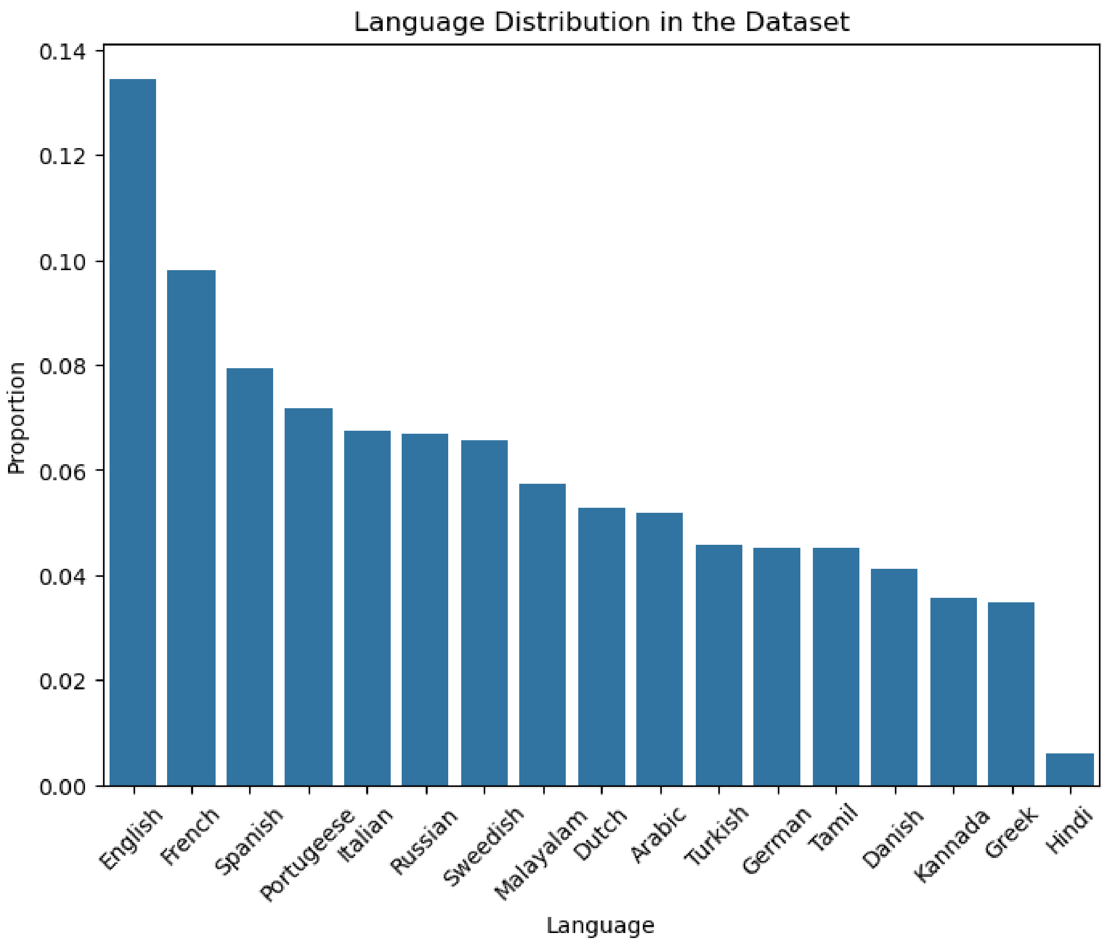
[ ]:
```
from sklearn.preprocessing import LabelEncoder

# Define a maximum text length for padding or truncation
max_text_length = 100  # Adjust as needed

# Ensure all texts have a consistent length by padding or truncating
x = [text[:max_text_length] if len(text) > max_text_length else text.
 ↪ljust(max_text_length) for text in x]

# Create a label encoder to encode language labels
label_encoder = LabelEncoder()
#label_encoder.fit(y)
y_encoded = label_encoder.fit_transform(y)

# Example: Language detection for a short text
user_input = "Bonjour"
user_input = user_input[:max_text_length] if len(user_input) > max_text_length␣
 ↪else user_input.ljust(max_text_length)
user_input_encoded = cv.transform([user_input]).toarray()
predicted_language_encoded = model.predict(user_input_encoded)
predicted_language = label_encoder.inverse_transform(predicted_language_encoded)
print("Predicted Language:", predicted_language[0])
```

[69]:
```
import re

# Data Cleaning
data.dropna(inplace=True)  # Remove rows with missing values
data.drop_duplicates(inplace=True)  # Remove duplicate rows

# Text Preprocessing
def preprocess_text(text):
    # Convert text to lowercase
    text = text.lower()

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

    return text
```

```
# Apply text preprocessing to the "Text" column
data['Text'] = data['Text'].apply(preprocess_text)

# Model Evaluation
accuracy = model.score(X_test, y_test)
print("Model Accuracy:", accuracy)
```

```
Model Accuracy: 0.9825918762088974
```

[70]:
```
# Bias Analysis
# Calculate the distribution of languages in the dataset
language_distribution = data['Language'].value_counts(normalize=True)

# Plot the distribution of languages
plt.figure(figsize=(8, 6))
sns.barplot(x=language_distribution.index, y=language_distribution.values)
plt.title('Language Distribution in the Dataset')
plt.xlabel('Language')
plt.ylabel('Proportion')
plt.xticks(rotation=45)
plt.show()
```



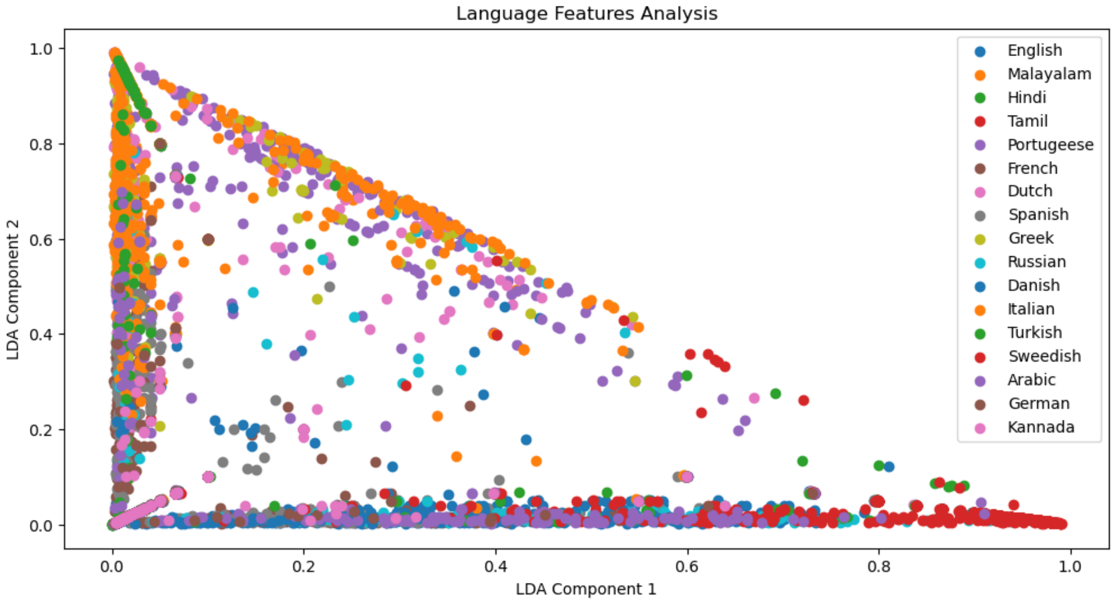
[71]:
```
# Noise Analysis
# Check for empty or very short text samples
data['Text_Length'] = data['Text'].apply(len)
short_text_threshold = 10  # Adjust as needed
noise_short_texts = data[data['Text_Length'] < short_text_threshold]

# Check for text samples with very long lengths
long_text_threshold = 1000  # Adjust as needed
noise_long_texts = data[data['Text_Length'] > long_text_threshold]

# Display the noisy short and long text samples
print("Noisy Short Texts (length <", short_text_threshold, "):")
print(noise_short_texts[['Text', 'Language']])

print("\nNoisy Long Texts (length >", long_text_threshold, "):")
print(noise_long_texts[['Text', 'Language']])
```

```
Noisy Short Texts (length < 10 ):
```

```
             Text Language
347       kennedy  English
750           gne  English
1125     its fine  English
1133     im sorry  English
1138    oh my god  English
…           …      …
10294              Kannada
10313              Kannada
10320              Kannada
10331              Kannada
10332              Kannada

[1605 rows x 2 columns]

Noisy Long Texts (length > 1000 ):
                                                   Text    Language
1979         \n       \n       \n      \n         \n    …        Hindi
1997                                     \n             …        Hindi
2041                                                    …        Hindi
2889   o mediawiki tem documentao sobre wikipdia ing…  Portugeese
3858  ces programmes selon leur degr de perfectionne…      French
```

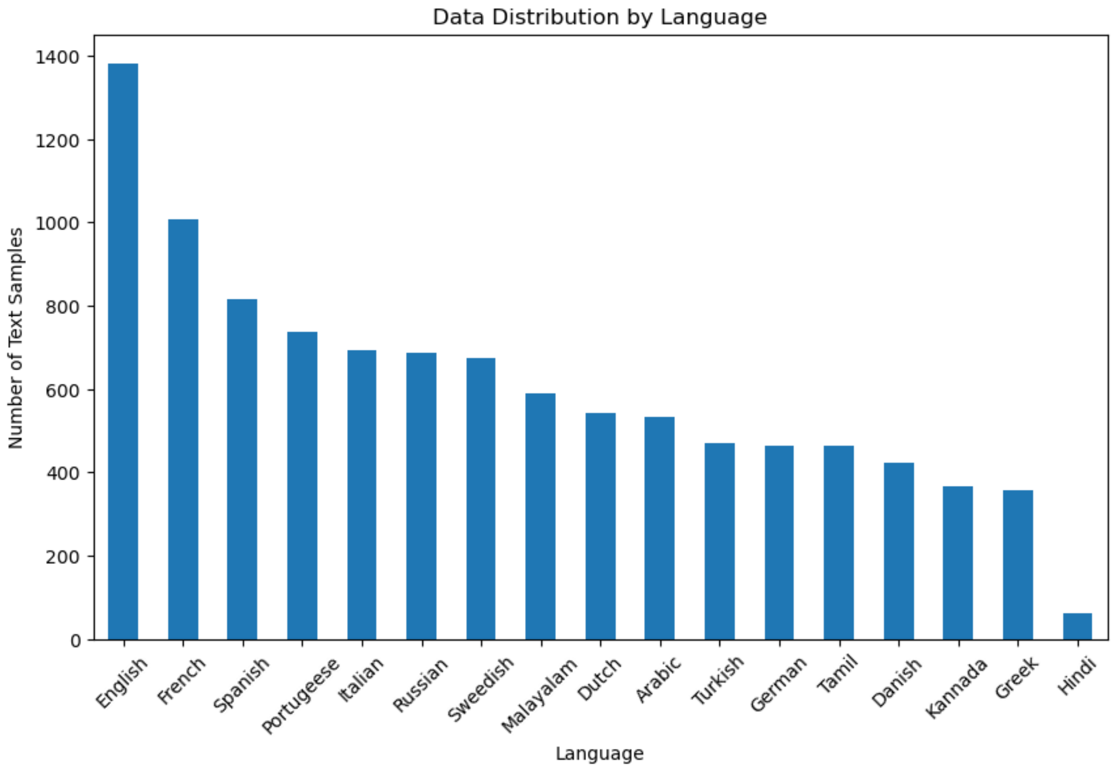
[72]:

```python
from sklearn.decomposition import LatentDirichletAllocation

# Apply Latent Dirichlet Allocation (LDA) for feature analysis
lda = LatentDirichletAllocation(n_components=5, random_state=42)  # You can␣
 ↪adjust the number of components
X_lda = lda.fit_transform(X)

# Visualize language features using LDA components
plt.figure(figsize=(12, 6))
for language in data['Language'].unique():
    plt.scatter(X_lda[y == language][:, 0], X_lda[y == language][:, 1],␣
 ↪label=language)

plt.title('Language Features Analysis')
plt.xlabel('LDA Component 1')
plt.ylabel('LDA Component 2')
plt.legend()
plt.show()
```



[73]:

```python
# Data Distribution Analysis
language_distribution = data['Language'].value_counts()

# Plot the distribution of languages
plt.figure(figsize=(10, 6))
language_distribution.plot(kind='bar')
plt.title('Data Distribution by Language')
plt.xlabel('Language')
plt.ylabel('Number of Text Samples')
plt.xticks(rotation=45)
plt.show()
```



[74]:
```
x = data["Text"]
y = data["Language"]

cv = CountVectorizer()
X = cv.fit_transform(x)
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.33,␣
 ↪random_state=42)
```

[75]:
```
model = MultinomialNB()
model.fit(X_train, y_train)
accuracy = model.score(X_test, y_test)
print("Model Accuracy:", accuracy)
```

```
Model Accuracy: 0.6935103244837758
```

[76]:
```
import tkinter as tk
from tkinter import messagebox
import webbrowser
import pandas as pd
import numpy as np
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.naive_bayes import MultinomialNB
```

```python
# Load the dataset
data = pd.read_csv("Language Detection.csv")

# Create the CountVectorizer and train the MultinomialNB model
x = np.array(data["Text"])
y = np.array(data["Language"])
cv = CountVectorizer()
X = cv.fit_transform(x)
model = MultinomialNB()
model.fit(X, y)

# Global variable to store detected language
detected_language = None

# Function to perform language detection
def detect_language():
    global detected_language
    user_input = text_entry.get(1.0, tk.END).strip()
    if not user_input:
        messagebox.showwarning("Input Error", "Please enter some text for␣
↪detection.")
        return
    data = cv.transform([user_input]).toarray()
    detected_language = model.predict(data)[0]
    language_result.config(text=f"The language is: {detected_language}")

# Function to open Google with search for the detected language
def view_details():
    if not detected_language:
        messagebox.showwarning("No Language Detected", "Please detect a␣
↪language first.")
        return
    query = f"{detected_language} language"
    webbrowser.open(f"https://www.google.com/search?q={query}")

# Function to switch windows
def show_frame(frame):
    frame.tkraise()

# Create the root window
root = tk.Tk()
root.title("Stylish Language Detection App")
root.geometry("800x600")

# Create a container for stacking frames
container = tk.Frame(root)
```

```
container.pack(fill="both", expand=True)

# Configure grid layout for the container
container.grid_rowconfigure(0, weight=1)
container.grid_columnconfigure(0, weight=1)

# Function to set background color for frames
def set_background(frame, color):
    frame.configure(bg=color)

# Create the frames
main_menu = tk.Frame(container)
language_detection = tk.Frame(container)
about_window = tk.Frame(container)

# Assign different colors to frames
set_background(main_menu, "#FAF6E3")  # Light Cream
set_background(language_detection, "#FAF6E3")  # Light Cream
set_background(about_window, "#FAF6E3")  # Light Cream

for frame in (main_menu, language_detection, about_window):
    frame.grid(row=0, column=0, sticky="nsew")

# Main Menu Frame
main_label = tk.Label(main_menu, text="Welcome to Language Detection App",␣
 ↪font=("Helvetica", 18, "bold"), bg="#FAF6E3", fg="#2A3663")
main_label.pack(pady=20)

detect_button_main = tk.Button(main_menu, text="Go to Language Detection",␣
 ↪command=lambda: show_frame(language_detection), bg="#D8DBBD", fg="#2A3663",␣
 ↪font=("Helvetica", 14))
detect_button_main.pack(pady=10)

about_button_main = tk.Button(main_menu, text="About/Help", command=lambda:␣
 ↪show_frame(about_window), bg="#D8DBBD", fg="#2A3663", font=("Helvetica", 14))
about_button_main.pack(pady=10)

# Language Detection Frame
input_label = tk.Label(language_detection, text="Enter a text:",␣
 ↪font=("Helvetica", 14), bg="#FAF6E3", fg="#2A3663")
input_label.pack(pady=10)

text_entry = tk.Text(language_detection, height=10, width=70, bg="#FFFFFF",␣
 ↪fg="black", font=("Helvetica", 12))  # Updated to White
text_entry.pack(pady=10)
```

```python
detect_button = tk.Button(language_detection, text="Detect Language", command=detect_language, bg="#D8DBBD", fg="#2A3663", font=("Helvetica", 14))
detect_button.pack(pady=10)

language_result = tk.Label(language_detection, text="", font=("Helvetica", 14), bg="#FAF6E3", fg="#2A3663", wraplength=600)
language_result.pack(pady=10)

details_button = tk.Button(language_detection, text="View Details", command=view_details, bg="#D8DBBD", fg="#2A3663", font=("Helvetica", 14))
details_button.pack(pady=10)

back_button = tk.Button(language_detection, text="Back to Main Menu", command=lambda: show_frame(main_menu), bg="#D8DBBD", fg="#2A3663", font=("Helvetica", 14))
back_button.pack(pady=10)

# About/Help Frame
about_label = tk.Label(about_window, text="About/Help", font=("Helvetica", 18, "bold"), bg="#FAF6E3", fg="#2A3663")
about_label.pack(pady=20)

help_text = (
    "This application detects the language of a given text using a trained "
    "Naive Bayes model. To use:\n\n"
    "1. Enter some text in the input box.\n"
    "2. Click the 'Detect Language' button.\n"
    "3. The detected language will be displayed below the button.\n"
    "4. Click 'View Details' to search for more information about the detected language on Google.\n\n"
    "Navigate between windows using the buttons."
)
help_label = tk.Label(about_window, text=help_text, font=("Helvetica", 12), bg="#FAF6E3", fg="#2A3663", wraplength=700, justify="left")
help_label.pack(pady=10)

back_button_about = tk.Button(about_window, text="Back to Main Menu", command=lambda: show_frame(main_menu), bg="#D8DBBD", fg="#2A3663", font=("Helvetica", 14))
back_button_about.pack(pady=10)

# Start with the main menu
show_frame(main_menu)

# Run the application
root.mainloop()
```

```
[ ]:
```