Team Members

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1. Project Overview

This project aims to develop a natural language chatbot capable of generating human-like responses and understanding informal customer feedback expressed in English, Kenyan Swahili and Sheng. Designed for a startup expanding into the Kenyan market, the chatbot will help the company engage users more naturally and analyze feedback from social platforms and online conversations. By training on locally relevant dialogue data including YouTube comments and Kenyan media the system will capture the linguistic and cultural nuances often missed by standard models.

1.1 Problem Statement

Startups entering new markets often struggle to understand customer feedback when it's expressed in local dialects or informal language. In Kenya, much of this communication occurs in Swahili and Sheng, which combine local slang, English, and Swahili in a fluid, often unstructured manner. Existing chatbot systems trained on formal English fail to grasp the tone, intent, or meaning behind such messages. This project aims to fill that gap by building a chatbot trained specifically on real-world Kenyan conversations to interpret and respond to customer queries and feedback with local context and relevance.

1.2 Objectives

- Collect and preprocess Kenyan user dialogue from YouTube, social media, and local content featuring Swahili and Sheng
- Fine-tune the chatbot with foundational data for conversational structure, while emphasizing local language patterns
- Build a sequence-to-sequence model capable of handling informal, code-switched dialogue
- Evaluate the chatbot's performance with emphasis on contextual relevance and local understanding
- Present a working prototype that simulates real customer feedback scenarios

2.0 Overall EDA

!pip install matplotlib

```
!pip install matplotlib
```

```
Collecting matplotlib
  Downloading matplotlib-3.7.5-cp38-cp38-win_amd64.whl.metadata (5.8
kB)
Collecting contourpy>=1.0.1 (from matplotlib)
  Downloading contourpy-1.1.1-cp38-cp38-win_amd64.whl.metadata (5.9
kB)
Collecting cycler>=0.10 (from matplotlib)
  Downloading cycler-0.12.1-py3-none-any.whl.metadata (3.8 kB)
Collecting fonttools>=4.22.0 (from matplotlib)
  Downloading fonttools-4.57.0-cp38-cp38-win_amd64.whl.metadata (104
kB)
Collecting kiwisolver>=1.0.1 (from matplotlib)
  Downloading kiwisolver-1.4.7-cp38-cp38-win_amd64.whl.metadata (6.4
kB)
Requirement already satisfied: numpy<2,>=1.20 in c:\users\hp\
anaconda3\envs\learn-env\lib\site-packages (from matplotlib) (1.24.3)
Requirement already satisfied: packaging>=20.0 in c:\users\hp\
anaconda3\envs\learn-env\lib\site-packages (from matplotlib) (25.0)
Collecting pillow>=6.2.0 (from matplotlib)
  Downloading pillow-10.4.0-cp38-cp38-win_amd64.whl.metadata (9.3 kB)
Collecting pyparsing>=2.3.1 (from matplotlib)
  Downloading pyparsing-3.1.4-py3-none-any.whl.metadata (5.1 kB)
Requirement already satisfied: python-dateutil>=2.7 in c:\users\hp\
anaconda3\envs\learn-env\lib\site-packages (from matplotlib) (2.9.0)
Collecting importlib-resources>=3.2.0 (from matplotlib)
  Downloading importlib_resources-6.4.5-py3-none-any.whl.metadata (4.0
kB)
Requirement already satisfied: zipp>=3.1.0 in c:\users\hp\anaconda3\
envs\learn-env\lib\site-packages (from importlib-resources>=3.2.0-
>matplotlib) (3.20.2)
Requirement already satisfied: six>=1.5 in c:\users\hp\anaconda3\envs\
learn-env\lib\site-packages (from python-dateutil>=2.7->matplotlib)
(1.16.0)
Downloading matplotlib-3.7.5-cp38-cp38-win_amd64.whl (7.5 MB)
   ---------------------------------------- 0.0/7.5 MB ? eta -:--:--
   - -------------------------------------- 0.3/7.5 MB ? eta -:--:--
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0:00:03
   ----------- ---------------------------- 2.4/7.5 MB 4.8 MB/s eta
0:00:02
   ------------------------------ --------- 5.8/7.5 MB 8.6 MB/s eta
0:00:01
   ---------------------------------------- 7.5/7.5 MB 8.8 MB/s eta
0:00:00
Downloading contourpy-1.1.1-cp38-cp38-win_amd64.whl (477 kB)
Downloading cycler-0.12.1-py3-none-any.whl (8.3 kB)
Downloading fonttools-4.57.0-cp38-cp38-win_amd64.whl (1.5 MB)
   ---------------------------------------- 0.0/1.5 MB ? eta -:--:--
   ------ --------------------------------- 0.3/1.5 MB ? eta -:--:--
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```

```
   ------ --------------------------------- 0.3/1.5 MB ? eta -:--:--
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   ------------ --------------------------- 0.5/1.5 MB 233.0 kB/s eta
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   ------------------------- ------------ 1.0/1.5 MB 441.3 kB/s eta
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   ---------------------------------- ----- 1.3/1.5 MB 516.0 kB/s eta
0:00:01
   ---------------------------------------- 1.5/1.5 MB 575.3 kB/s eta
0:00:00
Downloading importlib_resources-6.4.5-py3-none-any.whl (36 kB)
Downloading kiwisolver-1.4.7-cp38-cp38-win_amd64.whl (55 kB)
Downloading pillow-10.4.0-cp38-cp38-win_amd64.whl (2.6 MB)
   ---------------------------------------- 0.0/2.6 MB ? eta -:--:--
   ---------------------------------------- 2.6/2.6 MB 24.4 MB/s eta
0:00:00
Downloading pyparsing-3.1.4-py3-none-any.whl (104 kB)
Installing collected packages: pyparsing, pillow, kiwisolver,
importlib-resources, fonttools, cycler, contourpy, matplotlib
Successfully installed contourpy-1.1.1 cycler-0.12.1 fonttools-4.57.0
importlib-resources-6.4.5 kiwisolver-1.4.7 matplotlib-3.7.5 pillow-
10.4.0 pyparsing-3.1.4
```

```
# importing relevant notebooks
import pandas as pd
import numpy as np
import random
import ast
import re
import matplotlib.pyplot as plt
import seaborn as sns
import string
```

2.1 Loading & Inspecting Datasets

```
#Reading movie_lines data

with open("original-data\movie_lines.txt", encoding='utf-8') as f:
    for _ in range(5):
        print(f.readline())
```

```
L1045 +++$+++ u0 +++$+++ m0 +++$+++ BIANCA +++$+++ They do not!

L1044 +++$+++ u2 +++$+++ m0 +++$+++ CAMERON +++$+++ They do to!
```

```
L985 +++$+++ u0 +++$+++ m0 +++$+++ BIANCA +++$+++ I hope so.

L984 +++$+++ u2 +++$+++ m0 +++$+++ CAMERON +++$+++ She okay?

L925 +++$+++ u0 +++$+++ m0 +++$+++ BIANCA +++$+++ Let's go.
```

```
with open("original-data\pamela-youtube_comments.csv", encoding="utf-8") as f:
    for _ in range(5):
        print(f.readline())
```

```
video_id,comment

qlZM3McwO1Q,What an incredible victory. I agree the Kenyans should have been celebrated at the end. This was an incredible performance.

qlZM3McwO1Q,❤

qlZM3McwO1Q,“Claudia is an amazonian goddess with a beautiful clam!” - Bruce Wayne

qlZM3McwO1Q,Proud of my motherland Kenya ❤❤❤and Africa.at large
```

```
columns = ["VideoID", "comment"]

movie_titles = pd.read_csv(
    "original-data\pamela-youtube_comments.csv",
    sep=' \+\+\+\$\+\+\+ ',
    engine='python',
    names=columns,
    encoding='ISO-8859-1'
)

movie_titles.head()
```

```
                                              VideoID  comment
0                                   video_id,comment      NaN
1  qlZM3McwO1Q,What an incredible victory. I agre...      NaN
2                                    qlZM3McwO1Q,â□¤      NaN
3  qlZM3McwO1Q,â€Claudia is an amazonian goddess...      NaN
4  qlZM3McwO1Q,Proud of my motherland Kenya â□¤â□...      NaN
```

```
with open ("original-data/brian_youtube_data_comments.csv", encoding="utf-8") as f:
    for _ in range(5):
        print(f.readline())
```

```
Top Comment,Reply

"Apple missed the boat on AI OR... Apple is doing what it always does,
```

```
waiting for others to prove a new technology, then ride in on their massive platform and take over. Time will tell which statement is true.",

"Who added the background music to the video its so fucking distracting. It sounds like nier automata bgm, that makes it impossible to focus",

16:26  FEMI KUTI !!! RAAHHH !!!,

"The greatest AI scam in history, is AI.",


columns = ["comment", "response"]

movie_titles = pd.read_csv(
    "original-data/brian_youtube_data_comments.csv",
    sep=' \+\+\+\$\+\+\+ ',
    engine='python',
    names=columns,
    encoding='ISO-8859-1'
)

movie_titles.head()
```

	comment	response
0	ï»¿Top Comment,Reply	NaN
1	"Apple missed the boat on AI OR... Apple is do...	NaN
2	"Who added the background music to the video i...	NaN
3	16:26 FEMI KUTI !!! RAAHHH !!!,	NaN
4	"The greatest AI scam in history, is AI.",	NaN

```
## Reading the conversation data

with open("original-data\movie_conversations.txt", encoding="ISO-8859-1") as f:
    for _ in range(5):
        print(f.readline())

u0 +++$+++ u2 +++$+++ m0 +++$+++ ['L194', 'L195', 'L196', 'L197']

u0 +++$+++ u2 +++$+++ m0 +++$+++ ['L198', 'L199']

u0 +++$+++ u2 +++$+++ m0 +++$+++ ['L200', 'L201', 'L202', 'L203']

u0 +++$+++ u2 +++$+++ m0 +++$+++ ['L204', 'L205', 'L206']

u0 +++$+++ u2 +++$+++ m0 +++$+++ ['L207', 'L208']


# Reading movie titles data
```

```
with open ("original-data\movie_titles_metadata.txt", encoding= "ISO-8859-1") as f:
    for _ in range(5):
        print(f.readline())
```

```
m0 +++$+++ 10 things i hate about you +++$+++ 1999 +++$+++ 6.90 +++$+++ 62847 +++$+++ ['comedy', 'romance']

m1 +++$+++ 1492: conquest of paradise +++$+++ 1992 +++$+++ 6.20 +++$+++ 10421 +++$+++ ['adventure', 'biography', 'drama', 'history']

m2 +++$+++ 15 minutes +++$+++ 2001 +++$+++ 6.10 +++$+++ 25854 +++$+++ ['action', 'crime', 'drama', 'thriller']

m3 +++$+++ 2001: a space odyssey +++$+++ 1968 +++$+++ 8.40 +++$+++ 163227 +++$+++ ['adventure', 'mystery', 'sci-fi']

m4 +++$+++ 48 hrs. +++$+++ 1982 +++$+++ 6.90 +++$+++ 22289 +++$+++ ['action', 'comedy', 'crime', 'drama', 'thriller']
```

```
columns = ["MovieID", "Movie Title","Year", "Rating", "no_votes", "Genre"]

movie_titles = pd.read_csv(
    "original-data\movie_titles_metadata.txt",
    sep=' \+\+\+\$\+\+\+ ',
    engine='python',
    names=columns,
    encoding='ISO-8859-1'
)

movie_titles.head()
```

	MovieID	Movie Title	Year	Rating	no_votes	Genre
0	m0	10 things i hate about you	1999	6.9	62847	['comedy', 'romance']
1	m1	1492: conquest of paradise	1992	6.2	10421	['adventure', 'biography', 'drama', 'history']
2	m2	15 minutes	2001	6.1	25854	['action', 'crime', 'drama', 'thriller']
3	m3	2001: a space odyssey	1968	8.4	163227	['adventure', 'mystery', 'sci-fi']
4	m4	48 hrs.	1982	6.9	22289	['action', 'comedy', 'crime', 'drama', 'thrill...

```
movie_titles.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 617 entries, 0 to 616
Data columns (total 6 columns):
 #   Column       Non-Null Count  Dtype  
---  ------       --------------  -----  
 0   MovieID      617 non-null    object 
 1   Movie Title  617 non-null    object 
 2   Year         617 non-null    object 
 3   Rating       617 non-null    float64
 4   no_votes     617 non-null    int64  
 5   Genre        617 non-null    object 
dtypes: float64(1), int64(1), object(4)
memory usage: 29.0+ KB
```

```
# Reading raw_script data

with open ("original-data/raw_script_urls.txt", encoding = "ISO-
8859=1") as f:
        for _ in range(5):
              print(f.readline())
```

```
m0 +++$+++ 10 things i hate about you +++$+++
http://www.dailyscript.com/scripts/10Things.html

m1 +++$+++ 1492: conquest of paradise +++$+++
http://www.hundland.org/scripts/1492-ConquestOfParadise.txt

m2 +++$+++ 15 minutes +++$+++
http://www.dailyscript.com/scripts/15minutes.html

m3 +++$+++ 2001: a space odyssey +++$+++
http://www.scifiscripts.com/scripts/2001.txt

m4 +++$+++ 48 hrs. +++$+++
http://www.awesomefilm.com/script/48hours.txt
```

2.1.1 Data Usage Explanation

- Youtube Dataset (scraped) - Help chatbot understand local expressions, slang, and questions users are actually asking
- Cornell Dataset Teach dialog structure (turn-taking, responses), mostly in English

2.1.2 Merging Youtube Datasets

```
# Load both datasets without filtering columns yet
df1 = pd.read_csv("original-data/pamela-youtube_comments.csv")
df2 = pd.read_csv("original-data/brian_youtube_data_comments.csv")
```

```
# Print column names to inspect
print("pamela-youtube_comments.csv Columns:", df1.columns.tolist())
print("brian_youtube_data_comments.csv Columns:",
df2.columns.tolist())
```

```
pamela-youtube_comments.csv Columns: ['video_id', 'comment']
brian_youtube_data_comments.csv Columns: ['Top Comment', 'Reply']
```

```
import pandas as pd

# Load both datasets
df1 = pd.read_csv("original-data/pamela-youtube_comments.csv")
df2 = pd.read_csv("original-data/brian_youtube_data_comments.csv")
# Clean df1: keep only 'comment' and drop nulls
df1 = df1[['comment']].dropna()
df1['response'] = None  # add placeholder column for consistency

# Clean df2: rename columns and drop nulls
df2 = df2.rename(columns={"Top Comment": "comment", "Reply":
"response"})
df2 = df2[['comment', 'response']].dropna()

# Combine both
df_combined = pd.concat([df1, df2], ignore_index=True)

# Preview
print("Combined Dataset Shape:", df_combined.shape)
display(df_combined.sample(5))
```

```
Combined Dataset Shape: (26095, 2)
```

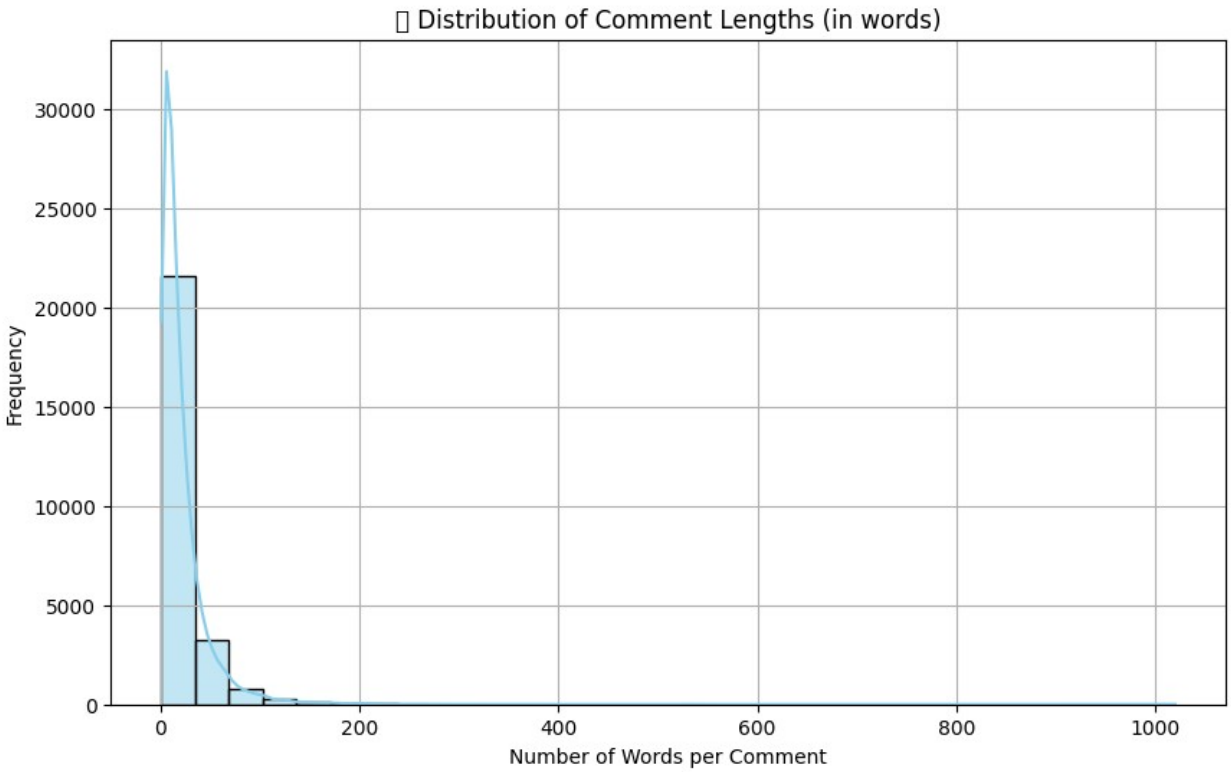
	comment	response
11738	Justice for baby Kingsley	None
20625	Yes teach her she has options...and walking aw...	None
4906	May god grant this lady the peace she needs,ma...	None
17874	I love Lynn!	None
12733	Kamura	None

2.1.3 Comments length Distribution

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

# Add a new column: comment length (in words)
df_combined['comment_length'] = df_combined['comment'].apply(lambda x:
len(str(x).split()))

# Plot distribution
plt.figure(figsize=(10, 6))
sns.histplot(df_combined['comment_length'], bins=30, kde=True,
```

```
color='skyblue')
plt.title("□ Distribution of Comment Lengths (in words)")
plt.xlabel("Number of Words per Comment")
plt.ylabel("Frequency")
plt.grid(True)
plt.show()
```

```
c:\Users\hp\anaconda3\envs\learn-env\lib\site-packages\IPython\core\
pylabtools.py:152: UserWarning: Glyph 128221 (\N{MEMO}) missing from
current font.
  fig.canvas.print_figure(bytes_io, **kw)
```

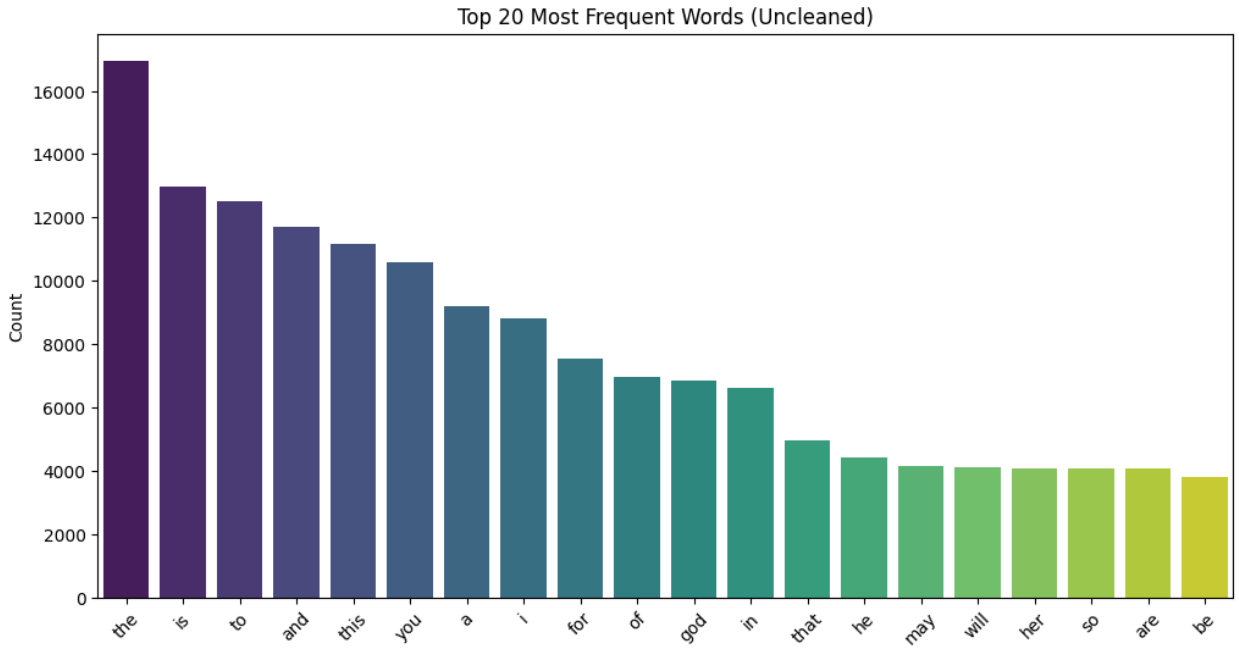


2.1.3 Top words in comments

```
from collections import Counter
import string

# Combine all comments into one string
all_text = "
".join(df_combined['comment'].dropna().astype(str)).lower()

# Basic tokenization: split by space, remove punctuation
tokens = [word.strip(string.punctuation) for word in all_text.split()]


# Basic tokenization: split by space, remove punctuation
```

```
tokens = [word.strip(string.punctuation) for word in all_text.split()]
tokens = [word for word in tokens if word]  # remove empty

# Count frequencies
word_freq = Counter(tokens)
top_words = word_freq.most_common(20)

# Plot
words, counts = zip(*top_words)
plt.figure(figsize=(12, 6))
sns.barplot(x=list(words), y=list(counts), palette='viridis')
plt.title("Top 20 Most Frequent Words (Uncleaned)")
plt.xticks(rotation=45)
plt.ylabel("Count")
plt.show()
```

```
C:\Users\hp\AppData\Local\Temp\ipykernel_24016\3391410998.py:22:
FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be
removed in v0.14.0. Assign the `x` variable to `hue` and set
`legend=False` for the same effect.

  sns.barplot(x=list(words), y=list(counts), palette='viridis')
```



2.2. Language Detection and preprocessing - Youtube data

Here I want to check the amount of swahili / sheng in my youtube dataset to understand whether the data is efficient to use for training

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

```
[nltk_data] Downloading package punkt to
[nltk_data]     C:\Users\hp\AppData\Roaming\nltk_data...
[nltk_data]   Package punkt is already up-to-date!
```

```
True
```

```
# Clear any corrupted cache
nltk.data.path.clear()

# Explicitly set download directory
nltk.data.path.append("C:/Users/hp/nltk_data")

# Re-download punkt
nltk.download('punkt', download_dir="C:/Users/hp/nltk_data")
```

```
[nltk_data] Downloading package punkt to C:/Users/hp/nltk_data...
[nltk_data]   Package punkt is already up-to-date!
```

```
True
```

```
import nltk
from nltk.tokenize import word_tokenize

# Download both 'punkt' and 'punkt_tab'
nltk.download('punkt')
nltk.download('punkt_tab') # This is the crucial line to add/ensure

text = "This is a test."
print(word_tokenize(text))
```

```
[nltk_data] Downloading package punkt to
[nltk_data]     C:\Users\hp\AppData\Roaming\nltk_data...
[nltk_data]   Package punkt is already up-to-date!
[nltk_data] Downloading package punkt_tab to
[nltk_data]     C:\Users\hp\AppData\Roaming\nltk_data...
[nltk_data]   Unzipping tokenizers\punkt_tab.zip.
```

```
---------------------------------------------------------------------
-----
LookupError                               Traceback (most recent call
last)
Cell In[36], line 9
      6 nltk.download('punkt_tab') # This is the crucial line to
add/ensure
      8 text = "This is a test."
----> 9 print(word_tokenize(text))

File c:\Users\hp\anaconda3\envs\learn-env\lib\site-packages\nltk\
tokenize\__init__.py:142, in word_tokenize(text, language,
```

```
preserve_line)
    127 def word_tokenize(text, language="english",
preserve_line=False):
    128     """
    129     Return a tokenized copy of *text*,
    130     using NLTK's recommended word tokenizer
   (...)
    140     :type preserve_line: bool
    141     """
--> 142     sentences = [text] if preserve_line else
sent_tokenize(text, language)
    143     return [
    144         token for sent in sentences for token in
_treebank_word_tokenizer.tokenize(sent)
    145     ]

File c:\Users\hp\anaconda3\envs\learn-env\lib\site-packages\nltk\
tokenize\__init__.py:119, in sent_tokenize(text, language)
    109 def sent_tokenize(text, language="english"):
    110     """
    111     Return a sentence-tokenized copy of *text*,
    112     using NLTK's recommended sentence tokenizer
   (...)
    117     :param language: the model name in the Punkt corpus
    118     """
--> 119     tokenizer = _get_punkt_tokenizer(language)
    120     return tokenizer.tokenize(text)

File c:\Users\hp\anaconda3\envs\learn-env\lib\site-packages\nltk\
tokenize\__init__.py:105, in _get_punkt_tokenizer(language)
     96 @functools.lru_cache
     97 def _get_punkt_tokenizer(language="english"):
     98     """
     99     A constructor for the PunktTokenizer that utilizes
    100     a lru cache for performance.
   (...)
    103     :type language: str
    104     """
--> 105     return PunktTokenizer(language)

File c:\Users\hp\anaconda3\envs\learn-env\lib\site-packages\nltk\
tokenize\punkt.py:1744, in PunktTokenizer.__init__(self, lang)
   1742 def __init__(self, lang="english"):
   1743     PunktSentenceTokenizer.__init__(self)
-> 1744     self.load_lang(lang)

File c:\Users\hp\anaconda3\envs\learn-env\lib\site-packages\nltk\
tokenize\punkt.py:1749, in PunktTokenizer.load_lang(self, lang)
   1746 def load_lang(self, lang="english"):
   1747     from nltk.data import find
```

```
-> 1749     lang_dir = find(f"tokenizers/punkt_tab/{lang}/")
   1750     self._params = load_punkt_params(lang_dir)
   1751     self._lang = lang

File c:\Users\hp\anaconda3\envs\learn-env\lib\site-packages\nltk\
data.py:579, in find(resource_name, paths)
    577 sep = "*" * 70
    578 resource_not_found = f"\n{sep}\n{msg}\n{sep}\n"
--> 579 raise LookupError(resource_not_found)

LookupError:
**********************************************************************
  Resource punkt_tab not found.
  Please use the NLTK Downloader to obtain the resource:

  >>> import nltk
  >>> nltk.download('punkt_tab')

  For more information see: https://www.nltk.org/data.html

  Attempted to load tokenizers/punkt_tab/english/

  Searched in:
    - 'C:/Users/hp/nltk_data'
**********************************************************************
```

```
from nltk.tokenize import word_tokenize
import nltk

nltk.download('punkt')  # Just to be sure

text = "This is a test."
print(word_tokenize(text))
```

```
[nltk_data] Downloading package punkt to
[nltk_data]     C:\Users\hp\AppData\Roaming\nltk_data...
[nltk_data]   Package punkt is already up-to-date!

---------------------------------------------------------------------------
-----
LookupError                                 Traceback (most recent call
last)
Cell In[34], line 7
      4 nltk.download('punkt')  # Just to be sure
      6 text = "This is a test."
----> 7 print(word_tokenize(text))

File c:\Users\hp\anaconda3\envs\learn-env\lib\site-packages\nltk\
tokenize\__init__.py:142, in word_tokenize(text, language,
preserve_line)
```

```
    127 def word_tokenize(text, language="english",
preserve_line=False):
    128     """
    129     Return a tokenized copy of *text*,
    130     using NLTK's recommended word tokenizer
   (...)
    140     :type preserve_line: bool
    141     """
--> 142     sentences = [text] if preserve_line else
sent_tokenize(text, language)
    143     return [
    144         token for sent in sentences for token in
_treebank_word_tokenizer.tokenize(sent)
    145     ]

File c:\Users\hp\anaconda3\envs\learn-env\lib\site-packages\nltk\
tokenize\__init__.py:119, in sent_tokenize(text, language)
    109 def sent_tokenize(text, language="english"):
    110     """
    111     Return a sentence-tokenized copy of *text*,
    112     using NLTK's recommended sentence tokenizer
   (...)
    117     :param language: the model name in the Punkt corpus
    118     """
--> 119     tokenizer = _get_punkt_tokenizer(language)
    120     return tokenizer.tokenize(text)

File c:\Users\hp\anaconda3\envs\learn-env\lib\site-packages\nltk\
tokenize\__init__.py:105, in _get_punkt_tokenizer(language)
     96 @functools.lru_cache
     97 def _get_punkt_tokenizer(language="english"):
     98     """
     99     A constructor for the PunktTokenizer that utilizes
    100     a lru cache for performance.
   (...)
    103     :type language: str
    104     """
--> 105     return PunktTokenizer(language)

File c:\Users\hp\anaconda3\envs\learn-env\lib\site-packages\nltk\
tokenize\punkt.py:1744, in PunktTokenizer.__init__(self, lang)
   1742 def __init__(self, lang="english"):
   1743     PunktSentenceTokenizer.__init__(self)
-> 1744     self.load_lang(lang)

File c:\Users\hp\anaconda3\envs\learn-env\lib\site-packages\nltk\
tokenize\punkt.py:1749, in PunktTokenizer.load_lang(self, lang)
   1746 def load_lang(self, lang="english"):
   1747     from nltk.data import find
-> 1749     lang_dir = find(f"tokenizers/punkt_tab/{lang}/")
```

```
   1750     self._params = load_punkt_params(lang_dir)
   1751     self._lang = lang

File c:\Users\hp\anaconda3\envs\learn-env\lib\site-packages\nltk\
data.py:579, in find(resource_name, paths)
    577 sep = "*" * 70
    578 resource_not_found = f"\n{sep}\n{msg}\n{sep}\n"
--> 579 raise LookupError(resource_not_found)

LookupError:
**********************************************************************
  Resource punkt_tab not found.
  Please use the NLTK Downloader to obtain the resource:

  >>> import nltk
  >>> nltk.download('punkt_tab')

  For more information see: https://www.nltk.org/data.html

  Attempted to load tokenizers/punkt_tab/english/

  Searched in:
    - 'C:/Users/hp/nltk_data'
**********************************************************************


# Preparing tokenized words list

from nltk.tokenize import word_tokenize
import string


all_text = "
".join(df_combined["comment"].dropna().astype(str).tolist())

# Tokenizing
tokens = word_tokenize(all_text.lower())

# Removing punctuations
tokens = [word for word in tokens if word not in string.punctuation]

---------------------------------------------------------------------
-----
LookupError                               Traceback (most recent call
last)
Cell In[35], line 10
      7 all_text = "
".join(df_combined["comment"].dropna().astype(str).tolist())
      9 # Tokenizing
---> 10 tokens = word_tokenize(all_text.lower())
     12 # Removing punctuations
```

```
     13 tokens = [word for word in tokens if word not in
string.punctuation]

File c:\Users\hp\anaconda3\envs\learn-env\lib\site-packages\nltk\
tokenize\__init__.py:142, in word_tokenize(text, language,
preserve_line)
    127 def word_tokenize(text, language="english",
preserve_line=False):
    128     """
    129     Return a tokenized copy of *text*,
    130     using NLTK's recommended word tokenizer
   (...)
    140     :type preserve_line: bool
    141     """
--> 142     sentences = [text] if preserve_line else
sent_tokenize(text, language)
    143     return [
    144         token for sent in sentences for token in
_treebank_word_tokenizer.tokenize(sent)
    145     ]

File c:\Users\hp\anaconda3\envs\learn-env\lib\site-packages\nltk\
tokenize\__init__.py:119, in sent_tokenize(text, language)
    109 def sent_tokenize(text, language="english"):
    110     """
    111     Return a sentence-tokenized copy of *text*,
    112     using NLTK's recommended sentence tokenizer
   (...)
    117     :param language: the model name in the Punkt corpus
    118     """
--> 119     tokenizer = _get_punkt_tokenizer(language)
    120     return tokenizer.tokenize(text)

File c:\Users\hp\anaconda3\envs\learn-env\lib\site-packages\nltk\
tokenize\__init__.py:105, in _get_punkt_tokenizer(language)
     96 @functools.lru_cache
     97 def _get_punkt_tokenizer(language="english"):
     98     """
     99     A constructor for the PunktTokenizer that utilizes
    100     a lru cache for performance.
   (...)
    103     :type language: str
    104     """
--> 105     return PunktTokenizer(language)

File c:\Users\hp\anaconda3\envs\learn-env\lib\site-packages\nltk\
tokenize\punkt.py:1744, in PunktTokenizer.__init__(self, lang)
   1742 def __init__(self, lang="english"):
   1743     PunktSentenceTokenizer.__init__(self)
-> 1744     self.load_lang(lang)
```

```
File c:\Users\hp\anaconda3\envs\learn-env\lib\site-packages\nltk\
tokenize\punkt.py:1749, in PunktTokenizer.load_lang(self, lang)
   1746 def load_lang(self, lang="english"):
   1747     from nltk.data import find
-> 1749     lang_dir = find(f"tokenizers/punkt_tab/{lang}/")
   1750     self._params = load_punkt_params(lang_dir)
   1751     self._lang = lang

File c:\Users\hp\anaconda3\envs\learn-env\lib\site-packages\nltk\
data.py:579, in find(resource_name, paths)
    577 sep = "*" * 70
    578 resource_not_found = f"\n{sep}\n{msg}\n{sep}\n"
--> 579 raise LookupError(resource_not_found)

LookupError:
**********************************************************************
  Resource punkt_tab not found.
  Please use the NLTK Downloader to obtain the resource:

  >>> import nltk
  >>> nltk.download('punkt_tab')

  For more information see: https://www.nltk.org/data.html

  Attempted to load tokenizers/punkt_tab/english/

  Searched in:
    - 'C:/Users/hp/nltk_data'
**********************************************************************


sheng_swahili_vocab = {
    "msee", "manze", "vile", "sasa", "buda", "nani", "kiasi", "si",
"poa", "kwani",
    "hapo", "ushapata", "unadai", "ni", "aje", "nimeona", "noma",
"mbogi", "beshte",
    "wasee", "ati", "ndio", "sana", "sijui", "nduthi", "wewe", "kuna",
"niko", "leo",
    "kesho", "shida", "rafiki", "asante", "karibu", "mambo", "habari",
"leo", "mzuri"
}

from collections import Counter

# Countfing all words
word_counts = Counter(tokens)

# Counting only Swahili/Sheng words
swahili_sheng_counts = {word: count for word, count in
word_counts.items() if word in sheng_swahili_vocab}
```

```python
# Total words and total Swahili/Sheng
total_words = sum(word_counts.values())
total_swahili_sheng = sum(swahili_sheng_counts.values())

print(f"Swahili/Sheng word count: {total_swahili_sheng}")
print(f"Total words: {total_words}")
print(f"Swahili/Sheng word percentage: {total_swahili_sheng /
total_words:.2%}")
```

```
Swahili/Sheng word count: 2786
Total words: 602079
Swahili/Sheng word percentage: 0.46%
```

```python
from pprint import pprint

print("Top Swahili/Sheng words in dataset:")
pprint(sorted(swahili_sheng_counts.items(), key=lambda x: x[1],
reverse=True)[:20])
```

```
Top Swahili/Sheng words in dataset:
[('ni', 870),
 ('sana', 518),
 ('wewe', 201),
 ('ndio', 166),
 ('si', 127),
 ('kuna', 121),
 ('ati', 116),
 ('sasa', 92),
 ('vile', 89),
 ('hapo', 85),
 ('kwani', 63),
 ('aje', 51),
 ('mambo', 41),
 ('leo', 40),
 ('sijui', 37),
 ('shida', 37),
 ('nani', 27),
 ('niko', 17),
 ('poa', 16),
 ('mzuri', 12)]
```

```
pip install langdetect
```

```
^C
Note: you may need to restart the kernel to use updated packages.
```

```
Requirement already satisfied: langdetect in c:\users\helle\anaconda3\
envs\learn-env2\lib\site-packages (1.0.9)
Requirement already satisfied: six in c:\users\helle\anaconda3\envs\
learn-env2\lib\site-packages (from langdetect) (1.16.0)
```

2.2.1. Swahili words in the Yotube Combined Dataset

```
from langdetect import detect, LangDetectException
from tqdm import tqdm
import re

tqdm.pandas()

def safe_detect(text):
    try:
        text = str(text).strip()

        cleaned = re.sub(r'[^a-zA-Z]', '', text)  # Removing digits
and punctuation, keep only alphabetic characters
        if len(cleaned) < 5:
            return "unknown"
        return detect(text)
    except LangDetectException:
        return "unknown"

df_combined["language"] =
df_combined["comment"].progress_apply(safe_detect)

# Count Swahili comments (ISO 639-1 code for Swahili is 'sw')
swahili_count = df_combined[df_combined["language"] == "sw"]
["comment"].count()
total = df_combined["comment"].count()

print(f"Swahili comments: {swahili_count} / {total}
({(swahili_count/total):.2%})")
```

```
100%|██████████| 26095/26095 [01:44<00:00, 249.87it/s]

Swahili comments: 1821 / 26095 (6.98%)
```

```
df_combined. head(10)
```

```
                                                comment response
comment_length  \
0  What an incredible victory. I agree the Kenyan...     None
20
1                                                  ❤     None
1
2  “Claudia is an amazonian goddess with a beauti...     None
12
3  Proud of my motherland Kenya ❤❤❤and Africa.at ...     None
8
4                                              Damn      None
1
5              Kenya you should proud of yr self❤❤❤❤     None
```

```
7
6                                Well done team Kenya❤     None
4
7  This channel is racist! Report the channel, it...     None
24
8               Congs Kenya, lots of love from Uganda     None
7
9         Just WOW Kenya, what a run, what a stamina!     None
9
```

```
  language
0       en
1  unknown
2       en
3       en
4  unknown
5       en
6       id
7       en
8       en
9       en
```

```
# Phrases with combined Swahili and English (Code-switched comments)

def detect_code_switch(text):
    try:
        langs = detect_langs(text)
        lang_set = {lang.lang for lang in langs}
        return 'en' in lang_set and 'sw' in lang_set
    except LangDetectException:
        return False

df_combined["code_switched"] =
df_combined["comment"].astype(str).apply(detect_code_switch)

percentage = (df_combined["code_switched"].sum() / len(df_combined)) *
100
print(f"{percentage:.2f}% of comments are code-switched.")
```

```
1.79% of comments are code-switched.
```

2.2.2 Findings from the Youtube data Inspection

- There is Low prevalence of Swahili/Sheng (less than 0.5%) in the dataset.
- This likely meant most comments are in English, or the Swahili/Sheng vocabulary list is too small to capture what's actually Swahili/Sheng.

  Inspecting phrases with language switching show that :

– only a small fraction of the YouTube data contains both English and Swahili within the same comment.

2.2.3 Introducing dataset with more swahili words

I decided to load the allenai/c4 dataset from Hugging Face.

```
!pip install -q datasets

from datasets import load_dataset
```

```
c:\Users\helle\anaconda3\envs\Learn-env2\Lib\site-packages\tqdm\
auto.py:21: TqdmWarning: IProgress not found. Please update jupyter
and ipywidgets. See
https://ipywidgets.readthedocs.io/en/stable/user_install.html
  from .autonotebook import tqdm as notebook_tqdm
```

```
swahili_data = load_dataset("allenai/c4", name="sw",
split="train[:1%]")
```

```
Downloading data: 100%|██████████| 32/32 [09:07<00:00, 17.10s/files]
Generating train split: 985654 examples [01:51, 8853.26 examples/s]
Generating validation split: 994 examples [00:00, 6963.70 examples/s]
```

```
# Converting sampled data to dataframe

additional_sw_df = pd.DataFrame(swahili_data)

additional_sw_df.rename(columns={"text": "comment"}, inplace=True)

print(additional_sw_df.head())
```

```
                                                comment
timestamp  \
0  2016 - 75 Miaka Meiringen Air Base - AviaSpott... 2019-10-16
05:11:38
1  JENIFFER KYAKA (ODAMA): J FIML 4 LIFE: Lulu Ha... 2018-07-22
08:54:40
2  Imewekwa: July 13th, 2018\n“Marufuku watoto ku... 2019-06-19
13:00:43
3  Kipengele Ngono na Ukahaba katika Cebu Wasicha... 2018-12-10
13:10:19
4  KINGOTANZANIA:: HABARI, PICHA NA MATANGAZO: MA... 2017-08-20
13:33:24

                                                 url
0  https://www.aviaspotter.it/75-jahre-militarflu...
1  http://odama1.blogspot.com/2015/12/lulu-haishi...
2  http://ilejedc.go.tz/new/marufuku-watoto-kuone...
3  https://sw.videochat.ph/sex-chat-roulette-phil...
4  http://kingotanzania.blogspot.com/2012/10/maua...
```

```
# merging the combined youtube dataset with the additional swahili
dataset

df_combined_extended = pd.concat([df_combined, additional_sw_df],
ignore_index=True)

# Shuffling to ensure better mixing of both sources(Prevents model
from overfitting to the structure/order of the data)

df_combined_extended =
df_combined_extended.sample(frac=1).reset_index(drop=True)


print(f"Original YouTube rows: {len(df_combined)}")
print(f"CC100 (Swahili) sample rows: {len(additional_sw_df)}")
print(f"Combined total rows: {len(df_combined_extended)}")
df_combined_extended.head()
```

```
Original YouTube rows: 26095
CC100 (Swahili) sample rows: 9857
Combined total rows: 35952
```

```
                                                comment response
comment_length  \
0                                      Am sorry 😭😭😭😭     None
3.0
1  For serah to invite Maureen to stay in her hou...     None
65.0
2  Jinsi Raia wa Mynmar Wanavyokabiliana na Kupan...      NaN
NaN
3  This is so painful....I can't help but cry wit...     None
52.0
4  Condom inaposuluhisha ugoni! | JamiiForums | T...      NaN
NaN

  language code_switched           timestamp  \
0       en         False                 NaT
1       en         False                 NaT
2      NaN           NaN 2020-01-29 08:33:36
3       en         False                 NaT
4      NaN           NaN 2018-01-19 11:57:16

                                                 url
0                                                NaN
1                                                NaN
2  https://sw.globalvoices.org/2016/05/jinsi-raia...
3                                                NaN
4  https://www.jamiiforums.com/threads/condom-ina...
```

2.3 Cleaning & Preprocessing combined dataset

```
# Drop rows where 'comment' is completely missing
df_combined_extended = df_combined_extended.dropna(subset=['comment'])

# Strip, lowercase, and remove URLs & excess whitespace

def clean_comment(text):
    text = str(text).lower().strip()
    text = re.sub(r"http\S+|www.\S+", "", text)
    text = re.sub(r'\s+', ' ', text)
    return text

df_combined_extended['comment'] =
df_combined_extended['comment'].apply(clean_comment)

df_combined_extended. head(10)
```

```
                                                comment response
comment_length  \
0                                      am sorry 😭😭😭😭     None
3.0
1  for serah to invite maureen to stay in her hou...     None
65.0
2  jinsi raia wa mynmar wanavyokabiliana na kupan...      NaN
NaN
3  this is so painful....i can't help but cry wit...     None
52.0
4  condom inaposuluhisha ugoni! | jamiiforums | t...      NaN
NaN
5           i agree, both have serious esteem issues     None
7.0
6  juventus special thread | jamiiforums | the ho...      NaN
NaN
7  viongozi wa nchi za maziwa makuu wawekea vikwa...      NaN
NaN
8  that is a devil  of a man,n the way the baby ...     None
36.0
9  ooh god of mercy, may your will be done in hea...     None
25.0

  language code_switched           timestamp  \
0       en         False                 NaT
1       en         False                 NaT
2      NaN           NaN 2020-01-29 08:33:36
3       en         False                 NaT
4      NaN           NaN 2018-01-19 11:57:16
5       en         False                 NaT
6      NaN           NaN 2017-01-23 19:11:59
7      NaN           NaN 2017-01-21 08:29:28
```

```
8       en         False                  NaT
9       en         False                  NaT

                                                  url
0                                                 NaN
1                                                 NaN
2  https://sw.globalvoices.org/2016/05/jinsi-raia...
3                                                 NaN
4  https://www.jamiiforums.com/threads/condom-ina...
5                                                 NaN
6  https://www.jamiiforums.com/threads/juventus-s...
7  http://www.voaswahili.com/a/viongozi-wa-nchi-z...
8                                                 NaN
9                                                 NaN
```

```
# Recalculating comment length (Helps analyze and filter comments
(e.g., remove extremely short or long ones).


df_combined_extended['comment_length'] =
df_combined_extended['comment'].apply(lambda x: len(x.split()))

# Detecting language only if missing
def safe_detect(text):
    try:
        return detect(text)
    except LangDetectException:
        return "unknown"

df_combined_extended['language'] =
df_combined_extended['language'].fillna(df_combined_extended['comment'
].apply(safe_detect))


# Filling  missing response column with None (if it exists) - This
helps create a language-specific chatbot that doesn't train on
unrelated or noisy data

if 'response' in df_combined_extended.columns:
    df_combined_extended['response'] =
df_combined_extended['response'].fillna('no_response')


# Filling  missing code-switched flags with False
if 'code_switched' in df_combined_extended.columns:
    df_combined_extended['code_switched'] =
df_combined_extended['code_switched'].fillna(False)

# dropping  unnecessary columns
df_combined_extended = df_combined_extended.drop(columns=['timestamp',
'url'], errors='ignore')
```

```
# 8. Resetting index
df_combined_extended.reset_index(drop=True, inplace=True)

df_combined_extended.head(15)
## Preparing input-reponse pairs from the Cornell dataset.
```

```
                                                comment     response  \
0                                      am sorry 😭😭😭😭  no_response

1   for serah to invite maureen to stay in her hou...  no_response
2   jinsi raia wa mynmar wanavyokabiliana na kupan...  no_response
3   this is so painful....i can't help but cry wit...  no_response
4   condom inaposuluhisha ugoni! | jamiiforums | t...  no_response
5            i agree, both have serious esteem issues  no_response
6   juventus special thread | jamiiforums | the ho...  no_response
7   viongozi wa nchi za maziwa makuu wawekea vikwa...  no_response
8   that is a devil  of a man,n the way the baby ...  no_response
9   ooh god of mercy, may your will be done in hea...  no_response
10                huyu mwanaume hana pesa ni ya diana  no_response
11     over my dead body i'm not sharing my man 😭☹  no_response
12                   wueeeh..... to each their own.  no_response
13  staying together is a no... kila mtu akae kwak...  no_response
14  nufuvi(swot analysis), tathmini muhimu kabla h...  no_response
```

```
    comment_length language  code_switched
0                3       en          False
1               65       en          False
2              382       sw          False
3               52       en          False
4              307       sw          False
5                7       en          False
6             1629       sw          False
7              392       sw          False
8               36       en          False
9               25       en          False
10               7       sw          False
11              10       en          False
12               5       en          False
13              28       en           True
14             851       sw          False
```

```
# Defining file paths
lines_path = "original-data/movie_lines.txt"
conversations_path = "original-data/movie_conversations.txt"


# Loading  and parsing  movie_lines.txt
```

```
lines = {}
with open(lines_path, encoding='ISO-8859-1') as f:
    for line in f:
        parts = line.strip().split(" +++$+++ ")
        if len(parts) == 5:
            line_id, _, _, _, text = parts
            lines[line_id] = text


# Loading and parsing movie_conversations.txt

conversations = []
with open(conversations_path, encoding='ISO-8859-1') as f:
    for line in f:
        parts = line.strip().split(" +++$+++ ")
        if len(parts) == 4:
            utterance_ids = ast.literal_eval(parts[3])  # Converting
string list to actual list
            conversations.append(utterance_ids)


# Creating comment-response pairs

pairs = []
for conv in conversations:
    for i in range(len(conv) - 1):
        input_id = conv[i]
        response_id = conv[i + 1]

        input_text = lines.get(input_id)
        response_text = lines.get(response_id)

        if input_text and response_text:
            pairs.append((input_text, response_text))

# Creating a DataFrame
df_cornell = pd.DataFrame(pairs, columns=["comment", "response"])
print(df_cornell.head())
```

```
                                             comment  \
0  Can we make this quick?  Roxanne Korrine and A...
1  Well, I thought we'd start with pronunciation,...
2  Not the hacking and gagging and spitting part....
3  You're asking me out.  That's so cute. What's ...
4  No, no, it's my fault -- we didn't have a prop...

                                            response
0  Well, I thought we'd start with pronunciation,...
1  Not the hacking and gagging and spitting part....
2  Okay... then how 'bout we try out some French ...
```

```
3                                                Forget it.
4                                                  Cameron.
```

2.3.1. Cleaning paired Dataframe

```
def clean_text(text, remove_emojis=True):
    if pd.isnull(text):
        return ""
        text = text.lower()   # Lowercase

    text = text.translate(str.maketrans('', '', string.punctuation))
# Removing punctuation

    text = re.sub(r'\s+', ' ', text).strip()     # Removing extra
whitespace

    return text

df_cornell['comment'] = df_cornell['comment'].apply(lambda x:
clean_text(x))
df_cornell['response'] = df_cornell['response'].apply(lambda x:
clean_text(x))

df_cornell = df_cornell[(df_cornell['comment'].str.strip() != '') &
(df_cornell['response'].str.strip() != '')] #Dropping rows with empty
comments or responses

print(df_cornell.sample(5))
```

```
                                                    comment  \
46715                       From the club You didnt answer
134069  Okay Im delighted to have someone to talk to a...
136570                            250000 right off the top
217458                                    Who did Mrs Feur
73975                                           Smile good

                                                    response
46715   I must have fallen asleep I was asleep when yo...
134069                       Im such a heel Howd you guess
136570                                       Is he straight
217458                                Maybe Point isnot me
73975                                                  Yes
```

3 Modeling

3.1. TF-IDF + Cosine Similarity Chatbot

A simple NLP chatbot using TF-IDF and cosine similarity for conversational response matching.

```
# Import required libraries
import pandas as pd
import numpy as np
import re
import ast
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.metrics.pairwise import cosine_similarity

#Load the Cornell Movie Dialogs Dataset
conversations =
pd.read_csv('original-data/movie_conversations.txt',sep=r'\s*\+\+\+\$\
+\+\+\s*',engine='python', names=["character1", "character2",
"movieID", "utteranceIDs"],encoding='iso-8859-1')
lines = pd.read_csv('original-data/movie_lines.txt',sep=r'\s*\+\+\+\$\
+\+\+\s*',engine='python',names=["lineID", "characterID", "movieID",
"character", "text"],encoding='iso-8859-1')

yt1= pd.read_csv('original-data/brian_youtube_data_comments.csv')
yt2= pd.read_csv('original-data/pamela-youtube_comments.csv')

# Convert utteranceIDs from string to list
conversations['utteranceIDs'] =
conversations['utteranceIDs'].apply(ast.literal_eval)

#Extract Conversational Pairs (input-response)
line_dict = dict(zip(lines['lineID'], lines['text']))

pairs = []

for conv in conversations['utteranceIDs']:
    for i in range(len(conv) - 1):
        # Get both lines from the dictionary
        in_line = line_dict.get(conv[i])
        out_line = line_dict.get(conv[i+1])

        # Ensure both exist and are strings
        if isinstance(in_line, str) and isinstance(out_line, str):
            in_line = in_line.strip()
            out_line = out_line.strip()
            if in_line and out_line:
                pairs.append((in_line, out_line))
```

```
# Create DataFrame
chat_df = pd.DataFrame(pairs, columns=["input", "response"])

# Sanity check
print(f"□ Extracted {len(chat_df)} conversation pairs.")
if not chat_df.empty:
    print(chat_df.sample(5))
else:
    print("□ No valid pairs found.")
```

```
□ Extracted 221282 conversation pairs.
                                                    input  \
92511   Oh, okay, forgive me.  Your neighbors are here...
77948                                So you're a lawyer.
18704                                             Oh, no.
7333    He suspects I know something. I think he was s...
128637  Don't recognize him. You were trapped by Morga...

                                                 response
92511              Exactly what I mean.  It's all ruined.
77948     That's right. What are you doing in Bodega Bay?
18704                      I knew you'd understand. Here.
7333                                              Why?!
128637  ...Gawain and Perceval, Bors and Bohort, Carad...
```

```
#Preprocess the Text
def clean_text(text):
    text = text.lower()
    text = re.sub(r"[^a-zA-Z0-9\s]", "", text)
    text = re.sub(r"\s+", " ", text).strip()
    return text

chat_df['clean_input'] = chat_df['input'].apply(clean_text)

# Create TF-IDF Matrix for User Inputs
vectorizer = TfidfVectorizer(ngram_range=(1, 2), stop_words='english')
tfidf_matrix = vectorizer.fit_transform(chat_df['clean_input'])

# Chatbot Function Using Cosine Similarity
def chatbot_response(user_input):
    cleaned_input = clean_text(user_input)
    user_vec = vectorizer.transform([cleaned_input])
    similarities = cosine_similarity(user_vec, tfidf_matrix).flatten()
    best_match_idx = similarities.argmax()
    if similarities[best_match_idx] > 0:
        return chat_df.iloc[best_match_idx]['response']
    else:
        return "I'm not sure how to respond to that."

import gradio as gr
```

```
# Function that takes user input and returns chatbot response
def chat_with_bot(user_input):
    user_input_vector = vectorizer.transform([user_input])
    similarity = cosine_similarity(user_input_vector, tfidf_matrix)
    best_match_idx = similarity.argmax()
    return chat_df.iloc[best_match_idx]["response"]

# Create Gradio interface
iface = gr.Interface(fn=chat_with_bot,
                     inputs=gr.Textbox(lines=2, placeholder="Type a
message..."),
                     outputs="text",
                     title="TF-IDF and cosine similarity baseline
model",
                     description="Ask something and get a response
based on similarity!")

iface.launch()

* Running on local URL:  http://127.0.0.1:7860
* To create a public link, set `share=True` in `launch()`.

<IPython.core.display.HTML object>
```

3.1.2. Why This Baseline Model Needs Further Advancement

The current chatbot uses a TF-IDF (Term Frequency-Inverse Document Frequency) vectorizer combined with cosine similarity to find the most relevant response to a user's input. While this method is simple and effective as a baseline, it has several limitations that make it unsuitable for production-level conversational AI:

1. **Lack of Context Awareness**

The model treats each input-response pair as independent. It doesn't remember prior messages in the conversation, making it unable to maintain coherent multi-turn interactions.

2. **No Semantic Understanding**

TF-IDF relies purely on the frequency of words. It doesn’t understand the meaning behind words or recognize synonyms. For instance, "How are you doing?" and "How's it going?" might be treated as unrelated.

3. **Rigid Matching**

The model will fail to respond well to slightly rephrased, paraphrased, or typo-ridden inputs, since it depends on exact or partial word overlap.

4. **Scalability Issues**

As the dataset grows, cosine similarity computations become slower, especially with larger TF-IDF matrices. This limits performance in real-time applications.

5. **No Personalization or Dynamic Learning**

The model cannot adapt to different users, preferences, or conversation styles. It also doesn't improve over time unless retrained.

3.1.3. Future Improvements

To build a more intelligent and natural chatbot

This baseline model is a great starting point for understanding chatbot mechanics, but it's only the first step toward building a truly intelligent conversational agent.

4 Advanced Modeling

```
from sentence_transformers import SentenceTransformer
from sklearn.metrics.pairwise import cosine_similarity

df_combined_extended.head(5)
```

```
                                              comment     response  \
0                                    am sorry 😭😭😭😭  no_response

1  for serah to invite maureen to stay in her hou...  no_response
2  jinsi raia wa mynmar wanavyokabiliana na kupan...  no_response
3  this is so painful....i can't help but cry wit...  no_response
4  condom inaposuluhisha ugoni! | jamiiforums | t...  no_response

   comment_length language  code_switched
0               3       en          False
1              65       en          False
2             382       sw          False
3              52       en          False
4             307       sw          False
```

```
df_cornell.head(5)
```

```
                                              comment  \
0  Can we make this quick Roxanne Korrine and And...
1  Well I thought wed start with pronunciation if...
2  Not the hacking and gagging and spitting part ...
3  Youre asking me out Thats so cute Whats your n...
4  No no its my fault we didnt have a proper intr...

                                            response
0  Well I thought wed start with pronunciation if...
1  Not the hacking and gagging and spitting part ...
2  Okay then how bout we try out some French cuis...
```

```
3                                                 Forget it
4                                                   Cameron

df_combined_extended_clean =
df_combined_extended[df_combined_extended['response'] !=
'no_response'].copy()
df_combined_extended_clean = df_combined_extended_clean[['comment',
'response']].rename(columns={'comment': 'prompt'})

# Renaming df_cornell columns

df_cornell_clean = df_cornell.rename(columns={'comment': 'prompt'})

# Combining datasets
df_all = pd.concat([df_cornell_clean, df_combined_extended_clean],
ignore_index=True)
df_all = df_all.dropna(subset=['prompt',
'response']).reset_index(drop=True)
```

4.1. Retrieval Model

Explaining the retrieval model

Load a sentence embedding model (all-MiniLM-L6-v2).

Encoded the prompts (questions) into vector embeddings.

Store those embeddings in a FAISS index.

```
What is FAISS Index?
FAISS stands for Facebook AI Similarity Search. It's an open-source
library developed by Meta AI for efficient similarity search and
clustering of dense vectors.
- It's super fast even with millions of vectors
- It supports approximate nearest neighbors, which trade a tiny bit of
accuracy for huge speed
```

Load the responses in a list.

At runtime, when a user sends a message, the model:

Embeds the user message,

Compares it to the saved vectors (using cosine similarity or L2 distance),

Returns the most similar response.

Data Source	Role in Retrieval Model
YouTube & Hugging Face	Adds **Swahili/mixed-language examples** to improve understanding and vocabulary coverage.
Movie Dialogues	Adds **conversational flow**, helps bot feel more natural.

Data Source	Role in Retrieval Model
Your Pairing Work	Created **prompt-response pairs** for the model to compare against.
Sentence Transformer	Turns all inputs into **meaning-based vectors** (even across languages).

```
!pip install faiss-cpu
```

```
Collecting faiss-cpu
  Using cached faiss_cpu-1.11.0.post1-cp311-cp311-
win_amd64.whl.metadata (5.1 kB)
Requirement already satisfied: numpy<3.0,>=1.25.0 in c:\users\helle\
anaconda3\envs\learn-env2\lib\site-packages (from faiss-cpu) (1.26.4)
Requirement already satisfied: packaging in c:\users\helle\anaconda3\
envs\learn-env2\lib\site-packages (from faiss-cpu) (23.2)
Using cached faiss_cpu-1.11.0.post1-cp311-cp311-win_amd64.whl (14.9
MB)
Installing collected packages: faiss-cpu
Successfully installed faiss-cpu-1.11.0.post1
```

```
import faiss

#model
#a pre-trained sentence transformer model called all-MiniLM-L6-v2

model = SentenceTransformer('sentence-transformers/all-MiniLM-L6-v2')

corpus_embeddings = model.encode(df_all['prompt'].tolist(),
show_progress_bar=True)
corpus_embeddings = np.array(corpus_embeddings).astype('float32')

# Creating FAISS index for fast similarity search
dimension = corpus_embeddings.shape[1]
index = faiss.IndexFlatL2(dimension)
index.add(corpus_embeddings)
```

```
Batches: 100%|██████████| 6930/6930 [44:50<00:00,  2.58it/s]
```

```
import json

# Save FAISS index
faiss.write_index(index, 'chatbot_index.faiss')

# Save responses to JSON
with open('chatbot_responses.json', 'w', encoding='utf-8') as f:
    json.dump(df_all['response'].tolist(), f, ensure_ascii=False,
indent=2)

print("Retrieval chatbot setup complete")
```

```
Retrieval chatbot setup complete
```

```python
# Load the saved responses

with open('chatbot_responses.json', 'r', encoding='utf-8') as f:
    responses = json.load(f)

def get_response(user_input, top_k=1):
    query_embedding = model.encode([user_input]).astype('float32')
    distances, indices = index.search(query_embedding, top_k)
    return [responses[i] for i in indices[0]]

user_input = "how are you feeling today?"
top_response = get_response(user_input, top_k=1)

print("User:", user_input)
print("Bot:", top_response[0])
```

```
User: how are you feeling today?
Bot: I feel much better Thank you for asking And you
```

```python
test_inputs = [
    "Hi there!",
    "What's your name?",
    "Tell me something funny",
    "Habari yako?",
    "Unaweza kunisaidia?",
    "I feel sad today"
]

for inp in test_inputs:
    print(f"\nUser: {inp}")
    print("Bot:", get_response(inp)[0])
```

```
User: Hi there!
Bot: Hi

User: What's your name?
Bot: Leeloo Minai LekararibaLaminaiTchai Ekbat De Sebat

User: Tell me something funny
Bot: What the hell

User: Habari yako?
Bot: Good Very good

User: Unaweza kunisaidia?
Bot: No Our informer in McCluskeys precinct Tonight at 800 he signed
out for Louis Restaurant in the Bronx Anyone know it

User: I feel sad today
```

```
Bot: You know how you feel when you come out of a bad hangover Like
your eyes can open a little bit more


def get_response(user_input, top_k=1):
    try:
        # Detect language (Swahili, English, etc.)
        lang = detect(user_input)
    except:
        lang = "unknown"

    # Print or log detected language (optional)
    print(f"Detected language: {lang}")

    # Convert input to vector and search for nearest response
    query_embedding = model.encode([user_input]).astype('float32')
    distances, indices = index.search(query_embedding, top_k)

    # Fetch and return responses
    return [responses[i] for i in indices[0]]

# Test input examples
test_inputs = [
    "How are you doing today?",          # English
    "Habari yako?",                      # Swahili
    "Naomba refund ya order yangu",     # Code-switch (Swahili +
English)
    "Je, unaweza kuniambia delivery iko wapi?",  # Mixed
]

for user_input in test_inputs:
    responses_output = get_response(user_input)
    print(f"\nUser: {user_input}")
    print(f"Bot: {responses_output[0]}")

Detected language: en

User: How are you doing today?
Bot: Its another day I think Im alright
Detected language: sw

User: Habari yako?
Bot: Good Very good
Detected language: id

User: Naomba refund ya order yangu
Bot: Tuttle
Detected language: sw

User: Je, unaweza kuniambia delivery iko wapi?
Bot: You know exactly where they are
```

4.2. Fine tuning

4.2.1. Loading Sample data

```
from datasets import load_dataset

ds = load_dataset("MohammadOthman/mo-customer-support-tweets-945k",
split="train")

# Preview first item
print(ds[0])
```

```
c:\Users\helle\anaconda3\envs\Learn-env2\Lib\site-packages\tqdm\
auto.py:21: TqdmWarning: IProgress not found. Please update jupyter
and ipywidgets. See
https://ipywidgets.readthedocs.io/en/stable/user_install.html
  from .autonotebook import tqdm as notebook_tqdm

{'output': 'I would love the chance to review the account and provide
assistance.', 'input': 'is the worst customer service'}
```

```
from sentence_transformers import InputExample

dataset = load_dataset("MohammadOthman/mo-customer-support-tweets-
945k", split="train")
sampled_dataset = dataset.shuffle(seed=42).select(range(5000))

# Creating InputExamples for fine-tuning
train_samples = [
    InputExample(texts=[item["input"], item["output"]])
    for item in sampled_dataset
    if item["output"] is not None
]
```

```
WARNING:tensorflow:From c:\Users\helle\anaconda3\envs\Learn-env2\Lib\
site-packages\tf_keras\src\losses.py:2976: The name
tf.losses.sparse_softmax_cross_entropy is deprecated. Please use
tf.compat.v1.losses.sparse_softmax_cross_entropy instead.


!pip install "accelerate>=0.26.0"

# a hugging face library often used when fine-tuning models like
transformers
```

```
Collecting accelerate>=0.26.0
  Using cached accelerate-1.9.0-py3-none-any.whl.metadata (19 kB)
Requirement already satisfied: numpy<3.0.0,>=1.17 in c:\users\helle\
anaconda3\envs\learn-env2\lib\site-packages (from accelerate>=0.26.0)
(1.26.4)
Requirement already satisfied: packaging>=20.0 in c:\users\helle\
```

```
anaconda3\envs\learn-env2\lib\site-packages (from accelerate>=0.26.0)
(23.2)
Requirement already satisfied: psutil in c:\users\helle\anaconda3\
envs\learn-env2\lib\site-packages (from accelerate>=0.26.0) (5.9.8)
Requirement already satisfied: pyyaml in c:\users\helle\anaconda3\
envs\learn-env2\lib\site-packages (from accelerate>=0.26.0) (6.0.2)
Requirement already satisfied: torch>=2.0.0 in c:\users\helle\
anaconda3\envs\learn-env2\lib\site-packages (from accelerate>=0.26.0)
(2.7.1)
Requirement already satisfied: huggingface_hub>=0.21.0 in c:\users\
helle\anaconda3\envs\learn-env2\lib\site-packages (from
accelerate>=0.26.0) (0.33.4)
Requirement already satisfied: safetensors>=0.4.3 in c:\users\helle\
anaconda3\envs\learn-env2\lib\site-packages (from accelerate>=0.26.0)
(0.5.3)
Requirement already satisfied: filelock in c:\users\helle\anaconda3\
envs\learn-env2\lib\site-packages (from huggingface_hub>=0.21.0-
>accelerate>=0.26.0) (3.18.0)
Requirement already satisfied: fsspec>=2023.5.0 in c:\users\helle\
anaconda3\envs\learn-env2\lib\site-packages (from
huggingface_hub>=0.21.0->accelerate>=0.26.0) (2025.3.0)
Requirement already satisfied: requests in c:\users\helle\anaconda3\
envs\learn-env2\lib\site-packages (from huggingface_hub>=0.21.0-
>accelerate>=0.26.0) (2.32.3)
Requirement already satisfied: tqdm>=4.42.1 in c:\users\helle\
anaconda3\envs\learn-env2\lib\site-packages (from
huggingface_hub>=0.21.0->accelerate>=0.26.0) (4.67.1)
Requirement already satisfied: typing-extensions>=3.7.4.3 in c:\users\
helle\anaconda3\envs\learn-env2\lib\site-packages (from
huggingface_hub>=0.21.0->accelerate>=0.26.0) (4.14.1)
Requirement already satisfied: sympy>=1.13.3 in c:\users\helle\
anaconda3\envs\learn-env2\lib\site-packages (from torch>=2.0.0-
>accelerate>=0.26.0) (1.14.0)
Requirement already satisfied: networkx in c:\users\helle\anaconda3\
envs\learn-env2\lib\site-packages (from torch>=2.0.0-
>accelerate>=0.26.0) (3.5)
Requirement already satisfied: jinja2 in c:\users\helle\anaconda3\
envs\learn-env2\lib\site-packages (from torch>=2.0.0-
>accelerate>=0.26.0) (3.1.6)
Requirement already satisfied: mpmath<1.4,>=1.1.0 in c:\users\helle\
anaconda3\envs\learn-env2\lib\site-packages (from sympy>=1.13.3-
>torch>=2.0.0->accelerate>=0.26.0) (1.3.0)
Requirement already satisfied: colorama in c:\users\helle\anaconda3\
envs\learn-env2\lib\site-packages (from tqdm>=4.42.1-
>huggingface_hub>=0.21.0->accelerate>=0.26.0) (0.4.6)
Requirement already satisfied: MarkupSafe>=2.0 in c:\users\helle\
anaconda3\envs\learn-env2\lib\site-packages (from jinja2-
>torch>=2.0.0->accelerate>=0.26.0) (3.0.2)
Requirement already satisfied: charset-normalizer<4,>=2 in c:\users\
```

```
helle\anaconda3\envs\learn-env2\lib\site-packages (from requests-
>huggingface_hub>=0.21.0->accelerate>=0.26.0) (3.4.2)
Requirement already satisfied: idna<4,>=2.5 in c:\users\helle\
anaconda3\envs\learn-env2\lib\site-packages (from requests-
>huggingface_hub>=0.21.0->accelerate>=0.26.0) (3.10)
Requirement already satisfied: urllib3<3,>=1.21.1 in c:\users\helle\
anaconda3\envs\learn-env2\lib\site-packages (from requests-
>huggingface_hub>=0.21.0->accelerate>=0.26.0) (2.4.0)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\helle\
anaconda3\envs\learn-env2\lib\site-packages (from requests-
>huggingface_hub>=0.21.0->accelerate>=0.26.0) (2025.4.26)
Using cached accelerate-1.9.0-py3-none-any.whl (367 kB)
Installing collected packages: accelerate
Successfully installed accelerate-1.9.0
```

```
from sentence_transformers import InputExample

# Example training data: a list of InputExample objects
train_samples = [
    InputExample(texts=["How are you?", "How do you do?"]),
    InputExample(texts=["What's your name?", "May I know your
name?"]),
    InputExample(texts=["I love pizza", "Pizza is my favorite"]),
]

from sentence_transformers import SentenceTransformer, losses
from torch.utils.data import DataLoader

model = SentenceTransformer('sentence-transformers/all-MiniLM-L6-v2')
train_dataloader = DataLoader(train_samples, shuffle=True,
batch_size=16)
train_loss = losses.MultipleNegativesRankingLoss(model)

model.fit(
    train_objectives=[(train_dataloader, train_loss)],
    epochs=3,
    warmup_steps=100
)
```

```
c:\Users\helle\anaconda3\envs\Learn-env2\Lib\site-packages\torch\
utils\data\dataloader.py:665: UserWarning: 'pin_memory' argument is
set as true but no accelerator is found, then device pinned memory
won't be used.
  warnings.warn(warn_msg)

<IPython.core.display.HTML object>
```

```
model.save("finetuned_customer_care_model")
```

```
# Example test input (user query)
user_input = "I need help tracking my order"

# Candidate responses (these can come from your response dataset or a
list)
candidate_responses = [
    "Sure, let me check the status of your order.",
    "Please provide your order number so I can assist you.",
    "Try rebooting your device.",
    "That's not something we can help with."
]

# Encoding the input and candidates
from numpy import dot
from numpy.linalg import norm

user_embedding = model.encode(user_input)
response_embeddings = model.encode(candidate_responses)

# Computing cosine similarities
def cosine_similarity(a, b):
    return dot(a, b) / (norm(a) * norm(b))

similarities = [cosine_similarity(user_embedding, resp_emb) for
resp_emb in response_embeddings]

best_index = similarities.index(max(similarities))
print("User:", user_input)
print("Bot:", candidate_responses[best_index])

User: I need help tracking my order
Bot: Sure, let me check the status of your order.
```

4.3. Evaluation

4.3.1. Semantic Similarity Evaluation

```
from sentence_transformers.evaluation import
EmbeddingSimilarityEvaluator

# Sample sentence pairs and scores
sentences1 = [
    "Where is my order?",
    "Your service is terrible",
    "Can I get a refund?",
    "Thank you for the help"
]

sentences2 = [
    "The delivery should arrive today.",
```

```
    "I’m sorry to hear that, let me assist.",
    "Sure, let me process your refund now.",
    "Glad we could help!"
]

# Human-labeled similarity scores
scores = [0.9, 0.8, 1.0, 0.95]

# Evaluate
evaluator = EmbeddingSimilarityEvaluator(sentences1, sentences2,
scores)
model.evaluate(evaluator)
```

```
{'pearson_cosine': 0.9224705839869486, 'spearman_cosine':
0.7999999999999999}
```

4.3.2. Retrieval-Based Evaluation

```
from sentence_transformers import util

# Corpus of known responses (like chatbot answers)
corpus = [
    "I'm checking on your order right now.",
    "Sorry to hear that, let me look into it.",
    "Your refund has been processed.",
    "We're happy to assist you anytime!",
    "Please allow 24 hours for delivery."
]

corpus_embeddings = model.encode(corpus, convert_to_tensor=True)

# Example user queries
queries = [
    "Where is my delivery?",
    "This service sucks.",
    "I want a refund",
    "Thanks for the help!",
    "How long should I wait?"
]

# Evaluating each query
for query in queries:
    query_embedding = model.encode(query, convert_to_tensor=True)
    hits = util.semantic_search(query_embedding, corpus_embeddings,
top_k=1)
    top_hit = hits[0][0]
    print(f"\nQuery: {query}")
    print(f"→ Top Match (Score: {top_hit['score']:.2f}):
{corpus[top_hit['corpus_id']]}")
```

```
Query: Where is my delivery?
→ Top Match (Score: 0.55): Please allow 24 hours for delivery.

Query: This service sucks.
→ Top Match (Score: 0.32): Sorry to hear that, let me look into it.

Query: I want a refund
→ Top Match (Score: 0.70): Your refund has been processed.

Query: Thanks for the help!
→ Top Match (Score: 0.33): We're happy to assist you anytime!

Query: How long should I wait?
→ Top Match (Score: 0.16): Please allow 24 hours for delivery.
```

4.3.3 Further Training

```
from sentence_transformers import InputExample
import random

# Swahili-only, English-only, and mixed-language ecommerce dialogues
swahili_inputs = [
    ("Je, ninaweza kulipa kwa M-Pesa?", "Ndiyo, tunakubali malipo
kupitia M-Pesa."),
    ("Nimesubiri siku tatu sasa", "Tunaomba radhi, tutakujulisha mara
moja kuhusu agizo lako."),
    ("Naomba refund", "Tunaomba radhi kwa usumbufu. Pesa zako
zitarudishwa hivi karibuni."),
    ("Nataka kubadilisha agizo langu", "Tafadhali tuma ombi lako la
mabadiliko kupitia akaunti yako."),
    ("Agizo langu halijafika", "Tunaomba radhi, tunaifuatilia mara
moja."),
    ("Ninahitaji msaada na akaunti yangu", "Tafadhali elezea shida
yako na tutakusaidia."),
    ("Je, kuna ofa maalum?", "Ndiyo, tuna punguzo la asilimia 10 wiki
hii."),
    ("Huduma yenu ni bora", "Asante sana kwa maoni yako chanya."),
    ("Nimepokea bidhaa isiyo sahihi", "Tunaomba radhi, tafadhali
rudisha bidhaa na tutatuma mpya."),
    ("Je, mnafanya usafirishaji kimataifa?", "Ndiyo, tunasafirisha
kimataifa kwa ada ya ziada."),
]

english_inputs = [
    ("Where is my package?", "Your order is on the way and will arrive
within 24 hours."),
    ("Thanks!", "You’re welcome! Let us know if you need anything
else."),
    ("I want to change my order", "Sure, you can update your order in
```

```
your account settings."),
    ("My item arrived damaged", "We're sorry to hear that. Please send
a photo and we'll replace it."),
    ("Do you offer express shipping?", "Yes, we offer same-day
delivery in select areas."),
    ("How do I track my order?", "You can track your order using the
tracking link sent to your email."),
    ("I forgot my password", "Click on ‘Forgot Password’ on the login
page to reset it."),
    ("Can I return an item?", "Yes, you can return items within 14
days."),
    ("Do you offer discounts?", "Yes, check our homepage for current
promotions."),
    ("Is this item in stock?", "Yes, it's currently available."),
]

mixed_inputs = [
    ("Nataka kuplace order lakini site haifunguki", "Tunaomba radhi,
jaribu tena baada ya dakika chache."),
    ("How much is shipping to Nairobi?", "Standard shipping to Nairobi
is KSh 250."),
    ("Agizo langu limechelewa", "We're sorry for the delay, your
package is on its way."),
    ("Is it possible to cancel my agizo?", "Yes, you can cancel your
order within 30 minutes."),
    ("Can I pay via M-Pesa or card?", "Yes, both M-Pesa and card
payments are accepted."),
    ("Je, kuna warranty kwa hizi bidhaa?", "Yes, all electronics come
with a 1-year warranty."),
    ("Nimesahau password ya akaunti", "Click on ‘Forgot Password’ on
the login screen."),
    ("Delivery inachukua muda gani?", "It takes 1-2 business days
within Nairobi."),
    ("I need a refund for my last agizo", "Please contact support and
we’ll initiate a refund."),
    ("Je, hii item iko available?", "Yes, it's available and ready to
ship."),
]

# Convert to InputExample
all_samples = [
    InputExample(texts=[q, a])
    for q, a in (swahili_inputs + english_inputs + mixed_inputs)
]

# Multiply and shuffle to get ~510 samples
train_samples = all_samples * 17
random.shuffle(train_samples)
```

```
from sentence_transformers import SentenceTransformer, losses, models
from torch.utils.data import DataLoader

# Loading transformer model
model = SentenceTransformer('sentence-transformers/all-MiniLM-L6-v2')

train_dataloader = DataLoader(train_samples, shuffle=True,
batch_size=16)

# Loss function
train_loss = losses.MultipleNegativesRankingLoss(model)

# Fine-tuning model
model.fit(
    train_objectives=[(train_dataloader, train_loss)],
    epochs=3,
    warmup_steps=100,
    show_progress_bar=True
)
```

```
c:\Users\helle\anaconda3\envs\Learn-env2\Lib\site-packages\torch\
utils\data\dataloader.py:665: UserWarning: 'pin_memory' argument is
set as true but no accelerator is found, then device pinned memory
won't be used.
  warnings.warn(warn_msg)
```

```
<IPython.core.display.HTML object>
```

```
model.save('./ecom-mixedlang-model')

query = "Je, mnapokea Visa Card?"
corpus = ["Yes, we accept Visa Card.", "No, only M-Pesa is allowed.",
"You can use credit or debit cards."]

from sentence_transformers import util

query_embedding = model.encode(query, convert_to_tensor=True)
corpus_embeddings = model.encode(corpus, convert_to_tensor=True)

hits = util.semantic_search(query_embedding, corpus_embeddings,
top_k=2)
print("Best Match:", corpus[hits[0][0]['corpus_id']])
```

```
Best Match: Yes, we accept Visa Card.
```

```
# loading Fine tuned model

from sentence_transformers import SentenceTransformer, util

model = SentenceTransformer('./ecom-mixedlang-model')
```

```
# Defining Knowledge based

# Define answers the bot can return
corpus = [
    "Ndiyo, tunakubali malipo kupitia M-Pesa.",
    "Your order is on the way and will arrive within 24 hours.",
    "Tunaomba radhi kwa usumbufu. Pesa zako zitarudishwa hivi
karibuni.",
    "You're welcome! Let us know if you need anything else.",
    "Tunaomba radhi, tutakujulisha mara moja kuhusu agizo lako.",
    "Yes, both M-Pesa and card payments are accepted.",
    "Click on 'Forgot Password' on the login screen.",
    "It takes 1-2 business days within Nairobi.",
    "Tafadhali tuma ombi lako la mabadiliko kupitia akaunti yako.",
    "Yes, all electronics come with a 1-year warranty.",
    "Tunaomba radhi, jaribu tena baada ya dakika chache.",
]

# Encode the corpus once
corpus_embeddings = model.encode(corpus, convert_to_tensor=True)

#Defining  Response Function

def chat_response(user_query):
    query_embedding = model.encode(user_query, convert_to_tensor=True)
    hits = util.semantic_search(query_embedding, corpus_embeddings,
top_k=1)
    best_idx = hits[0][0]['corpus_id']
    return corpus[best_idx]

# Gradio Interface

import gradio as gr

with gr.Blocks() as demo:
    gr.Markdown("#  Ecommerce Support Bot")
    chatbot = gr.Chatbot()
    with gr.Row():
        txt = gr.Textbox(placeholder="Ask a question in Swahili,
English, or both...", label="Your Message")
        send_btn = gr.Button("Send")

    def respond(message, chat_history):
        reply = chat_response(message)
        chat_history.append((message, reply))
        return chat_history, ""

    send_btn.click(respond, [txt, chatbot], [chatbot, txt])

demo.launch()
```

```
C:\Users\helle\AppData\Local\Temp\ipykernel_15584\3967544464.py:7:
UserWarning: You have not specified a value for the `type` parameter.
Defaulting to the 'tuples' format for chatbot messages, but this is
deprecated and will be removed in a future version of Gradio. Please
set type='messages' instead, which uses openai-style dictionaries with
'role' and 'content' keys.
  chatbot = gr.Chatbot()

* Running on local URL:  http://127.0.0.1:7862
* To create a public link, set `share=True` in `launch()`.

<IPython.core.display.HTML object>
```