A special thanks to all my mentors for helping me constantly to progress technically

Jupyter notebook prepared, arranged and executed by Karthi Balasundaram , sentimentally analysing Swahili language using real tweet data from twitter.

Thanks and credits to Masakhane Community for joining hands and providing the Swahili dataset

In [3]:

```
# # installing natural language toolkit(nltk)
# !pip install nltk
```

```
Defaulting to user installation because normal site-packages is not writeable
Collecting nltk
  Downloading nltk-3.7-py3-none-any.whl (1.5 MB)
     |████████████████████████████████| 1.5 MB 2.4 MB/s
Requirement already satisfied: click in ./Library/Python/3.9/lib/python/site-p
ackages (from nltk) (8.0.3)
Collecting regex>=2021.8.3
  Downloading regex-2022.3.15-cp39-cp39-macosx_10_9_x86_64.whl (288 kB)
     |████████████████████████████████| 288 kB 2.6 MB/s
Requirement already satisfied: tqdm in /Library/Frameworks/Python.framework/Ve
rsions/3.9/lib/python3.9/site-packages (from nltk) (4.62.3)
Requirement already satisfied: joblib in /Library/Frameworks/Python.framework/
Versions/3.9/lib/python3.9/site-packages (from nltk) (1.0.1)
Installing collected packages: regex, nltk
  WARNING: The script nltk is installed in '/Users/karthibalasundaram/Library/
Python/3.9/bin' which is not on PATH.
  Consider adding this directory to PATH or, if you prefer to suppress this wa
rning, use --no-warn-script-location.
Successfully installed nltk-3.7 regex-2022.3.15
WARNING: You are using pip version 21.3.1; however, version 22.0.4 is availabl
e.
You should consider upgrading via the '/Library/Frameworks/Python.framework/Ve
rsions/3.9/bin/python3.9 -m pip install --upgrade pip' command.
```

In [9]:

```
# # installing openpyxl (a python library to read/write excel files)
# !pip install openpyxl
```

```
Defaulting to user installation because normal site-packages is not writeable
Collecting openpyxl
  Downloading openpyxl-3.0.9-py2.py3-none-any.whl (242 kB)
     |████████████████████████████████| 242 kB 1.7 MB/s
Collecting et-xmlfile
  Downloading et_xmlfile-1.1.0-py3-none-any.whl (4.7 kB)
Installing collected packages: et-xmlfile, openpyxl
Successfully installed et-xmlfile-1.1.0 openpyxl-3.0.9
WARNING: You are using pip version 21.3.1; however, version 22.0.4 is availabl
e.
You should consider upgrading via the '/Library/Frameworks/Python.framework/Ve
rsions/3.9/bin/python3.9 -m pip install --upgrade pip' command.
```

In [1]:

```
#importing other default and necessary libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import string
import re
import nltk
from nltk.util import pr
from nltk.corpus import stopwords
import warnings
warnings.filterwarnings('ignore')
stemmer = nltk.SnowballStemmer("english")
nltk.download('stopwords')
stopword=set(stopwords.words('english'))
```

```
[nltk_data] Downloading package stopwords to
[nltk_data]     /Users/karthibalasundaram/nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
```

In [16]:

```
#reading the excel file using pandas library
data = pd.read_csv("/Users/karthibalasundaram/Desktop/Emerging_Technologies/E
```

In [17]:

```
#the below line calls last 5 rows from the excel
data.tail()
```

Out[17]:

	Tweets	Labels	Language
2258	Je unamfahamu kijana yeyote ambaye ana tatizo ...	0	Swahili
2259	Af ndio inanoga mzee juma halali damu inaflow ...	0	Swahili
2260	Viingilio vya tamasha kubwa zaidi nchini Unawe...	0	Swahili
2261	Asanteni Asanteni kwa kuungana na mimi sasa t...	1	Swahili
2262	Hakuna maji wangeishijekuziba watu midomo si ...	1	Swahili

In [18]:

```
#the below line calls first 5 rows from the excel
data.head()
```

Out[18]:

	Tweets	Labels	Language
0	So chuga si tunakutana kesho kwenye Nyamachoma...	0	Swahili
1	Asante sana watu wa Sirari jimbo la Tarime ...	1	Swahili
2	Leo nimepata kitambulisho changu cha taifa ...	1	Swahili
3	Mgema akisifiwa tembo hulitia maji	0	Swahili
4	Ee Mwenyezi Mungu Msamehe na Umrehemu na Umuaf...	1	Swahili

In [19]:

```
#understanding rows and columns present in the excel
data.shape
```

Out[19]:

```
(2263, 3)
```

In [20]:

```
#retreives basic info about the excel data
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2263 entries, 0 to 2262
Data columns (total 3 columns):
 #   Column    Non-Null Count  Dtype 
---  ------    --------------  ----- 
 0   Tweets    2263 non-null   object
 1   Labels    2263 non-null   int64 
 2   Language  2263 non-null   object
dtypes: int64(1), object(2)
memory usage: 53.2+ KB
```

In [21]:

```
#a brief description about the data
data.describe()
```

Out[21]:

	Labels
count	2263.000000
mean	0.196642
std	0.607751
min	-1.000000
25%	0.000000
50%	0.000000
75%	1.000000
max	1.000000

In [22]:

```
data.isnull().sum()
```

Out[22]:

```
Tweets      0
Labels      0
Language    0
dtype: int64
```

In [23]:

```
#retreives all the columns
data.columns
```

Out[23]:

```
Index(['Tweets', 'Labels', 'Language'], dtype='object')
```

In [24]:

```
#lists first 5 data(tweets) listed under the column "tweet"
data[["Tweets"]].head()
```

Out[24]:

	Tweets
0	So chuga si tunakutana kesho kwenye Nyamachoma...
1	Asante sana watu wa Sirari jimbo la Tarime ...
2	Leo nimepata kitambulisho changu cha taifa ...
3	Mgema akisifiwa tembo hulitia maji
4	Ee Mwenyezi Mungu Msamehe na Umrehemu na Umuaf...

In [25]:

```
#lists first 5 data(username) listed under the column "username"
data[["Labels"]].head()
```

Out[25]:

	Labels
0	0
1	1
2	1
3	0
4	1

In [27]:

```
#lists first 5 data(langauge) listed under the column "language"
data[["Language"]].head()
```

Out[27]:

	Language
0	Swahili
1	Swahili
2	Swahili
3	Swahili
4	Swahili

In [28]:

```
#displays the tweets posted in corresponding languages
data["Language"].value_counts()
```

Out[28]:

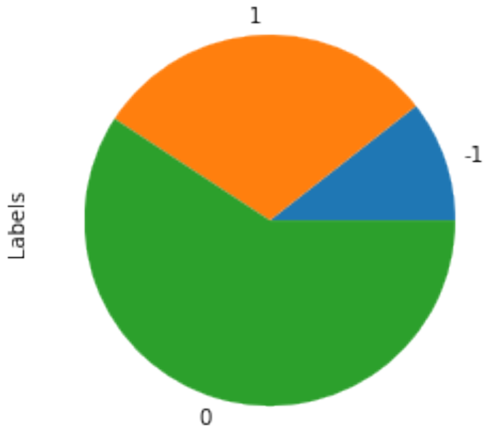
```
Swahili    2263
Name: Language, dtype: int64
```

In [29]:

```
#sorting the languages
pi = data.Labels.value_counts().sort_values()
```

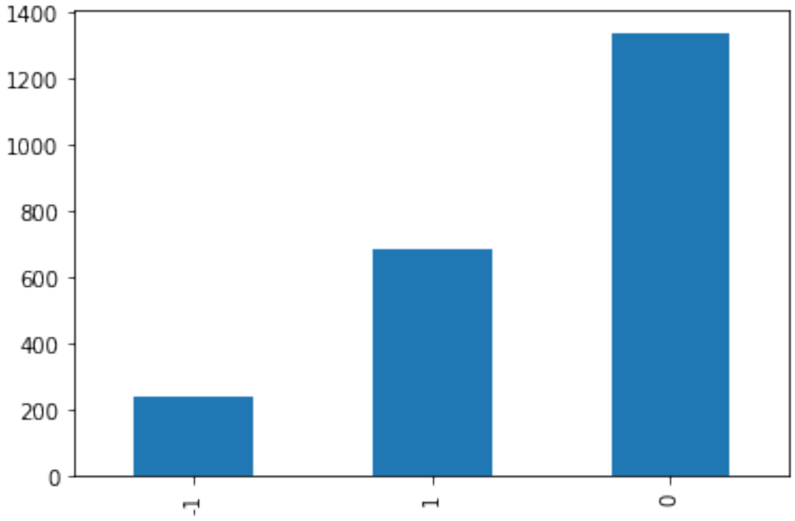
In [30]:

```
#displaying the sorted lanuages in a pie chart
displ = pi.plot(kind = 'pie')
```



In [31]:

```
#displaying the sorted lanuages in a bar chart
displ1 = pi.plot(kind = 'bar')
```



In [32]:

```
#displays the 369th tweet
data["Tweets"][369]
```

Out[32]:

```
'Kwanza kufikiria tu kila banker ni teller ni kipimo tosha cha uwezo wa mtu ku
fikiriso tuwaache'
```

In [33]:

```
# defining function for twitter hashtag extraction to classify sentiment anal
def hashtag_extract(text_list):
    hashtags = []
    for text in text_list:
        ht = re.findall(r"#(\w+)", text)
        hashtags.append(ht)
    return hashtags
```

In [34]:

```
def generate_hashtag_freqdist(hashtags):
    a = nltk.FreqDist(hashtags)
    b = pd.DataFrame({'Hashtag': list(a.keys()),'Count': list(a.values())})
    # selecting top 15 most frequent hashtags
    b = b.nlargest(columns="Count", n = 25)
    plt.figure(figsize=(16,7))
    ax = sns.barplot(data=b, x= "Hashtag", y = "Count")
    plt.xticks(rotation=80)
    ax.set(ylabel = 'Count')
    plt.show()
```

In [36]:

```
hashtags = hashtag_extract(data["Tweets"])
hashtags = sum(hashtags, [])
```

In [37]:

```
import seaborn as sns
```

In [39]:

```
# generate_hashtag_freqdist(hashtags)
```

In [41]:

```
data['total_length_characters'] = data['Tweets'].str.len()
print(data['total_length_characters'])
total_length_characters = data['total_length_characters'].sum()
print(total_length_characters)
count = 0
for y in data["Tweets"]:
    count = count + 1
print(count)
average_length = total_length_characters / count
print (average_length)
```

```
0       113
1       121
2        57
3        37
4       264
       ...
2258     62
2259     53
2260     93
2261     83
2262     86
Name: total_length_characters, Length: 2263, dtype: int64
246291
2263
108.8338488731772
```

In [42]:

```
data['total_count_words'] = data['Tweets'].str.split().str.len()
print(data['total_count_words'])
total_words = data['total_count_words'].sum()
print(total_words)
count = 0
for y in data["Tweets"]:
    count = count + 1
print(count)
average_words = total_words / count
print (average_words)
```

```
0       14
1       22
2        8
3        5
4       44
        ..
2258    11
2259     9
2260    14
2261    12
2262    13
Name: total_count_words, Length: 2263, dtype: int64
38005
2263
16.794078656650463
```

In [43]:

```
def clean(text):
    text = str(text).lower()
    text = re.sub('\[.*?\]', '', text)
    text = re.sub('https?://\S+|www\.\S+', '', text)
    text = re.sub('<.*?>+', '', text)
    text = re.sub('[%s]' % re.escape(string.punctuation), '', text)
    text = re.sub('\n', '', text)
    text = re.sub('\w*\d\w*', '', text)
    text = [word for word in text.split(' ') if word not in stopword]
    text=" ".join(text)
    text = [stemmer.stem(word) for word in text.split(' ')]
    text=" ".join(text)
    return text
data["Tweets"] = data["Tweets"].apply(clean)
```

In [44]:

```
data['total_length_characters'] = data['Tweets'].str.len()
print(data['total_length_characters'])
total_length_characters = data['total_length_characters'].sum()
print(total_length_characters)
count = 0
for y in data["Tweets"]:
    count = count + 1
print(count)
average_length = total_length_characters / count
print (average_length)
```

```
0       106
1       117
2        56
3        37
4       256
       ...
2258     60
2259     53
2260     93
2261     81
2262     86
Name: total_length_characters, Length: 2263, dtype: int64
239110
2263
105.66062748563853
```

In [45]:

```
data['total_count_words'] = data['Tweets'].str.split().str.len()
print(data['total_count_words'])
total_words = data['total_count_words'].sum()
print(total_words)
count = 0
for y in data["Tweets"]:
    count = count + 1
print(count)
average_words = total_words / count
print (average_words)
```

```
0       13
1       22
2        8
3        5
4       44
        ..
2258    11
2259     9
2260    14
2261    12
2262    13
Name: total_count_words, Length: 2263, dtype: int64
36861
2263
16.288555015466194
```

In [68]:

```
!pip3 install textblob
```

```
Defaulting to user installation because normal site-packages is not writeable
Collecting textblob
  Downloading textblob-0.17.1-py2.py3-none-any.whl (636 kB)
     |████████████████████████████████| 636 kB 1.7 MB/s
Requirement already satisfied: nltk>=3.1 in ./Library/Python/3.9/lib/python/si
te-packages (from textblob) (3.7)
Requirement already satisfied: joblib in /Library/Frameworks/Python.framework/
Versions/3.9/lib/python3.9/site-packages (from nltk>=3.1->textblob) (1.0.1)
Requirement already satisfied: click in ./Library/Python/3.9/lib/python/site-p
ackages (from nltk>=3.1->textblob) (8.0.3)
Requirement already satisfied: tqdm in /Library/Frameworks/Python.framework/Ve
rsions/3.9/lib/python3.9/site-packages (from nltk>=3.1->textblob) (4.62.3)
Requirement already satisfied: regex>=2021.8.3 in ./Library/Python/3.9/lib/pyt
hon/site-packages (from nltk>=3.1->textblob) (2022.3.15)
Installing collected packages: textblob
Successfully installed textblob-0.17.1
WARNING: You are using pip version 21.3.1; however, version 22.0.4 is availabl
e.
You should consider upgrading via the '/Library/Frameworks/Python.framework/Ve
rsions/3.9/bin/python3.9 -m pip install --upgrade pip' command.
```

In [46]:

```
from textblob import TextBlob
```

In [47]:

```
def analyze_sentiment(tweet):
    analysis = TextBlob(clean(tweet))
    if analysis.sentiment.polarity > 0:
        return 1
    elif analysis.sentiment.polarity == 0:
        return 0
    else:
        return -1
```

In [50]:

```
data['Sentiment'] = data['Tweets'].apply(lambda x:analyze_sentiment(x))
data['Source'] = 'random_user'
data['Length'] = data['Tweets'].apply(len)
data['Word_counts'] = data['Tweets'].apply(lambda x:len(str(x).split()))
```

In [57]:

```
data1=data[['Tweets', 'Sentiment', 'Source',
'Length','Word_counts']]
data1.head()
```

Out[57]:

	Tweets	Sentiment	Source	Length	Word_counts
0	chuga si tunakutana kesho kweny nyamachoma fes...	0	random_user	106	13
1	asant sana watu wa sirari jimbo la tarim vi...	0	random_user	117	22
2	leo nimepata kitambulisho changu cha taifa ...	0	random_user	56	8
3	mgema akisifiwa tembo hulitia maji	0	random_user	37	5
4	ee mwenyezi mungu msameh na umrehemu na umuafu...	0	random_user	256	44

In [59]:

```
data1['Clean tweet'] = data1['Tweets'].apply(lambda x:clean(x))
```

In [61]:

```
data1[["Clean tweet","Sentiment"]].iloc[369]
```

Out[61]:

```
Clean tweet    kwanza kufikiria tu kila banker ni teller ni k...
Sentiment                                                     0
Name: 369, dtype: object
```

In [62]:

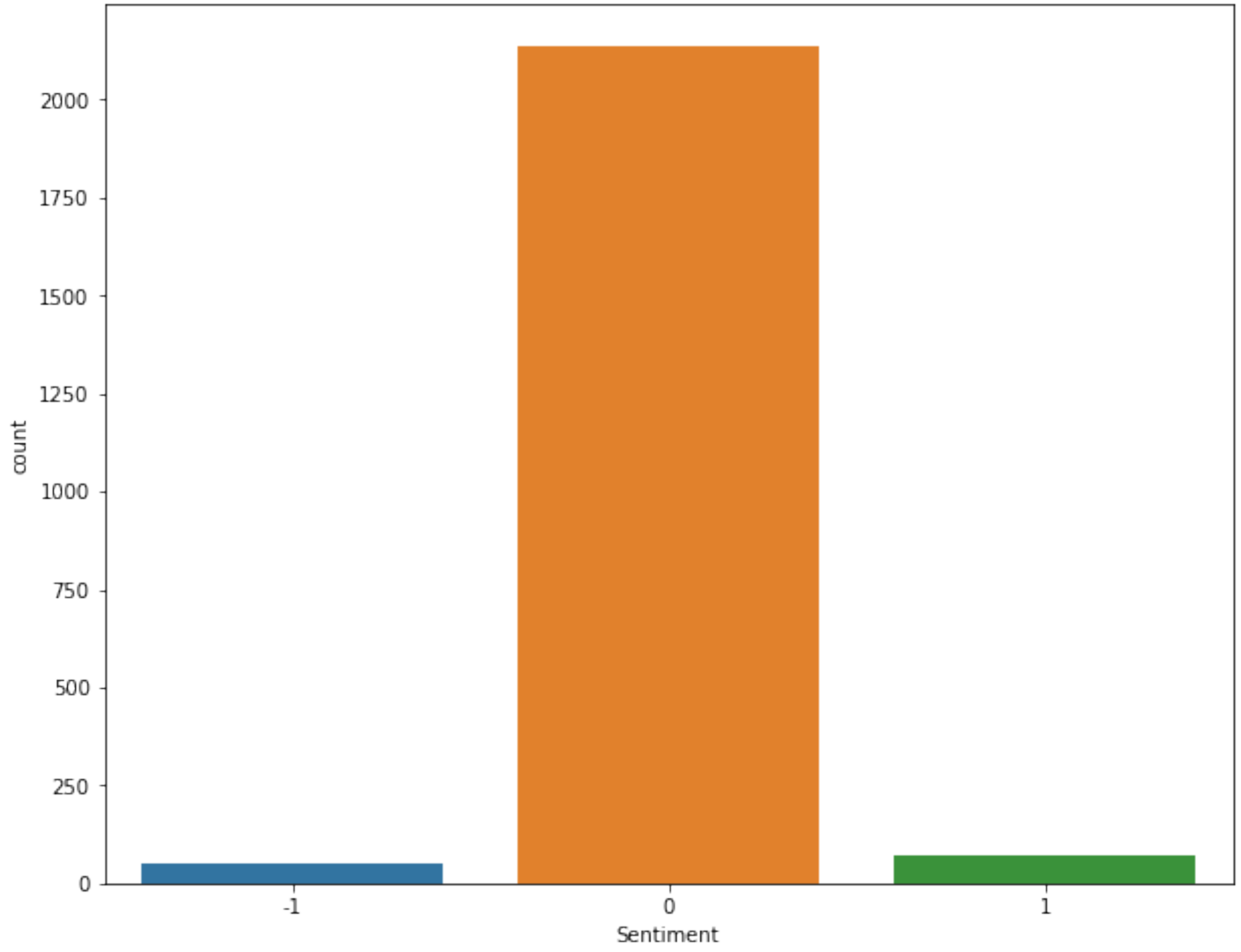
```
sentiment = data1['Sentiment'].value_counts()
sentiment
```

Out[62]:

```
 0    2138
 1      73
-1      52
Name: Sentiment, dtype: int64
```

In [63]:

```
plt.figure(figsize = (10,8))
sns.countplot(data = data1, x = 'Sentiment')
plt.show()
```



In [78]:

```
# fig, ax = plt.subplots(figsize = (6, 6))
# sizes = [count for count in data1['Sentiment'].value_counts()]
# labels = list(data['Sentiment'].value_counts().index)
# explode = (0.1, 0, 0)
# # ax.pie(x = sizes, labels = labels, autopct = '%1.1f%%', explode = explode
# # ax.set_title('Sentiment Polarity on invasion Tweets Data \n (total = 9127
# plt.show()
```

In [64]:

```
neutral = data1[data1['Sentiment'] == 0]
positive = data1[data1['Sentiment'] == 1]
negative = data1[data1['Sentiment'] == -1]
```

In [65]:

```
negative.iloc[1]
```

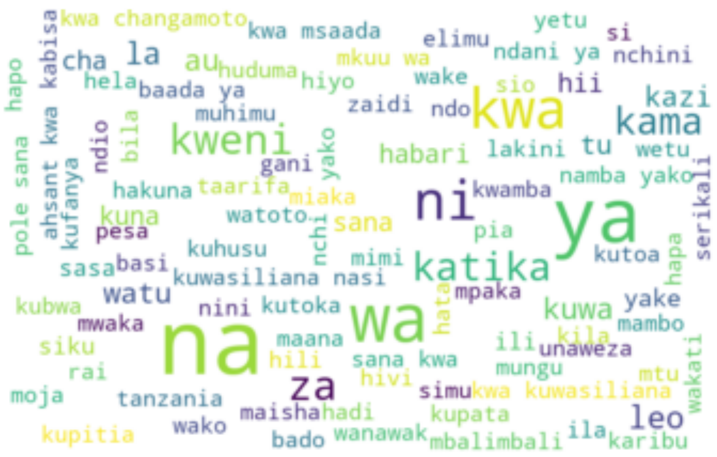
Out[65]:
```
Tweets             tulikuwa kama  lakini mpaka leo hii tumebak...
Sentiment                                                      -1
Source                                                random_user
Length                                                        118
Word_counts                                                    17
Clean tweet        tulikuwa kama  lakini mpaka leo hii tumebak...
Name: 69, dtype: object
```

In [67]:
```
#neutral_text
print("Neutral tweet example :",neutral['Tweets'].values[15])
# Positive tweet
print("Positive Tweet example :",positive['Tweets'].values[37])
#negative_text
print("Negative Tweet example :",negative['Tweets'].values[1])
```

```
Neutral tweet example : uhuru  jumatano  juni   ukw daima linapatikana mtaani
kwako sasa kwa bei ile ile ya tsh  tu wahi nakala yako
Positive Tweet example :    jana ni mara yangu ya mwisho kumpa barca straight
win ijumaa leo natembea hivi game  odd  stake  nimech
Negative Tweet example :    tulikuwa kama  lakini mpaka leo hii tumebakia watu
wawili tu elimu yangu ilinikomboa pale nilipoweza kuandika propo
```

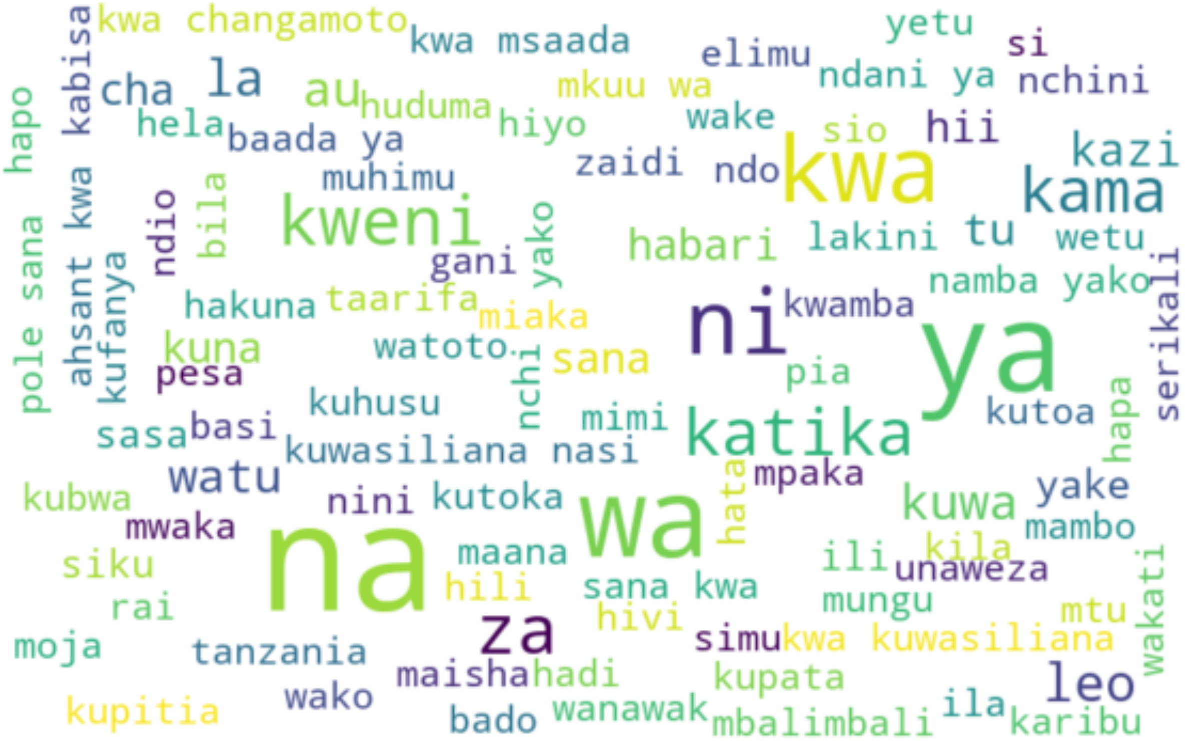
In [68]:
```
from wordcloud import WordCloud
```

In [69]:
```
txt = ' '.join(text for text in data1['Clean tweet'])
wordcloud = WordCloud(
            background_color = 'white',
            max_font_size = 100,
            max_words = 100,
            width = 800,
            height = 500
            ).generate(txt)
plt.imshow(wordcloud,interpolation = 'bilinear')
plt.axis('off')
plt.show()
```



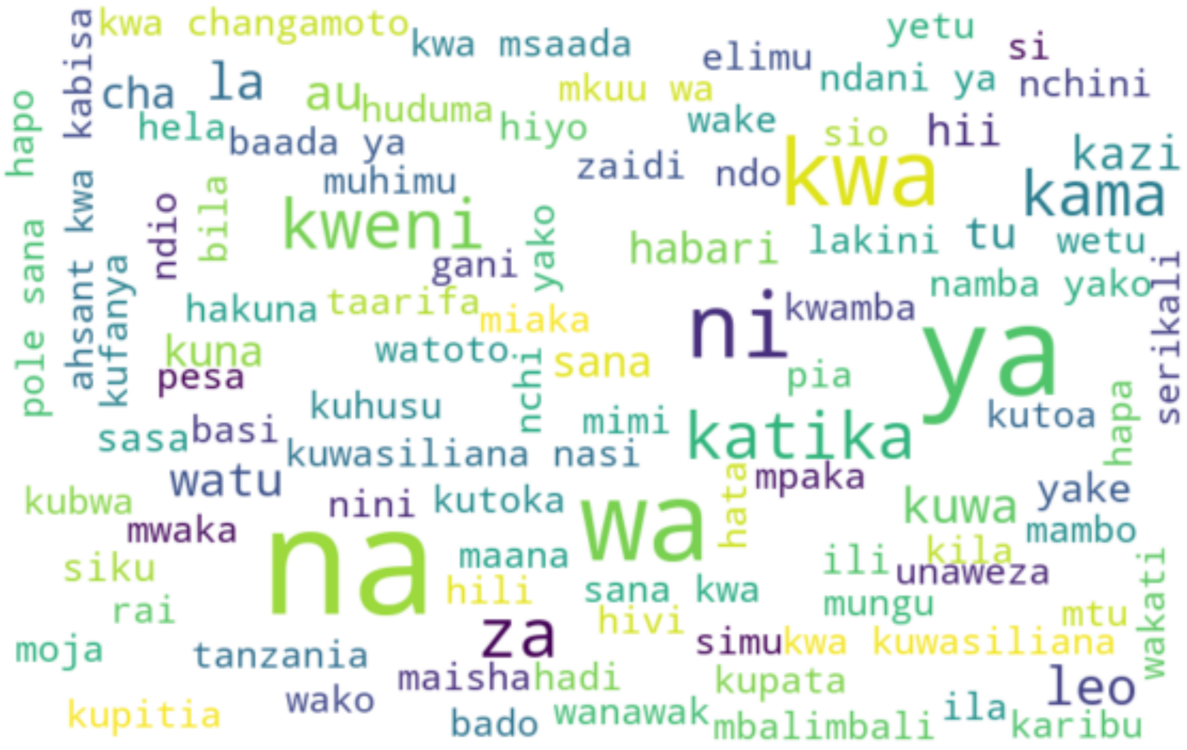
In [70]:

```
positive_words =' '.join([text for text in data1['Clean tweet'][data1['Sentim
#wordcloud = WordCloud(width=800, height=500, random_state=21, max_font_size=
wordcloud1 = WordCloud(
            random_state=21,
            max_font_size = 110,
            max_words = 100,
            width = 800,
            height = 500
            ).generate(positive_words)
plt.figure(figsize=(10, 7))
plt.imshow(wordcloud, interpolation="bilinear")
plt.axis('off')
plt.show()
```



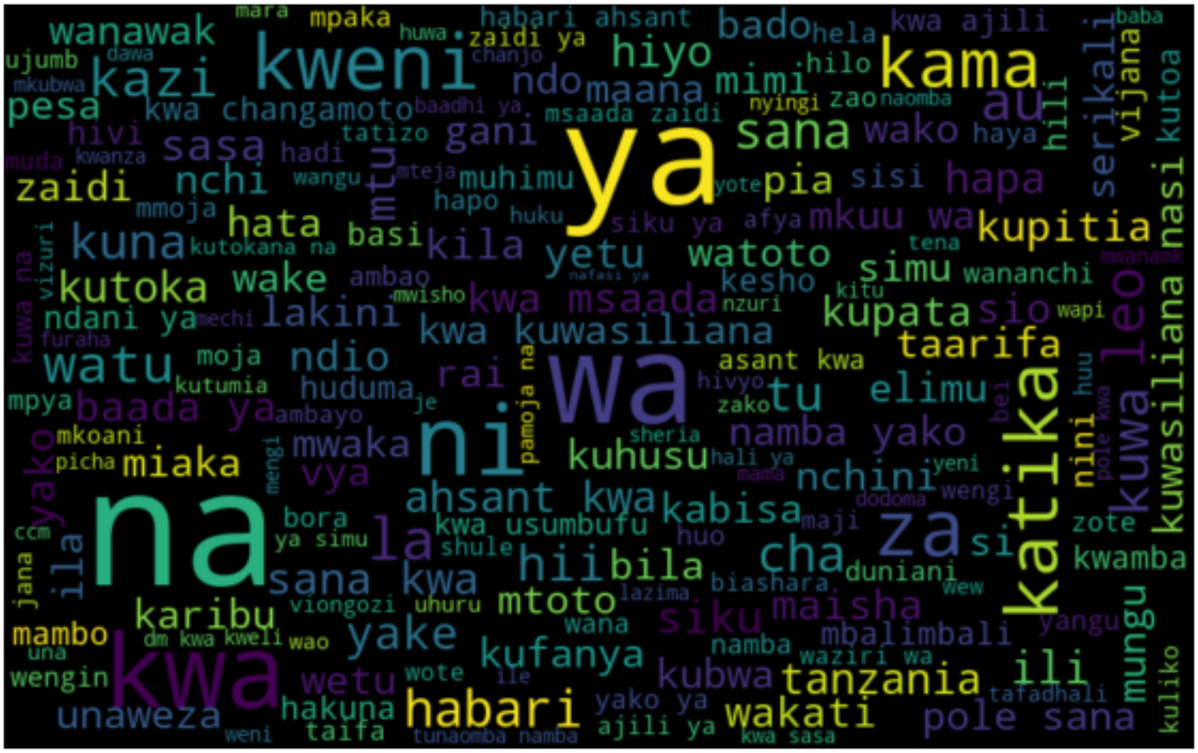
In [71]:

```
negative_words =' '.join([text for text in data1['Clean tweet'][data1['Sentim
#wordcloud = WordCloud(width=800, height=500, random_state=21, max_font_size=
wordcloud1 = WordCloud(
            random_state=21,
            max_font_size = 110,
            max_words = 100,
            width = 800,
            height = 500
            ).generate(negative_words)
plt.figure(figsize=(10, 7))
plt.imshow(wordcloud, interpolation="bilinear")
plt.axis('off')
plt.show()
```



In [72]:

```
neutral_words =' '.join([text for text in data1['Clean tweet'][data1['Sentime
wordcloud = WordCloud(width=800, height=500, random_state=21, max_font_size=1
plt.figure(figsize=(10, 7))
plt.imshow(wordcloud, interpolation="bilinear")
plt.axis('off')
plt.show()
```



Thank you for your time going through.

Dataset may be shared upon request.