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Temporary\n",
      "[nltk_data]     failure in name resolution>\n"
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Temporary\n",
      "[nltk_data]     failure in name resolution>\n"
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    "import numpy as np\n",
    "import pandas as pd\n",
    "import seaborn as sns\n",
    "import matplotlib.pyplot as plt\n",
    "import plotly.express as px\n",
```

```
    "import re, string, unicodedata\n",
    "from string import punctuation\n",
    "from termcolor import colored\n",
    "from collections import Counter\n",
    "\n",
    "from sklearn.preprocessing import LabelBinarizer\n",
    "from sklearn.metrics import classification_report,confusion_matrix,
accuracy_score\n",
    "from sklearn.model_selection import train_test_split\n",
    "from sklearn.preprocessing import LabelEncoder\n",
    "\n",
    "import keras\n",
    "import tensorflow as tf\n",
    "from keras.preprocessing import text, sequence\n",
    "from keras.models import Sequential\n",
    "from keras.layers import Dense,Embedding,LSTM,Dropout\n",
    "from keras.callbacks import ReduceLROnPlateau\n",
    "from tensorflow.keras.preprocessing.text import Tokenizer\n",
    "\n",
    "import nltk\n",
    "from nltk.corpus import stopwords\n",
    "from textblob import Word\n",
    "nltk.download('stopwords')\n",
    "nltk.download('wordnet')\n",
    "nltk.download('omw-1.4')\n",
    "from nltk.stem.porter import PorterStemmer\n",
    "from wordcloud import WordCloud,STOPWORDS\n",
    "from nltk.stem import WordNetLemmatizer\n",
    "from nltk.tokenize import word_tokenize, sent_tokenize\n",
    "from nltk import pos_tag\n",
    "from nltk.corpus import wordnet\n",
    "\n",
    "from warnings import filterwarnings\n",
    "filterwarnings('ignore')\n",
    "\n",
    "from sklearn import set_config\n",
    "set_config(print_changed_only = False)\n",
    "\n",
    "#to see full text:\n",
    "pd.set_option(\"display.max_colwidth\", -1)\n",
    "\n",
    "print(colored(\"\\nNECESSARY LIBRARIES WERE SUCCESFULLY
IMPORTED...\", color = \"green\", attrs = [\"bold\", \"dark\"]))"
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    "\n",
    "print(colored(\"\\nDATASETS WERE SUCCESFULLY LOADED...\",  color =
\"green\", attrs = [\"bold\", \"dark\"]))"
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       "    }\n",
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       "      <td>Go until jurong point, crazy.. Available only in bugis
n great world la e buffet... Cine there got amore wat...</td>\n",
       "      <td>NaN</td>\n",
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       "      <td>ham</td>\n",
       "      <td>Ok lar... Joking wif u oni...</td>\n",
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21st May 2005. Text FA to 87121 to receive entry question(std txt
rate)T&amp;amp;C's apply 08452810075over18's</td>\n",
```

```
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       "      <td>NaN</td>\n",
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say...</td>\n",
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       "      <td>NaN</td>\n",
       "      <td>NaN</td>\n",
       "    </tr>\n",
       "    <tr>\n",
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       "      <td>Nah I don't think he goes to usf, he lives around here
though</td>\n",
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       "      <td>NaN</td>\n",
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       "1  ham    \n",
       "2  spam   \n",
       "3  ham    \n",
       "4  ham    \n",
       "\n",
       "
v2  \\\n",
       "0  Go until jurong point, crazy.. Available only in bugis n great
world la e buffet... Cine there got amore wat...
\n",
       "1  Ok lar... Joking wif u oni...
\n",
       "2  Free entry in 2 a wkly comp to win FA Cup final tkts 21st May
2005. Text FA to 87121 to receive entry question(std txt rate)T&C's apply
08452810075over18's   \n",
       "3  U dun say so early hor... U c already then say...
\n",
       "4  Nah I don't think he goes to usf, he lives around here though
\n",
       "\n",
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       "0  NaN        NaN        NaN        \n",
       "1  NaN        NaN        NaN        \n",
       "2  NaN        NaN        NaN        \n",
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    "data.rename(columns = {\"v1\": \"target\", \"v2\": \"text\"}, 
inplace = True)\n",
    "\n",
    "#drop unnecessary columns\n",
    "data.drop([\"Unnamed: 2\",\"Unnamed: 3\", \"Unnamed: 4\"], axis = 1, 
inplace = True)\n",
    "\n",
    "print(colored(\"\\nOPERATIONS ON DATASETS WERE SUCCESFULLY 
COMPLETED...\",  color = \"green\", attrs = [\"bold\", \"dark\"]))"
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       "        vertical-align: top;\n",
       "    }\n",
       "\n",
       "    .dataframe thead th {\n",
       "        text-align: right;\n",
       "    }\n",
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       "    </tr>\n",
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       "  <tbody>\n",
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       "      <td>ham</td>\n",
       "      <td>Go until jurong point, crazy.. Available only in bugis
n great world la e buffet... Cine there got amore wat...</td>\n",
       "    </tr>\n",
       "    <tr>\n",
       "      <th>1</th>\n",
       "      <td>ham</td>\n",
       "      <td>Ok lar... Joking wif u oni...</td>\n",
       "    </tr>\n",
       "    <tr>\n",
       "      <th>2</th>\n",
       "      <td>spam</td>\n",
       "      <td>Free entry in 2 a wkly comp to win FA Cup final tkts
21st May 2005. Text FA to 87121 to receive entry question(std txt
rate)T&amp;amp;C's apply 08452810075over18's</td>\n",
       "    </tr>\n",
```

```
       "    <tr>\n",
       "      <th>3</th>\n",
       "      <td>ham</td>\n",
       "      <td>U dun say so early hor... U c already then
say...</td>\n",
       "    </tr>\n",
       "    <tr>\n",
       "      <th>4</th>\n",
       "      <td>ham</td>\n",
       "      <td>Nah I don't think he goes to usf, he lives around here
though</td>\n",
       "    </tr>\n",
       "  </tbody>\n",
       "</table>\n",
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       "0  ham     \n",
       "1  ham     \n",
       "2  spam    \n",
       "3  ham     \n",
       "4  ham     \n",
       "\n",
       "
text  \n",
       "0  Go until jurong point, crazy.. Available only in bugis n great
world la e buffet... Cine there got amore wat...
\n",
       "1  Ok lar... Joking wif u oni...
\n",
       "2  Free entry in 2 a wkly comp to win FA Cup final tkts 21st May
2005. Text FA to 87121 to receive entry question(std txt rate)T&C's apply
08452810075over18's  \n",
       "3  U dun say so early hor... U c already then say...
\n",
       "4  Nah I don't think he goes to usf, he lives around here though
"
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    "Data columns (total 2 columns):\n",
    " #   Column  Non-Null Count  Dtype \n",
    "---  ------  --------------  ----- \n",
    " 0   target  5572 non-null   object\n",
    " 1   text    5572 non-null   object\n",
    "dtypes: object(2)\n",
    "memory usage: 87.2+ KB\n"
   ]
  }
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```
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     ]
    }
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      "\u001b[2m\u001b[1m\u001b[32m\n",
      "DUPLICATED VALUES WERE SUCCESFULLY DROPPED...\u001b[0m\n"
     ]
    }
   ],
   "source": [
    "data.drop_duplicates(inplace = True)\n",
    "\n",
    "print(colored(\"\\nDUPLICATED VALUES WERE SUCCESFULLY DROPPED...\", color = \"green\", attrs = [\"bold\", \"dark\"]))"
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     "text      0\n",
     "dtype: int64"
    ]
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       "    x.observe(outputEl, {childList: true});\n",
       "}}\n",
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\"percent+label\",\n",
     "                  marker = dict(line = dict(width = 1.5, color =
\"#410F01\")))\n",
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#T_88c97_row2_col3, #T_88c97_row2_col4, #T_88c97_row2_col5,
#T_88c97_row2_col6, #T_88c97_row2_col7 {\n",
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LETTERS...\u001b[0m\n"
     ]
    }
   ],
   "source": [
    "data[\"text\"] = data[\"text\"].apply(lambda x: \" \".join(x.lower()
for x in x.split()))\n",
    "\n",
    "print(colored(\"\\nUPPERCASE LETTERS WERE SUCCESFULLY CONVERTED INTO
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\"dark\"]))"
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      "NUMBERS WERE SUCCESFULLY DELETED...\u001b[0m\n"
     ]
    }
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    "\n",
    "print(colored(\"\\nNUMBERS WERE SUCCESFULLY DELETED...\", color =
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    "punctuation = list(string.punctuation)\n",
    "stop_words.update(punctuation)\n",
    "\n",
    "data[\"text\"] = data[\"text\"].apply(lambda x: \" \".join(x for x
in x.split() if x not in stop_words))\n",
    "\n",
    "print(colored(\"\\nSTOPWORDS AND PUNCTUATION WERE SUCCESFULLY
DELETED ...\", color = \"green\", attrs = [\"bold\", \"dark\"]))"
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      "  Please use the NLTK Downloader to obtain the resource:\n",
      "\n",
      "  \u001b[31m>>> import nltk\n",
      "  >>> nltk.download('omw-1.4')\n",
      "  \u001b[0m\n",
      "  For more information see: https://www.nltk.org/data.html\n",
      "\n",
      "  Attempted to load \u001b[93mcorpora/omw-1.4\u001b[0m\n",
      "\n",
      "  Searched in:\n",
      "    - '/root/nltk_data'\n",
      "    - '/opt/conda/nltk_data'\n",
      "    - '/opt/conda/share/nltk_data'\n",
      "    - '/opt/conda/lib/nltk_data'\n",
      "    - '/usr/share/nltk_data'\n",
      "    - '/usr/local/share/nltk_data'\n",
      "    - '/usr/lib/nltk_data'\n",
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"**********************************************************************\n
",
      "\n"
     ]
    },
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     "evalue": "\nLooks like you are missing some required data for this
feature.\n\nTo download the necessary data, simply run\n\n    python -m
textblob.download_corpora\n\nor use the NLTK downloader to download the
missing data: http://nltk.org/data.html\nIf this doesn't fix the problem,
file an issue at https://github.com/sloria/TextBlob/issues.\n",
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packages/nltk/corpus/util.py\u001b[0m in
\u001b[0;36m__load\u001b[0;34m(self)\u001b[0m\n\u001b[1;32m
83\u001b[0m
\u001b[0;32mtry\u001b[0m\u001b[0;34m:\u001b[0m\u001b[0;34m\u001b[0m\u001b
[0;34m\u001b[0m\u001b[0m\n\u001b[0;32m---> 84\u001b[0;31m
\u001b[0mroot\u001b[0m \u001b[0;34m=\u001b[0m
\u001b[0mnltk\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0mdata\u001b[0m\u001b[
0;34m.\u001b[0m\u001b[0mfind\u001b[0m\u001b[0;34m(\u001b[0m\u001b[0;34mf\
```

```
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01b[0m\u001b[0;34m\u001b[0m\u001b[0m\n\u001b[0m\u001b[1;32m
85\u001b[0m                 \u001b[0;32mexcept\u001b[0m
\u001b[0mLookupError\u001b[0m\u001b[0;34m:\u001b[0m\u001b[0;34m\u001b[0m\
u001b[0;34m\u001b[0m\u001b[0m\n",
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packages/nltk/data.py\u001b[0m in
\u001b[0;36mfind\u001b[0;34m(resource_name, paths)\u001b[0m\n\u001b[1;32m
582\u001b[0m     \u001b[0mresource_not_found\u001b[0m
\u001b[0;34m=\u001b[0m
\u001b[0;34mf\"\\n{sep}\\n{msg}\\n{sep}\\n\"\u001b[0m\u001b[0;34m\u001b[0
m\u001b[0;34m\u001b[0m\u001b[0m\n\u001b[0;32m--> 583\u001b[0;31m
\u001b[0;32mraise\u001b[0m
\u001b[0mLookupError\u001b[0m\u001b[0;34m(\u001b[0m\u001b[0mresource_not_
found\u001b[0m\u001b[0;34m)\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u00
1b[0m\u001b[0m\n\u001b[0m\u001b[1;32m    584\u001b[0m
\u001b[0;34m\u001b[0m\u001b[0m\n",
      "\u001b[0;31mLookupError\u001b[0m:
\n**********************************************************************\
n  Resource \u001b[93momw-1.4\u001b[0m not found.\n  Please use the NLTK
Downloader to obtain the resource:\n\n  \u001b[31m>>> import nltk\n  >>>
nltk.download('omw-1.4')\n  \u001b[0m\n  For more information see:
https://www.nltk.org/data.html\n\n  Attempted to load
\u001b[93mcorpora/omw-1.4.zip/omw-1.4/\u001b[0m\n\n  Searched in:\n    -
'/root/nltk_data'\n    - '/opt/conda/nltk_data'\n    -
'/opt/conda/share/nltk_data'\n    - '/opt/conda/lib/nltk_data'\n    -
'/usr/share/nltk_data'\n    - '/usr/local/share/nltk_data'\n    -
'/usr/lib/nltk_data'\n    -
'/usr/local/lib/nltk_data'\n**********************************************
************************\n",
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\u001b[0;36mdecorated\u001b[0;34m(*args, **kwargs)\u001b[0m\n\u001b[1;32m
34\u001b[0m
\u001b[0;32mtry\u001b[0m\u001b[0;34m:\u001b[0m\u001b[0;34m\u001b[0m\u001b
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\u001b[0;32mreturn\u001b[0m
\u001b[0mfunc\u001b[0m\u001b[0;34m(\u001b[0m\u001b[0;34m*\u001b[0m\u001b[
0margs\u001b[0m\u001b[0;34m,\u001b[0m
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\u001b[0mLookupError\u001b[0m \u001b[0;32mas\u001b[0m
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packages/textblob/blob.py\u001b[0m in
\u001b[0;36mlemmatize\u001b[0;34m(self, pos)\u001b[0m\n\u001b[1;32m
160\u001b[0m         \u001b[0;32mif\u001b[0m \u001b[0mpos\u001b[0m
\u001b[0;32mis\u001b[0m
\u001b[0;32mNone\u001b[0m\u001b[0;34m:\u001b[0m\u001b[0;34m\u001b[0m\u001
b[0;34m\u001b[0m\u001b[0m\n\u001b[0;32m--> 161\u001b[0;31m
\u001b[0mtag\u001b[0m \u001b[0;34m=\u001b[0m
\u001b[0m_wordnet\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0mNOUN\u001b[0m\u0
```

```
01b[0;34m\u001b[0m\u001b[0;34m\u001b[0m\u001b[0m\n\u001b[0m\u001b[1;32m
162\u001b[0m         \u001b[0;32melif\u001b[0m \u001b[0mpos\u001b[0m
\u001b[0;32min\u001b[0m
\u001b[0m_wordnet\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0m_FILEMAP\u001b[0
m\u001b[0;34m.\u001b[0m\u001b[0mkeys\u001b[0m\u001b[0;34m(\u001b[0m\u001b
[0;34m)\u001b[0m\u001b[0;34m:\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u
001b[0m\u001b[0m\n",
      "\u001b[0;32m/opt/conda/lib/python3.7/site-
packages/nltk/corpus/util.py\u001b[0m in
\u001b[0;36m__getattr__\u001b[0;34m(self, attr)\u001b[0m\n\u001b[1;32m
120\u001b[0m \u001b[0;34m\u001b[0m\u001b[0m\n\u001b[0;32m-->
121\u001b[0;31m
\u001b[0mself\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0m__load\u001b[0m\u001
b[0;34m(\u001b[0m\u001b[0;34m)\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\
u001b[0m\u001b[0m\n\u001b[0m\u001b[1;32m    122\u001b[0m
\u001b[0;31m# This looks circular, but its not, since __load() changes
our\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u001b[
0m\u001b[0m\n",
      "\u001b[0;32m/opt/conda/lib/python3.7/site-
packages/nltk/corpus/util.py\u001b[0m in
\u001b[0;36m__load\u001b[0;34m(self)\u001b[0m\n\u001b[1;32m
88\u001b[0m         \u001b[0;31m# Load the
corpus.\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u0
01b[0m\u001b[0m\n\u001b[0;32m---> 89\u001b[0;31m
\u001b[0mcorpus\u001b[0m \u001b[0;34m=\u001b[0m
\u001b[0mself\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0m__reader_cls\u001b[0
m\u001b[0;34m(\u001b[0m\u001b[0mroot\u001b[0m\u001b[0;34m,\u001b[0m
\u001b[0;34m*\u001b[0m\u001b[0mself\u001b[0m\u001b[0;34m.\u001b[0m\u001b[
0m__args\u001b[0m\u001b[0;34m,\u001b[0m
\u001b[0;34m**\u001b[0m\u001b[0mself\u001b[0m\u001b[0;34m.\u001b[0m\u001b
[0m__kwargs\u001b[0m\u001b[0;34m)\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;3
4m\u001b[0m\u001b[0m\n\u001b[0m\u001b[1;32m     90\u001b[0m
\u001b[0;34m\u001b[0m\u001b[0m\n",
      "\u001b[0;32m/opt/conda/lib/python3.7/site-
packages/nltk/corpus/reader/wordnet.py\u001b[0m in
\u001b[0;36m__init__\u001b[0;34m(self, root,
omw_reader)\u001b[0m\n\u001b[1;32m   1175\u001b[0m
\u001b[0;32melse\u001b[0m\u001b[0;34m:\u001b[0m\u001b[0;34m\u001b[0m\u001
b[0;34m\u001b[0m\u001b[0m\n\u001b[0;32m-> 1176\u001b[0;31m
\u001b[0mself\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0mprovenances\u001b[0m
\u001b[0;34m=\u001b[0m
\u001b[0mself\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0momw_prov\u001b[0m\u0
01b[0;34m(\u001b[0m\u001b[0;34m)\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34
m\u001b[0m\u001b[0m\n\u001b[0m\u001b[1;32m   1177\u001b[0m
\u001b[0;34m\u001b[0m\u001b[0m\n",
      "\u001b[0;32m/opt/conda/lib/python3.7/site-
packages/nltk/corpus/reader/wordnet.py\u001b[0m in
\u001b[0;36momw_prov\u001b[0;34m(self)\u001b[0m\n\u001b[1;32m
1284\u001b[0m
\u001b[0mprovdict\u001b[0m\u001b[0;34m[\u001b[0m\u001b[0;34m\"eng\"\u001b
[0m\u001b[0;34m]\u001b[0m \u001b[0;34m=\u001b[0m
\u001b[0;34m\"\"\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u001b[0m\u001b
[0m\n\u001b[0;32m-> 1285\u001b[0;31m         \u001b[0mfileids\u001b[0m
\u001b[0;34m=\u001b[0m
\u001b[0mself\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0m_omw_reader\u001b[0m
\u001b[0;34m.\u001b[0m\u001b[0mfileids\u001b[0m\u001b[0;34m(\u001b[0m\u00
1b[0;34m)\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u001b[0m\u001b[0m\n\u
001b[0m\u001b[1;32m   1286\u001b[0m         \u001b[0;32mfor\u001b[0m
```

\u001b[0mfileid\u001b[0m \u001b[0;32min\u001b[0m
\u001b[0mfileids\u001b[0m\u001b[0;34m:\u001b[0m\u001b[0;34m\u001b[0m\u001
b[0;34m\u001b[0m\u001b[0m\n",
"\u001b[0;32m/opt/conda/lib/python3.7/site-
packages/nltk/corpus/util.py\u001b[0m in
\u001b[0;36m__getattr__\u001b[0;34m(self, attr)\u001b[0m\n\u001b[1;32m
120\u001b[0m \u001b[0;34m\u001b[0m\u001b[0m\n\u001b[0;32m-->
121\u001b[0;31m
\u001b[0mself\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0m__load\u001b[0m\u001
b[0;34m(\u001b[0m\u001b[0;34m)\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\
u001b[0m\u001b[0m\n\u001b[0m\u001b[1;32m 122\u001b[0m
\u001b[0;31m# This looks circular, but its not, since __load() changes
our\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u001b[
0m\u001b[0m\n",
"\u001b[0;32m/opt/conda/lib/python3.7/site-
packages/nltk/corpus/util.py\u001b[0m in
\u001b[0;36m__load\u001b[0;34m(self)\u001b[0m\n\u001b[1;32m
85\u001b[0m \u001b[0;32mexcept\u001b[0m
\u001b[0mLookupError\u001b[0m\u001b[0;34m:\u001b[0m\u001b[0;34m\u001b[0m\
u001b[0;34m\u001b[0m\u001b[0m\n\u001b[0;32m---> 86\u001b[0;31m
\u001b[0;32mraise\u001b[0m
\u001b[0me\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u001b[0m\u001b[0m\n\
u001b[0m\u001b[1;32m 87\u001b[0m \u001b[0;34m\u001b[0m\u001b[0m\n",
"\u001b[0;32m/opt/conda/lib/python3.7/site-
packages/nltk/corpus/util.py\u001b[0m in
\u001b[0;36m__load\u001b[0;34m(self)\u001b[0m\n\u001b[1;32m
80\u001b[0m
\u001b[0;32mtry\u001b[0m\u001b[0;34m:\u001b[0m\u001b[0;34m\u001b[0m\u001b
[0;34m\u001b[0m\u001b[0m\n\u001b[0;32m---> 81\u001b[0;31m
\u001b[0mroot\u001b[0m \u001b[0;34m=\u001b[0m
\u001b[0mnltk\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0mdata\u001b[0m\u001b[
0;34m.\u001b[0m\u001b[0mfind\u001b[0m\u001b[0;34m(\u001b[0m\u001b[0mf\
"{self.subdir}/{self.__name}\"\u001b[0m\u001b[0;34m)\u001b[0m\u001b[0;34m
\u001b[0m\u001b[0;34m\u001b[0m\u001b[0m\n\u001b[0m\u001b[1;32m
82\u001b[0m \u001b[0;32mexcept\u001b[0m
\u001b[0mLookupError\u001b[0m \u001b[0;32mas\u001b[0m
\u001b[0me\u001b[0m\u001b[0;34m:\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34
m\u001b[0m\u001b[0m\n",
"\u001b[0;32m/opt/conda/lib/python3.7/site-
packages/nltk/data.py\u001b[0m in
\u001b[0;36mfind\u001b[0;34m(resource_name, paths)\u001b[0m\n\u001b[1;32m
582\u001b[0m \u001b[0mresource_not_found\u001b[0m
\u001b[0;34m=\u001b[0m
\u001b[0;34mf\"\\n{sep}\\n{msg}\\n{sep}\\n\"\u001b[0m\u001b[0;34m\u001b[0
m\u001b[0;34m\u001b[0m\u001b[0m\n\u001b[0;32m--> 583\u001b[0;31m
\u001b[0;32mraise\u001b[0m
\u001b[0mLookupError\u001b[0m\u001b[0;34m(\u001b[0m\u001b[0mresource_not_
found\u001b[0m\u001b[0;34m)\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u00
1b[0m\u001b[0m\n\u001b[0m\u001b[1;32m 584\u001b[0m
\u001b[0;34m\u001b[0m\u001b[0m\n",
"\u001b[0;31mLookupError\u001b[0m:
\n**\
n Resource \u001b[93momw-1.4\u001b[0m not found.\n Please use the NLTK
Downloader to obtain the resource:\n\n \u001b[31m>>> import nltk\n >>>
nltk.download('omw-1.4')\n \u001b[0m\n For more information see:
https://www.nltk.org/data.html\n\n Attempted to load
\u001b[93mcorpora/omw-1.4\u001b[0m\n\n Searched in:\n -
'/root/nltk_data'\n - '/opt/conda/nltk_data'\n -

```
'/opt/conda/share/nltk_data'\n    - '/opt/conda/lib/nltk_data'\n    -
'/usr/share/nltk_data'\n    - '/usr/local/share/nltk_data'\n    -
'/usr/lib/nltk_data'\n    -
'/usr/local/lib/nltk_data'\n**********************************************
************************\n",
      "\nDuring handling of the above exception, another exception
occurred:\n",
      "\u001b[0;31mMissingCorpusError\u001b[0m
Traceback (most recent call last)",
      "\u001b[0;32m/tmp/ipykernel_19/81629729.py\u001b[0m in
\u001b[0;36m<module>\u001b[0;34m\u001b[0m\n\u001b[0;32m---->
1\u001b[0;31m
\u001b[0mdata\u001b[0m\u001b[0;34m[\u001b[0m\u001b[0;34m\"text\"\u001b[0m
\u001b[0;34m]\u001b[0m \u001b[0;34m=\u001b[0m
\u001b[0mdata\u001b[0m\u001b[0;34m[\u001b[0m\u001b[0;34m\"text\"\u001b[0m
\u001b[0;34m]\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0mapply\u001b[0m\u001b
[0;34m(\u001b[0m\u001b[0;32mlambda\u001b[0m
\u001b[0mx\u001b[0m\u001b[0;34m:\u001b[0m \u001b[0;34m\"
\"\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0mjoin\u001b[0m\u001b[0;34m(\u001
b[0m\u001b[0;34m[\u001b[0m\u001b[0mWord\u001b[0m\u001b[0;34m(\u001b[0m\u0
01b[0mword\u001b[0m\u001b[0;34m)\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0ml
emmatize\u001b[0m\u001b[0;34m(\u001b[0m\u001b[0;34m)\u001b[0m
\u001b[0;32mfor\u001b[0m \u001b[0mword\u001b[0m \u001b[0;32min\u001b[0m
\u001b[0mx\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0msplit\u001b[0m\u001b[0;
34m(\u001b[0m\u001b[0;34m)\u001b[0m\u001b[0;34m]\u001b[0m\u001b[0;34m)\u0
01b[0m\u001b[0;34m)\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u001b[0m\u0
01b[0m\n\u001b[0m\u001b[1;32m      2\u001b[0m
\u001b[0;34m\u001b[0m\u001b[0m\n\u001b[1;32m      3\u001b[0m
\u001b[0mprint\u001b[0m\u001b[0;34m(\u001b[0m\u001b[0mcolored\u001b[0m\u0
01b[0;34m(\u001b[0m\u001b[0;34m\"\\nTEXTS WERE SUCCESFULLY
LEMMATIZED...\"\u001b[0m\u001b[0;34m,\u001b[0m \u001b[0mcolor\u001b[0m
\u001b[0;34m=\u001b[0m
\u001b[0;34m\"green\"\u001b[0m\u001b[0;34m,\u001b[0m
\u001b[0mattrs\u001b[0m \u001b[0;34m=\u001b[0m
\u001b[0;34m[\u001b[0m\u001b[0;34m\"bold\"\u001b[0m\u001b[0;34m,\u001b[0m
\u001b[0;34m\"dark\"\u001b[0m\u001b[0;34m]\u001b[0m\u001b[0;34m)\u001b[0m
\u001b[0;34m)\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u001b[0m\u001b[0m
\n",
      "\u001b[0;32m/opt/conda/lib/python3.7/site-
packages/pandas/core/series.py\u001b[0m in
\u001b[0;36mapply\u001b[0;34m(self, func, convert_dtype, args,
**kwargs)\u001b[0m\n\u001b[1;32m   4355\u001b[0m
\u001b[0mdtype\u001b[0m\u001b[0;34m:\u001b[0m
\u001b[0mfloat64\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u001b[0m\u001b
[0m\n\u001b[1;32m   4356\u001b[0m         \"\"\"\n\u001b[0;32m->
4357\u001b[0;31m         \u001b[0;32mreturn\u001b[0m
\u001b[0mSeriesApply\u001b[0m\u001b[0;34m(\u001b[0m\u001b[0mself\u001b[0m
\u001b[0;34m,\u001b[0m \u001b[0mfunc\u001b[0m\u001b[0;34m,\u001b[0m
\u001b[0mconvert_dtype\u001b[0m\u001b[0;34m,\u001b[0m
\u001b[0margs\u001b[0m\u001b[0;34m,\u001b[0m
\u001b[0mkwargs\u001b[0m\u001b[0;34m)\u001b[0m\u001b[0;34m.\u001b[0m\u001
b[0mapply\u001b[0m\u001b[0;34m(\u001b[0m\u001b[0;34m)\u001b[0m\u001b[0;34
m\u001b[0m\u001b[0;34m\u001b[0m\u001b[0m\n\u001b[0m\u001b[1;32m
4358\u001b[0m \u001b[0;34m\u001b[0m\u001b[0m\n\u001b[1;32m
4359\u001b[0m     def _reduce(\n",
      "\u001b[0;32m/opt/conda/lib/python3.7/site-
packages/pandas/core/apply.py\u001b[0m in
\u001b[0;36mapply\u001b[0;34m(self)\u001b[0m\n\u001b[1;32m
```

```
1041\u001b[0m             \u001b[0;32mreturn\u001b[0m
\u001b[0mself\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0mapply_str\u001b[0m\u
001b[0;34m(\u001b[0m\u001b[0;34m)\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;3
4m\u001b[0m\u001b[0m\n\u001b[1;32m   1042\u001b[0m
\u001b[0;34m\u001b[0m\u001b[0m\n\u001b[0;32m-> 1043\u001b[0;31m
\u001b[0;32mreturn\u001b[0m
\u001b[0mself\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0mapply_standard\u001b
[0m\u001b[0;34m(\u001b[0m\u001b[0;34m)\u001b[0m\u001b[0;34m\u001b[0m\u001
b[0;34m\u001b[0m\u001b[0m\n\u001b[0m\u001b[1;32m   1044\u001b[0m
\u001b[0;34m\u001b[0m\u001b[0m\n\u001b[1;32m   1045\u001b[0m
\u001b[0;32mdef\u001b[0m
\u001b[0magg\u001b[0m\u001b[0;34m(\u001b[0m\u001b[0mself\u001b[0m\u001b[0
;34m)\u001b[0m\u001b[0;34m:\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u00
1b[0m\u001b[0m\n",
      "\u001b[0;32m/opt/conda/lib/python3.7/site-
packages/pandas/core/apply.py\u001b[0m in
\u001b[0;36mapply_standard\u001b[0;34m(self)\u001b[0m\n\u001b[1;32m
1099\u001b[0m
\u001b[0mvalues\u001b[0m\u001b[0;34m,\u001b[0m\u001b[0;34m\u001b[0m\u001b
[0;34m\u001b[0m\u001b[0m\n\u001b[1;32m   1100\u001b[0m
\u001b[0mf\u001b[0m\u001b[0;34m,\u001b[0m  \u001b[0;31m# type:
ignore[arg-
type]\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u001b[0m\u001b[0m\n\u001b
[0;32m-> 1101\u001b[0;31m
\u001b[0mconvert\u001b[0m\u001b[0;34m=\u001b[0m\u001b[0mself\u001b[0m\u00
1b[0;34m.\u001b[0m\u001b[0mconvert_dtype\u001b[0m\u001b[0;34m,\u001b[0m\u
001b[0;34m\u001b[0m\u001b[0;34m\u001b[0m\n\u001b[0m\u001b[1;32m
1102\u001b[0m                 )\n\u001b[1;32m   1103\u001b[0m
\u001b[0;34m\u001b[0m\u001b[0m\n",
      "\u001b[0;32m/opt/conda/lib/python3.7/site-
packages/pandas/_libs/lib.pyx\u001b[0m in
\u001b[0;36mpandas._libs.lib.map_infer\u001b[0;34m()\u001b[0m\n",
      "\u001b[0;32m/tmp/ipykernel_19/81629729.py\u001b[0m in
\u001b[0;36m<lambda>\u001b[0;34m(x)\u001b[0m\n\u001b[0;32m---->
1\u001b[0;31m
\u001b[0mdata\u001b[0m\u001b[0;34m[\u001b[0m\u001b[0;34m\"text\"\u001b[0m
\u001b[0;34m]\u001b[0m \u001b[0;34m=\u001b[0m
\u001b[0mdata\u001b[0m\u001b[0;34m[\u001b[0m\u001b[0;34m\"text\"\u001b[0m
\u001b[0;34m]\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0mapply\u001b[0m\u001b
[0;34m(\u001b[0m\u001b[0;32mlambda\u001b[0m
\u001b[0mx\u001b[0m\u001b[0;34m:\u001b[0m \u001b[0;34m\"
\"\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0mjoin\u001b[0m\u001b[0;34m(\u001
b[0m\u001b[0;34m[\u001b[0m\u001b[0mWord\u001b[0m\u001b[0;34m(\u001b[0m\u0
01b[0mword\u001b[0m\u001b[0;34m)\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0ml
emmatize\u001b[0m\u001b[0;34m(\u001b[0m\u001b[0;34m)\u001b[0m
\u001b[0;32mfor\u001b[0m \u001b[0mword\u001b[0m \u001b[0;32min\u001b[0m
\u001b[0mx\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0msplit\u001b[0m\u001b[0;
34m(\u001b[0m\u001b[0;34m)\u001b[0m\u001b[0;34m]\u001b[0m\u001b[0;34m)\u0
01b[0m\u001b[0;34m)\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u001b[0m\u0
01b[0m\n\u001b[0m\u001b[1;32m      2\u001b[0m
\u001b[0;34m\u001b[0m\u001b[0m\n\u001b[1;32m      3\u001b[0m
\u001b[0mprint\u001b[0m\u001b[0;34m(\u001b[0m\u001b[0mcolored\u001b[0m\u0
01b[0;34m(\u001b[0m\u001b[0;34m\"\\nTEXTS WERE SUCCESFULLY
LEMMATIZED...\"\u001b[0m\u001b[0;34m,\u001b[0m \u001b[0mcolor\u001b[0m
\u001b[0;34m=\u001b[0m
\u001b[0;34m\"green\"\u001b[0m\u001b[0;34m,\u001b[0m
\u001b[0mattrs\u001b[0m \u001b[0;34m=\u001b[0m
\u001b[0;34m[\u001b[0m\u001b[0;34m\"bold\"\u001b[0m\u001b[0;34m,\u001b[0m
```

```
\u001b[0;34m\"dark\"\u001b[0m\u001b[0;34m]\u001b[0m\u001b[0;34m)\u001b[0m
\u001b[0;34m)\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u001b[0m\u001b[0m
\n",
      "\u001b[0;32m/tmp/ipykernel_19/81629729.py\u001b[0m in
\u001b[0;36m<listcomp>\u001b[0;34m(.0)\u001b[0m\n\u001b[0;32m---->
1\u001b[0;31m
\u001b[0mdata\u001b[0m\u001b[0;34m[\u001b[0m\u001b[0;34m\"text\"\u001b[0m
\u001b[0;34m]\u001b[0m \u001b[0;34m=\u001b[0m
\u001b[0mdata\u001b[0m\u001b[0;34m[\u001b[0m\u001b[0;34m\"text\"\u001b[0m
\u001b[0;34m]\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0mapply\u001b[0m\u001b
[0;34m(\u001b[0m\u001b[0;32mlambda\u001b[0m
\u001b[0mx\u001b[0m\u001b[0;34m:\u001b[0m \u001b[0;34m\"
\"\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0mjoin\u001b[0m\u001b[0;34m(\u001
b[0m\u001b[0;34m[\u001b[0m\u001b[0mWord\u001b[0m\u001b[0;34m(\u001b[0m\u0
01b[0mword\u001b[0m\u001b[0;34m)\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0ml
emmatize\u001b[0m\u001b[0;34m(\u001b[0m\u001b[0;34m)\u001b[0m
\u001b[0;32mfor\u001b[0m \u001b[0mword\u001b[0m \u001b[0;32min\u001b[0m
\u001b[0mx\u001b[0m\u001b[0;34m.\u001b[0m\u001b[0msplit\u001b[0m\u001b[0;
34m(\u001b[0m\u001b[0;34m)\u001b[0m\u001b[0;34m]\u001b[0m\u001b[0;34m)\u0
01b[0m\u001b[0;34m)\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u001b[0m\u0
01b[0m\n\u001b[0m\u001b[1;32m      2\u001b[0m
\u001b[0;34m\u001b[0m\u001b[0m\n\u001b[1;32m      3\u001b[0m
\u001b[0mprint\u001b[0m\u001b[0;34m(\u001b[0m\u001b[0mcolored\u001b[0m\u0
01b[0;34m(\u001b[0m\u001b[0;34m\"\\nTEXTS WERE SUCCESFULLY
LEMMATIZED...\"\u001b[0m\u001b[0;34m,\u001b[0m \u001b[0mcolor\u001b[0m
\u001b[0;34m=\u001b[0m
\u001b[0;34m\"green\"\u001b[0m\u001b[0;34m,\u001b[0m
\u001b[0mattrs\u001b[0m \u001b[0;34m=\u001b[0m
\u001b[0;34m[\u001b[0m\u001b[0;34m\"bold\"\u001b[0m\u001b[0;34m,\u001b[0m
\u001b[0;34m\"dark\"\u001b[0m\u001b[0;34m]\u001b[0m\u001b[0;34m)\u001b[0m
\u001b[0;34m)\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u001b[0m\u001b[0m
\n",
      "\u001b[0;32m/opt/conda/lib/python3.7/site-
packages/textblob/decorators.py\u001b[0m in
\u001b[0;36mdecorated\u001b[0;34m(*args, **kwargs)\u001b[0m\n\u001b[1;32m
36\u001b[0m         \u001b[0;32mexcept\u001b[0m
\u001b[0mLookupError\u001b[0m \u001b[0;32mas\u001b[0m
\u001b[0merr\u001b[0m\u001b[0;34m:\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;
34m\u001b[0m\u001b[0m\n\u001b[1;32m     37\u001b[0m
\u001b[0mprint\u001b[0m\u001b[0;34m(\u001b[0m\u001b[0merr\u001b[0m\u001b[
0;34m)\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u001b[0m\u001b[0m\n\u001
b[0;32m---> 38\u001b[0;31m             \u001b[0;32mraise\u001b[0m
\u001b[0mMissingCorpusError\u001b[0m\u001b[0;34m(\u001b[0m\u001b[0;34m)\u
001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u001b[0m\u001b[0m\n\u001b[0m\u00
1b[1;32m     39\u001b[0m     \u001b[0;32mreturn\u001b[0m
\u001b[0mdecorated\u001b[0m\u001b[0;34m\u001b[0m\u001b[0;34m\u001b[0m\u00
1b[0m\n",
      "\u001b[0;31mMissingCorpusError\u001b[0m: \nLooks like you are
missing some required data for this feature.\n\nTo download the necessary
data, simply run\n\n    python -m textblob.download_corpora\n\nor use the
NLTK downloader to download the missing data:
http://nltk.org/data.html\nIf this doesn't fix the problem, file an issue
at https://github.com/sloria/TextBlob/issues.\n"
     ]
    }
   ],
   "source": [
```

```
    "data[\"text\"] = data[\"text\"].apply(lambda x: \"
\".join([Word(word).lemmatize() for word in x.split()]))\n",
    "\n",
    "print(colored(\"\\nTEXTS WERE SUCCESFULLY LEMMATIZED...\", color =
\"green\", attrs = [\"bold\", \"dark\"]))"
   ]
  },
  {
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     "shell.execute_reply.started": "2022-10-25T06:53:19.858131Z"
    },
    "papermill": {
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     "end_time": null,
     "exception": null,
     "start_time": null,
     "status": "pending"
    },
    "tags": []
   },
   "outputs": [],
   "source": [
    "data[\"text\"] = data[\"text\"].apply(lambda x: \"
\".join(re.sub(r'http\\S+', '', x) for x in x.split()))\n",
    "\n",
    "print(colored(\"\\nURLs WERE SUCCESFULLY REMOVED...\", color =
\"green\", attrs = [\"bold\", \"dark\"]))"
   ]
  },
  {
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   "execution_count": null,
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     "shell.execute_reply.started": "2022-10-25T06:53:19.860817Z"
    },
    "papermill": {
     "duration": null,
     "end_time": null,
     "exception": null,
     "start_time": null,
     "status": "pending"
    },
    "tags": []
   },
   "outputs": [],
   "source": [
```

```
    "data[\"text\"] = data[\"text\"].apply(lambda x: ' '.join([x for x in
x.split() if len(x) > 3]))\n",
    "\n",
    "print(colored(\"\\nWORDS LESS THAN 3 LETTERS LONG WERE SUCCESFULLY
REMOVED...\", color = \"green\", attrs = [\"bold\", \"dark\"]))"
   ]
  },
  {
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     "shell.execute_reply.started": "2022-10-25T06:53:19.863045Z"
    },
    "papermill": {
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     "end_time": null,
     "exception": null,
     "start_time": null,
     "status": "pending"
    },
    "tags": []
   },
   "outputs": [],
   "source": [
    "data.head(n = 10)"
   ]
  },
  {
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   "execution_count": null,
   "id": "32aeb4be",
   "metadata": {
    "execution": {
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     "iopub.status.idle": "2022-10-25T06:53:19.865418Z",
     "shell.execute_reply": "2022-10-25T06:53:19.865162Z",
     "shell.execute_reply.started": "2022-10-25T06:53:19.865137Z"
    },
    "papermill": {
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     "end_time": null,
     "exception": null,
     "start_time": null,
     "status": "pending"
    },
    "tags": []
   },
   "outputs": [],
   "source": [
    "corpus = []\n",
    "for i in data.text:\n",
    "    for j in i.split():\n",
    "        corpus.append(j.strip())"
```

```
   ]
  },
  {
   "cell_type": "code",
   "execution_count": null,
   "id": "7edc988c",
   "metadata": {
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     "shell.execute_reply": "2022-10-25T06:53:19.867705Z",
     "shell.execute_reply.started": "2022-10-25T06:53:19.867680Z"
    },
    "papermill": {
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     "end_time": null,
     "exception": null,
     "start_time": null,
     "status": "pending"
    },
    "tags": []
   },
   "outputs": [],
   "source": [
    "counter = Counter(corpus)\n",
    "common_words = counter.most_common(15)\n",
    "dict(common_words)"
   ]
  },
  {
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   "execution_count": null,
   "id": "5c9eef54",
   "metadata": {
    "execution": {
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     "shell.execute_reply.started": "2022-10-25T06:53:19.870062Z"
    },
    "papermill": {
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     "exception": null,
     "start_time": null,
     "status": "pending"
    },
    "tags": []
   },
   "outputs": [],
   "source": [
    "text = \" \".join(i for i in data.text)\n",
    "\n",
    "wc = WordCloud(background_color = \"white\", width = 1200, height =
600,\n",
    "               contour_width = 0, contour_color = \"#410F01\",
max_words = 1000,\n",
```

```
    "                scale = 1, collocations = False, repeat = True,
min_font_size = 1)\n",
    "\n",
    "wc.generate(text)\n",
    "\n",
    "plt.figure(figsize = [15, 7])\n",
    "plt.imshow(wc)\n",
    "plt.axis(\"off\")\n",
    "plt.show"
   ]
  },
  {
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   "execution_count": null,
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   "metadata": {
    "execution": {
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     "iopub.status.idle": "2022-10-25T06:53:19.872449Z",
     "shell.execute_reply": "2022-10-25T06:53:19.872203Z",
     "shell.execute_reply.started": "2022-10-25T06:53:19.872177Z"
    },
    "papermill": {
     "duration": null,
     "end_time": null,
     "exception": null,
     "start_time": null,
     "status": "pending"
    },
    "tags": []
   },
   "outputs": [],
   "source": [
    "fig,ax = plt.subplots(figsize = (15, 8))\n",
    "text_words = data[data[\"target\"] ==
\"spam\"][\"text\"].str.split().apply(lambda x : [len(i) for i in x])\n",
    "sns.distplot(text_words.map(lambda x: np.mean(x)), color =
\"#410F01\", ax = ax).set_title(\"Distribution of average word length in
texts where target is 'spam'\");"
   ]
  },
  {
   "cell_type": "code",
   "execution_count": null,
   "id": "75067b3e",
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     "shell.execute_reply": "2022-10-25T06:53:19.874653Z",
     "shell.execute_reply.started": "2022-10-25T06:53:19.874626Z"
    },
    "papermill": {
     "duration": null,
     "end_time": null,
     "exception": null,
     "start_time": null,
     "status": "pending"
```

```
    },
    "tags": []
   },
   "outputs": [],
   "source": [
    "fig,ax = plt.subplots(figsize = (15, 8))\n",
    "text_words = data[data[\"target\"] ==
\"ham\"][\"text\"].str.split().apply(lambda x : [len(i) for i in x])\n",
    "sns.distplot(text_words.map(lambda x: np.mean(x)), color =
\"#410F01\", ax = ax).set_title(\"Distribution of average word length in
texts where target is 'ham'\");"
   ]
  },
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     "shell.execute_reply.started": "2022-10-25T06:53:19.877365Z"
    },
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     "exception": null,
     "start_time": null,
     "status": "pending"
    },
    "tags": []
   },
   "outputs": [],
   "source": [
    "lb = LabelEncoder()\n",
    "data[\"target\"] = lb.fit_transform(data[\"target\"])"
   ]
  },
  {
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   "execution_count": null,
   "id": "f0774d71",
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    },
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     "exception": null,
     "start_time": null,
     "status": "pending"
    },
    "tags": []
```

```
   },
   "outputs": [],
   "source": [
    "x = data[\"text\"]\n",
    "y = data[\"target\"]\n",
    "\n",
    "train_x, test_x, train_y, test_y = train_test_split(x, y, test_size
= 0.20, shuffle = True, random_state = 11)\n",
    "\n",
    "print(colored(\"\\nDATASET WAS SUCCESFULLY DIVIDED ...\", color =
\"green\", attrs = [\"bold\", \"dark\"]))"
   ]
  },
  {
   "cell_type": "code",
   "execution_count": null,
   "id": "c2027779",
   "metadata": {
    "execution": {
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     "iopub.status.idle": "2022-10-25T06:53:19.882102Z",
     "shell.execute_reply": "2022-10-25T06:53:19.881871Z",
     "shell.execute_reply.started": "2022-10-25T06:53:19.881850Z"
    },
    "papermill": {
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     "end_time": null,
     "exception": null,
     "start_time": null,
     "status": "pending"
    },
    "tags": []
   },
   "outputs": [],
   "source": [
    "print(\"The shape of 'train_x' is {} and the shape of 'test_x' is
{}\".format(train_x.shape[0], test_x.shape[0]))"
   ]
  },
  {
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   "metadata": {
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     "iopub.status.idle": "2022-10-25T06:53:19.884013Z",
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    },
    "papermill": {
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     "exception": null,
     "start_time": null,
     "status": "pending"
    },
    "tags": []
```

```
   },
   "outputs": [],
   "source": [
    "tokenizer = Tokenizer(num_words = None)\n",
    "tokenizer.fit_on_texts(train_x)\n",
    "\n",
    "tokenized_train = tokenizer.texts_to_sequences(train_x)\n",
    "tokenized_test = tokenizer.texts_to_sequences(test_x)\n",
    "\n",
    "train_x = sequence.pad_sequences(tokenized_train, maxlen = None)\n",
    "test_x = sequence.pad_sequences(tokenized_test, maxlen = None)"
   ]
  },
  {
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   "id": "1ce9934b",
   "metadata": {
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     "shell.execute_reply.started": "2022-10-25T06:53:19.886475Z"
    },
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     "exception": null,
     "start_time": null,
     "status": "pending"
    },
    "tags": []
   },
   "outputs": [],
   "source": [
    "GLOVE_EMBEDDING = \"../input/glove-
twitter/glove.twitter.27B.100d.txt\""
   ]
  },
  {
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   "id": "43fa041f",
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     "shell.execute_reply.started": "2022-10-25T06:53:19.889013Z"
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     "exception": null,
     "start_time": null,
     "status": "pending"
    },
    "tags": []
```

```
   },
   "outputs": [],
   "source": [
    "def get_coefs(word, *arr):\n",
    "    return word, np.asarray(arr, dtype = \"float32\")\n",
    "embeddings_index = dict(get_coefs(*g.rstrip().rsplit(\" \")) for g
in open(GLOVE_EMBEDDING))\n",
    "\n",

"#_____________________________________________________________________
_____________________#\n",
    "\n",

"#_____________________________________________________________________
_____________________#\n",
    "\n",
    "embeddings = np.stack(embeddings_index.values())\n",
    "embedding_mean, embedding_std = embeddings.mean(),
embeddings.std()\n",
    "embedding_size = embeddings.shape[1]\n",
    "\n",
    "word_index = tokenizer.word_index\n",
    "nb_words = min(6012, len(word_index))+1\n",
    "\n",
    "embedding_matrix = embedding_matrix =
np.random.normal(embedding_mean, embedding_std, (nb_words,
embedding_size))\n",
    "for word, i in word_index.items():\n",
    "    if i >= 6012:\n",
    "        continue\n",
    "    embedding_vector = embeddings_index.get(word)\n",
    "    if embedding_vector is not None:\n",
    "        embedding_matrix[i] = embedding_vector"
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    "lr_reduce = ReduceLROnPlateau(monitor = \"val_accuracy\", patience =
2, factor = 0.5, min_lr = 0.00001)"
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    "model = Sequential()\n",
    "\n",
    "model.add(Embedding(6013, output_dim = 100, weights =
[embedding_matrix], trainable = False))\n",
    "\n",
    "model.add(LSTM(units = 128, return_sequences = True,
recurrent_dropout = 0.3, dropout = 0.5))\n",
    "\n",
    "model.add(LSTM(units = 64, recurrent_dropout = 0.3, dropout =
0.5))\n",
    "\n",
    "model.add(Dense(units = 32, activation = \"relu\"))\n",
    "\n",
    "model.add(Dense(1, activation = \"sigmoid\"))\n",
    "\n",
    "model.compile(optimizer = tf.keras.optimizers.Adam(lr = 0.01), loss
= \"binary_crossentropy\", metrics = [\"accuracy\"])"
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  "history = model.fit(train_x,\n",
  "                    train_y,\n",
  "                    batch_size = 64,\n",
  "                    validation_data = (test_x, test_y),\n",
  "                    epochs = 20,\n",
  "                    callbacks = [lr_reduce])"
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    "print(\"Model accuracy on the train set: \", model.evaluate(train_x,
train_y)[1])\n",
    "print(\"Model accuracy on the test set: \", model.evaluate(test_x,
test_y)[1])"
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    "epochs = [i for i in range(20)]\n",
    "\n",
    "fig, ax = plt.subplots(1, 2)\n",
    "train_acc = history.history[\"accuracy\"]\n",
    "train_loss = history.history[\"loss\"]\n",
    "val_acc = history.history[\"val_accuracy\"]\n",
    "val_loss = history.history[\"val_loss\"]\n",
    "fig.set_size_inches(20, 10)\n",
    "\n",
    "ax[0].plot(epochs, train_acc, \"go-\", label = \"Train
accuracy\")\n",
    "ax[0].plot(epochs, val_acc, \"ro-\", label = \"Test accuracy\")\n",
    "ax[0].set_title(\"Train and test accuracy\")\n",
    "ax[0].legend()\n",
    "ax[0].set_xlabel(\"Epochs\")\n",
    "ax[0].set_ylabel(\"Accuracy\")\n",
    "\n",
    "ax[1].plot(epochs, train_loss, \"go-\", label = \"Train loss\")\n",
    "ax[1].plot(epochs, val_loss, \"ro-\", label = \"Test loss\")\n",
    "ax[1].set_title(\"Train and test loss\")\n",
    "ax[1].legend()\n",
    "ax[1].set_xlabel(\"Epochs\")\n",
    "ax[1].set_ylabel(\"Loss\")\n",
    "plt.show()"
```

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    "prediction = model.predict(test_x)\n",
    "classes_pred = np.argmax(prediction, axis = 1)\n",
    "\n",
    "print(classification_report(test_y, classes_pred))"
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    "conf_mat = confusion_matrix(test_y, classes_pred)\n",
    "print(conf_mat)\n",
    "\n",
    "sns.heatmap(conf_mat, square = True, annot = True, robust =
True)\n",
    "plt.show()"
```

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