```
#installing the required libraries
pip install SpeechRecognition
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Requirement already satisfied: SpeechRecognition in /usr/local/lib/python3.7/dist-packages (3.8.1)
```

```
import os
import speech_recognition as sr
```

```
r = sr.Recognizer()
audio = sr.AudioFile('food.wav')
```

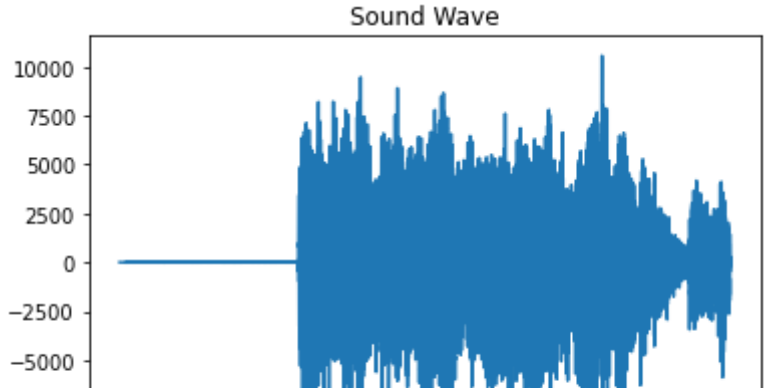
Data Preprocessing

```
#using wave to find out the details of the input provided
import wave
obj = wave.open('food.wav','r')
print( "Number of channels",obj.getnchannels())
print ( "Sample width",obj.getsampwidth())
print ( "Frame rate.",obj.getframerate())
print ("Number of frames",obj.getnframes())
print ( "parameters:",obj.getparams())
obj.close()
```

```
Number of channels 2
Sample width 2
Frame rate. 44100
Number of frames 175584384
parameters: _wave_params(nchannels=2, sampwidth=2, framerate=44100, nframes=175584384, comptype='NONE', compn
```

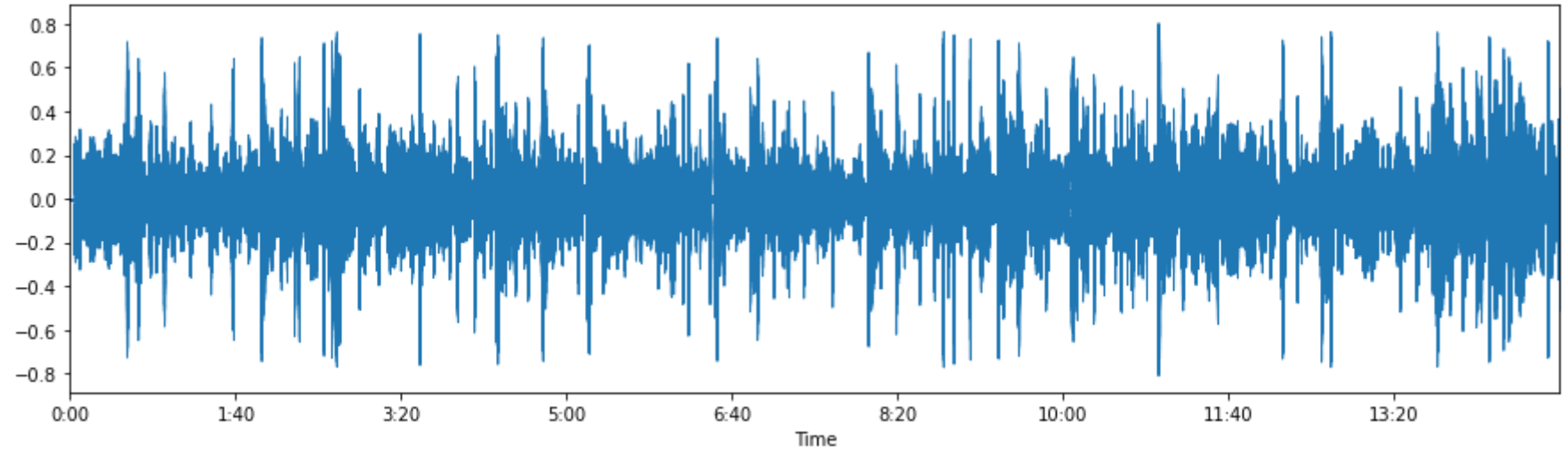
```
#importing the required libraries
import os
import speech_recognition as sr
```

```
import wave
import numpy as np
import matplotlib.pyplot as plt
import IPython.display as ipd
import librosa
import librosa.display



#opening the file using wave
raw = wave.open("food.wav")

  #reading the signal of 300000 frames
signal = raw.readframes(300000)
signal = np.frombuffer(signal, dtype ="int16")

    # gets the frame rate
f_rate = raw.getframerate()

  #for plotting the time, we divide the len of the signal with the frame rate.
time = np.linspace(
    0, # start
    len(signal) / f_rate,
    num = len(signal)
)

#using matplotlib for the plot
plt.figure(1)
plt.title("Sound Wave")
plt.xlabel("Time")
plt.plot(time, signal)
plt.show()
```




```
#using the librosa library and plot the wave file for time and sample rate for the provided wav file.
plt.figure(figsize=(15,4))
data1,sample_rate1 = librosa.load('food.wav', sr=44100, mono=True, offset=0.0, duration=900, res_type='kaiser_best
librosa.display.waveplot(data1,sr=sample_rate1, max_points=50000.0,x_axis='time', offset=0.0, max_sr=1000)
```

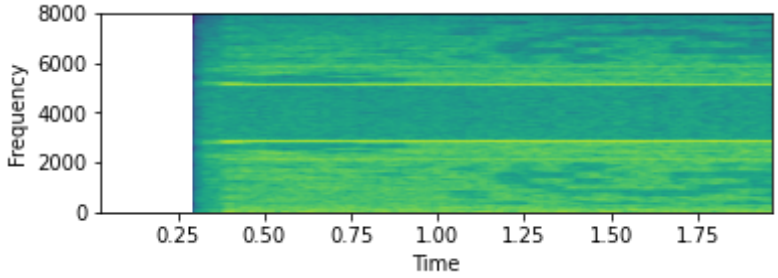
```
<matplotlib.collections.PolyCollection at 0x7f5aa4d41710>
```




```
#using the wav file to plot the energry vs sample rate and time vs frequency graphs

signal_wave = wave.open("food.wav", 'r')
sig = np.frombuffer(signal_wave.readframes(16000), dtype=np.int16)
plt.figure(1)
```

```
plot_b = plt.subplot(212)
plot_b.specgram(sig, NFFT=1024, Fs=16000, noverlap=900)
plot_b.set_xlabel('Time')
plot_b.set_ylabel('Frequency')

plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/matplotlib/axes/_axes.py:7592: RuntimeWarning: divide by zero encounte
  Z = 10. * np.log10(spec)
```



Speech to Text

```
#intializing text to empty first
finalText=""
#the intial offset is 0
offset=0
#i in the range of for the duration offset, we repeat the conversion
for i in range(10):
  #using the recogniser to find the text from the audio
  r = sr.Recognizer()
  audio = sr.AudioFile('food.wav')
  with audio as source:
    audio = r.record(source, duration=300,offset=offset)
  # set offset as 300
  offset=offset+300
  text=r.recognize_google(audio)
```

```
  finalText=finalText+text ## recognizing the speech and converting into text
print(finalText)
```

```
hello my name is food toxicology would like to welcome back once again today the subject of the lecture is go
```

Adding Punctuations

```
pip install deepmultilingualpunctuation
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Requirement already satisfied: deepmultilingualpunctuation in /usr/local/lib/python3.7/dist-packages (1.0.1)
Requirement already satisfied: torch>=1.8.1 in /usr/local/lib/python3.7/dist-packages (from deepmultilingualp
Requirement already satisfied: transformers in /usr/local/lib/python3.7/dist-packages (from deepmultilingualp
Requirement already satisfied: typing-extensions in /usr/local/lib/python3.7/dist-packages (from torch>=1.8.1
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.7/dist-packages (from transformers->
Requirement already satisfied: huggingface-hub<1.0,>=0.10.0 in /usr/local/lib/python3.7/dist-packages (from t
Requirement already satisfied: requests in /usr/local/lib/python3.7/dist-packages (from transformers->deepmul
Requirement already satisfied: pyyaml>=5.1 in /usr/local/lib/python3.7/dist-packages (from transformers->deep
Requirement already satisfied: tqdm>=4.27 in /usr/local/lib/python3.7/dist-packages (from transformers->deepm
Requirement already satisfied: numpy>=1.17 in /usr/local/lib/python3.7/dist-packages (from transformers->deep
Requirement already satisfied: regex!=2019.12.17 in /usr/local/lib/python3.7/dist-packages (from transformers
Requirement already satisfied: tokenizers!=0.11.3,<0.14,>=0.11.1 in /usr/local/lib/python3.7/dist-packages (f
Requirement already satisfied: filelock in /usr/local/lib/python3.7/dist-packages (from transformers->deepmul
Requirement already satisfied: importlib-metadata in /usr/local/lib/python3.7/dist-packages (from transformer
Requirement already satisfied: pyparsing!=3.0.5,>=2.0.2 in /usr/local/lib/python3.7/dist-packages (from packa
Requirement already satisfied: zipp>=0.5 in /usr/local/lib/python3.7/dist-packages (from importlib-metadata->
Requirement already satisfied: chardet<4,>=3.0.2 in /usr/local/lib/python3.7/dist-packages (from requests->tr
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.7/dist-packages (from requests->t
Requirement already satisfied: idna<3,>=2.5 in /usr/local/lib/python3.7/dist-packages (from requests->transfo
Requirement already satisfied: urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1 in /usr/local/lib/python3.7/dist-packa
```

```
pip install transformers[sentencepiece]
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Requirement already satisfied: transformers[sentencepiece] in /usr/local/lib/python3.7/dist-packages (4.24.0)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.7/dist-packages (from transformers[s
Requirement already satisfied: requests in /usr/local/lib/python3.7/dist-packages (from transformers[sentence
```

```
Requirement already satisfied: importlib-metadata in /usr/local/lib/python3.7/dist-packages (from transformer
Requirement already satisfied: huggingface-hub<1.0,>=0.10.0 in /usr/local/lib/python3.7/dist-packages (from t
Requirement already satisfied: pyyaml>=5.1 in /usr/local/lib/python3.7/dist-packages (from transformers[sente
Requirement already satisfied: numpy>=1.17 in /usr/local/lib/python3.7/dist-packages (from transformers[sente
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Requirement already satisfied: regex!=2019.12.17 in /usr/local/lib/python3.7/dist-packages (from transformers
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Requirement already satisfied: tqdm>=4.27 in /usr/local/lib/python3.7/dist-packages (from transformers[senten
Requirement already satisfied: protobuf<=3.20.2 in /usr/local/lib/python3.7/dist-packages (from transformers[
Requirement already satisfied: sentencepiece!=0.1.92,>=0.1.91 in /usr/local/lib/python3.7/dist-packages (from
Requirement already satisfied: typing-extensions>=3.7.4.3 in /usr/local/lib/python3.7/dist-packages (from hug
Requirement already satisfied: pyparsing!=3.0.5,>=2.0.2 in /usr/local/lib/python3.7/dist-packages (from packa
Requirement already satisfied: six>=1.9 in /usr/local/lib/python3.7/dist-packages (from protobuf<=3.20.2->tra
Requirement already satisfied: zipp>=0.5 in /usr/local/lib/python3.7/dist-packages (from importlib-metadata->
Requirement already satisfied: urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1 in /usr/local/lib/python3.7/dist-packa
Requirement already satisfied: chardet<4,>=3.0.2 in /usr/local/lib/python3.7/dist-packages (from requests->tr
Requirement already satisfied: idna<3,>=2.5 in /usr/local/lib/python3.7/dist-packages (from requests->transfo
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.7/dist-packages (from requests->t
```

```
#using the punctuation model to get the converted text with punctuations
from deepmultilingualpunctuation import PunctuationModel
!pip install transformers

model = PunctuationModel()
text = text1
clean_text=model.preprocess(text)
labeled_words=model.predict(clean_text)
result = model.restore_punctuation(text)
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Requirement already satisfied: transformers in /usr/local/lib/python3.7/dist-packages (4.24.0)
Requirement already satisfied: regex!=2019.12.17 in /usr/local/lib/python3.7/dist-packages (from transformers
Requirement already satisfied: huggingface-hub<1.0,>=0.10.0 in /usr/local/lib/python3.7/dist-packages (from t
Requirement already satisfied: importlib-metadata in /usr/local/lib/python3.7/dist-packages (from transformer
Requirement already satisfied: numpy>=1.17 in /usr/local/lib/python3.7/dist-packages (from transformers) (1.2
Requirement already satisfied: requests in /usr/local/lib/python3.7/dist-packages (from transformers) (2.23.0
Requirement already satisfied: tqdm>=4.27 in /usr/local/lib/python3.7/dist-packages (from transformers) (4.64
Requirement already satisfied: filelock in /usr/local/lib/python3.7/dist-packages (from transformers) (3.8.0)
```

```
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.7/dist-packages (from transformers)
Requirement already satisfied: tokenizers!=0.11.3,<0.14,>=0.11.1 in /usr/local/lib/python3.7/dist-packages (f
Requirement already satisfied: pyyaml>=5.1 in /usr/local/lib/python3.7/dist-packages (from transformers) (6.0
Requirement already satisfied: typing-extensions>=3.7.4.3 in /usr/local/lib/python3.7/dist-packages (from hug
Requirement already satisfied: pyparsing!=3.0.5,>=2.0.2 in /usr/local/lib/python3.7/dist-packages (from packa
Requirement already satisfied: zipp>=0.5 in /usr/local/lib/python3.7/dist-packages (from importlib-metadata->
Requirement already satisfied: urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1 in /usr/local/lib/python3.7/dist-packa
Requirement already satisfied: chardet<4,>=3.0.2 in /usr/local/lib/python3.7/dist-packages (from requests->tr
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.7/dist-packages (from requests->t
Requirement already satisfied: idna<3,>=2.5 in /usr/local/lib/python3.7/dist-packages (from requests->transfo
/usr/local/lib/python3.7/dist-packages/transformers/pipelines/token_classification.py:136: UserWarning: `grou
  "`grouped_entities` is deprecated and will be removed in version v5.0.0, defaulted to"
```

```
#predicted accuracy
print(labeled_words)
```

```
[['hello', ',', 0.89068866], ['my', '0', 0.9999896], ['name', '0', 0.9998072], ['is', '0', 0.9979177], ['food
```

```
#printing the punctuatized text
print(result)
```

```
hello, my name is food toxicology would like to welcome back once again. today. the subject of the lecture is
```

Capitalizing Text

```
#capitalizing the text that has been punctuated
def capitalizng_sentence(data):
  sent_tokenizer = nltk.data.load('tokenizers/punkt/english.pickle')
  sentences_from_summary = sent_tokenizer.tokenize(data)
  corrected_sentences = [sentence.capitalize() for sentence in sentences_from_summary]
  print(' '.join(corrected_sentences))
```

```
#printing the sentences
capitalizedres=capitalizng_sentence(result)
```

```
print(capitalizedres)
```

```
Hello, my name is food toxicology would like to welcome back once again. Today. The subject of the lecture is
None
```

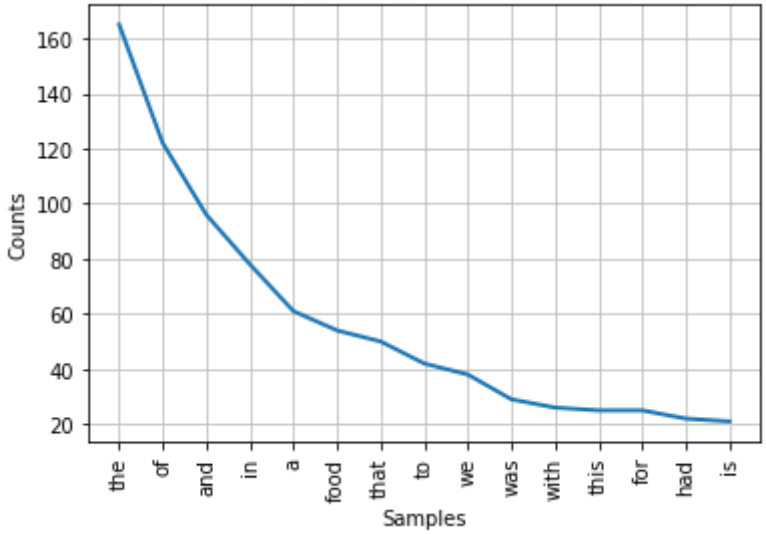
Text Summarization(Abstractive)

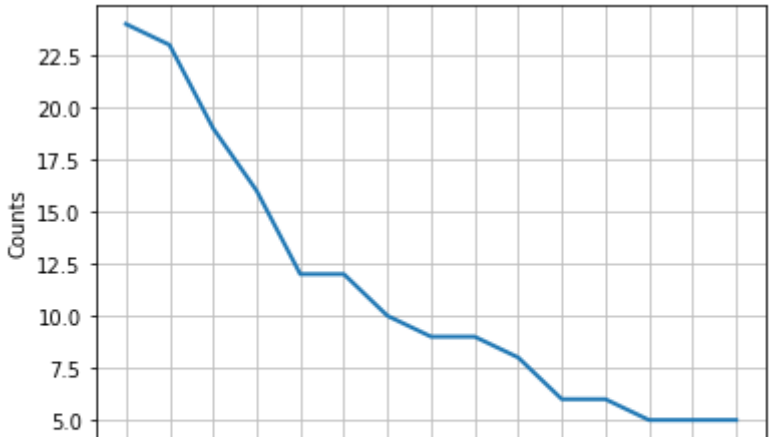
```
import spacy
from spacy.lang.en.stop_words import STOP_WORDS
from string import punctuation
from heapq import nlargest


#using abstractive summary for the text summarization
def summarize(text, per):
    nlp = spacy.load('en_core_web_sm')
    doc= nlp(text)
    tokens=[token.text for token in doc]
    word_frequencies={}
    for word in doc:
        if word.text.lower() not in list(STOP_WORDS):
            if word.text.lower() not in punctuation:
                if word.text not in word_frequencies.keys():
                    word_frequencies[word.text] = 1
                else:
                    word_frequencies[word.text] += 1
    max_frequency=max(word_frequencies.values())
    for word in word_frequencies.keys():
        word_frequencies[word]=word_frequencies[word]/max_frequency
    sentence_tokens= [sent for sent in doc.sents]
    sentence_scores = {}
    for sent in sentence_tokens:
        for word in sent:
            if word.text.lower() in word_frequencies.keys():
                if sent not in sentence_scores.keys():
                    sentence_scores[sent]=word_frequencies[word.text.lower()]
```

```
                else:
                    sentence_scores[sent]+=word_frequencies[word.text.lower()]
    select_length=int(len(sentence_tokens)*per)
    summary=nlargest(select_length, sentence_scores,key=sentence_scores.get)
    final_summary=[word.text for word in summary]
    summary=''.join(final_summary)
    return summary


#output of the summarized text with abstractive method
ext2=summarize(text1, 0.07)
print(text2)
```

```
     so in fact they had to prove certain health benefits and so the whole idea of patent or quack medicines went
```

```
def plotgraph(data):
  tokenized_words = word_tokenize(data)
  words_without_punc = []
  #iterating through the words list
  for word in tokenized_words:
      if word.isalpha():
          words_without_punc.append(word.lower())

  #finding the frequency of words
  freq_words = FreqDist(words_without_punc)
  #Ploting the 15 most common words
  freq_words.plot(15)
  plt.show()


#plotting the graph between text and the abstractive based summarization with the frequency of the words.
plotgraph(text1)
plotgraph(text2)
```





Text Summarization(Extractive)

```
!pip install -q bert-extractive-summarizer
!pip install -q spacy
!pip install -q transformers
!pip install -q neuralcoref


from summarizer import Summarizer
```

```
from pprint import pprint

#using the extractive summarizer
model = Summarizer()
```

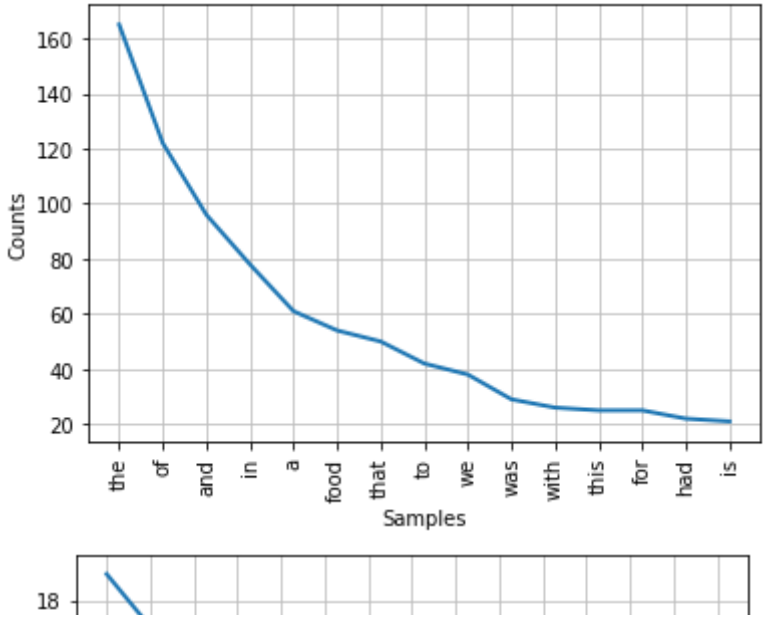
```
Some weights of the model checkpoint at bert-large-uncased were not used when initializing BertModel: ['cls.p
- This IS expected if you are initializing BertModel from the checkpoint of a model trained on another task o
- This IS NOT expected if you are initializing BertModel from the checkpoint of a model that you expect to be
```

```
#output of the summarized text with extractive method
full=""
res = model(result)
full = ''.join(res)
```

```
print(full)
```

```
hello, my name is food toxicology would like to welcome back once again. one of the answers, one of the respo
```

```
#plotting the graph between text and the extractive based summarization with the frequency of the words.
plotgraph(text1)
plotgraph(text1)
plotgraph(full)
```



Bigram model and smoothening

```
#using the bigram model for the counts
from collections import defaultdict
from collections import Counter
from numpy.random import choice
from tqdm import tqdm

class Bigram():
    def __init__(self):
        self.bigram_counts = defaultdict(Counter)
        self.unigram_counts = Counter()
        self.context = defaultdict(Counter)
        self.start_count = 0
        self.token_count = 0
        self.vocab_count = 0

    def convert_sentence(self, sentence):
        return ["<s>"] + [w.lower() for w in sentence] + ["</s>"]
```

```
    def get_counts(self, sentences):
        # collect unigram counts
        for sentence in sentences:
            sentence = self.convert_sentence(sentence)

            for word in sentence[1:]:  # from 1, because we don't need the <s> token
                self.unigram_counts[word] += 1

            self.start_count += 1

        # collect bigram counts
        for sentence in sentences:
            sentence = self.convert_sentence(sentence)
            bigram_list = zip(sentence[:-1], sentence[1:])
            for bigram in bigram_list:
                self.bigram_counts[bigram[0]][bigram[1]] += 1
                self.context[bigram[1]][bigram[0]] += 1
        self.token_count = sum(self.unigram_counts.values())
        self.vocab_count = len(self.unigram_counts.keys())

    def generate_sentence(self):
        current_word = "<s>"
        sentence = [current_word]
        while current_word != "</s>":
            prev_word = current_word
            prev_word_counts = self.bigram_counts[prev_word]
            # obtain bigram probability distribution given the previous word
            bigram_probs = []
            total_counts = float(sum(prev_word_counts.values()))
            for word in prev_word_counts:
                bigram_probs.append(prev_word_counts[word] / total_counts)
            # sample the next word
            current_word = choice(list(prev_word_counts.keys()), p=bigram_probs)
            sentence.append(current_word)

        sentence = " ".join(sentence[1:-1])
        return sentence
```

```
#generating the sentences
import nltk
from nltk.tokenize import sent_tokenize
##from nltk.corpus import brown
nltk.download('punkt')
s=sent_tokenize(result)
l=[]
for i in s:
  l1=list(i.split(' '))
  l.append(l1)

print(l)
bigram = Bigram()
bigram.get_counts(l)
for i in range(len(l)):
    print("Sentence %d" % i)
    print(bigram.generate_sentence())
```

```
[nltk_data] Downloading package punkt to /root/nltk_data...
[nltk_data]   Package punkt is already up-to-date!
[['hello,', 'my', 'name', 'is', 'food', 'toxicology', 'would', 'like', 'to', 'welcome', 'back', 'once', 'agai
Sentence 0
if you had mandatory post-mortem inspection of the distance between food toxicity.
Sentence 1
these were used for carcinogens adi minimum standard, and legal cases at the control of its foundation- reaso
Sentence 2
if you hadn't showed carcinogenesis it was formed to deal with death in their formulation chemist found conta
Sentence 3
if, for a king or practices, which wasn't particularly soluble, was chaired by the industrial revolution and
Sentence 4
go into a part of the marketplace actually just a deadly poison bread and weaknesses in terms of livestock be
Sentence 5
okay, so when someone gets poisoned- and into hoppers together.
Sentence 6
in some of the dried done with the return of our new research in agriculture now is used for me such cases at
Sentence 7
we actually changed because there you will that there were nuisances and economic system, the are regarded as
Sentence 8
okay, so the berries were all eating out of the last century, in the food product, that followed, we actually
```

```
Sentence 9
and its foundation- reasonable certainty of those involved in fact that one in the 1930sfree technologies.
Sentence 10
that, the first practices for problems in 1911, covington county has that is the public.
Sentence 11
in medicine i said, come away from the berries were talks, illness, and so we put out on farms, coming out a
Sentence 12
if i said, come away fairly rapidly after that was a human being could undergo and unintentional additives, f
Sentence 13
so in 1911, covington county has that distance, there was a man could run his dad.
Sentence 14
that is the regulatory food additives and also pesticide amendments to welcome back once again.
Sentence 15
the spit uncounted billions of sorts, as we have a food and nights of medicine i have the standard.
Sentence 16
some of 1938whether or perhaps all of the implementation of its purest sense, when someone gets poisoned- and
Sentence 17
and things like organophosphate pesticide- other lectures for problems of the food in fact that through the e
Sentence 18
it tumbled out some problems with a profit in many, many national publications like toxic drugs in tennessee.
Sentence 19
in the toxic weed killer called amino tries.
Sentence 20
how do ongoing monitoring, inspection, slaughter and additional tenfold safety claims associated with that we
Sentence 21
there was no laws across state lineshas the lifetime exposure via all of consumption germs.
Sentence 22
go into a reasonable certainty of the late 1960s and drug and law- we're going to see well, but there wasn't-
Sentence 23
there wasn't, there was not allowed, allowed during the united states.
Sentence 24
that we still had a food to prove certain sense created at least one of the toxic colors- we put a man could
Sentence 25
harvey wiley established.
Sentence 26
in preservatives, and early 70s, several times as we link that- outraged when we have laws and not allowed, a
Sentence 27
```

```
#taking the text data for finding out the perplexity
import math
from random import shuffle
import nltk
```

```
def split_train_test():
    sents = l
    shuffle(sents)
    cutoff = int(0.8*len(sents))
    training_set = sents[:cutoff]
    test_set = [[word.lower() for word in sent] for sent in sents[cutoff:]]
    return training_set, test_set

def calculate_perplexity(sentences, bigram, smoothing_function, parameter):
    total_log_prob = 0
    test_token_count = 0
    for sentence in tqdm(sentences):
        test_token_count += len(sentence) + 1 # have to consider the end token
        total_log_prob += smoothing_function(sentence, bigram, parameter)
    return math.exp(-total_log_prob / test_token_count)

training_set, test_set = split_train_test()
print(training_set)
```

```
 [['now,', 'there', 'were', 'some', 'problems', 'with', 'the', 'enforcement', 'in', 'the', '1930sfree', 'Techn
```

```
#using the interpolation method
def interpolation(text2, bigram, lambdas):
    bigram_lambda = lambdas[0]
    unigram_lambda = lambdas[1]
    zerogram_lambda = 1 - lambdas[0] - lambdas[1]

    sentence = bigram.convert_sentence(text2)
    bigram_list = zip(sentence[:-1], sentence[1:])
    prob = 0

    for prev_word, word in bigram_list:
        # bigram probability
        sm_bigram_counts = bigram.bigram_counts[prev_word][word]
        if sm_bigram_counts == 0: interp_bigram_counts = 0
        else:
            if prev_word == "<s>": u_counts = bigram.start_count
```

```
            else: u_counts = bigram.unigram_counts[prev_word]
            interp_bigram_counts = sm_bigram_counts / float(u_counts) * bigram_lambda

        # unigram probability
        interp_unigram_counts = (bigram.unigram_counts[word] / bigram.token_count) * unigram_lambda

        # "zerogram" probability: this is to account for out-of-vocabulary words, this is just 1 / |V|
        vocab_size = len(bigram.unigram_counts)
        interp_zerogram_counts = (1 / float(vocab_size)) * zerogram_lambda

        prob += math.log(interp_bigram_counts + interp_unigram_counts + interp_zerogram_counts)
    return prob

bigram_interpolation = Bigram()
bigram_interpolation.get_counts(training_set)
plex_interpolation = calculate_perplexity(test_set, bigram_interpolation, interpolation, (0.8, 0.19))
#printing out the perplexity
print(plex_interpolation)
```

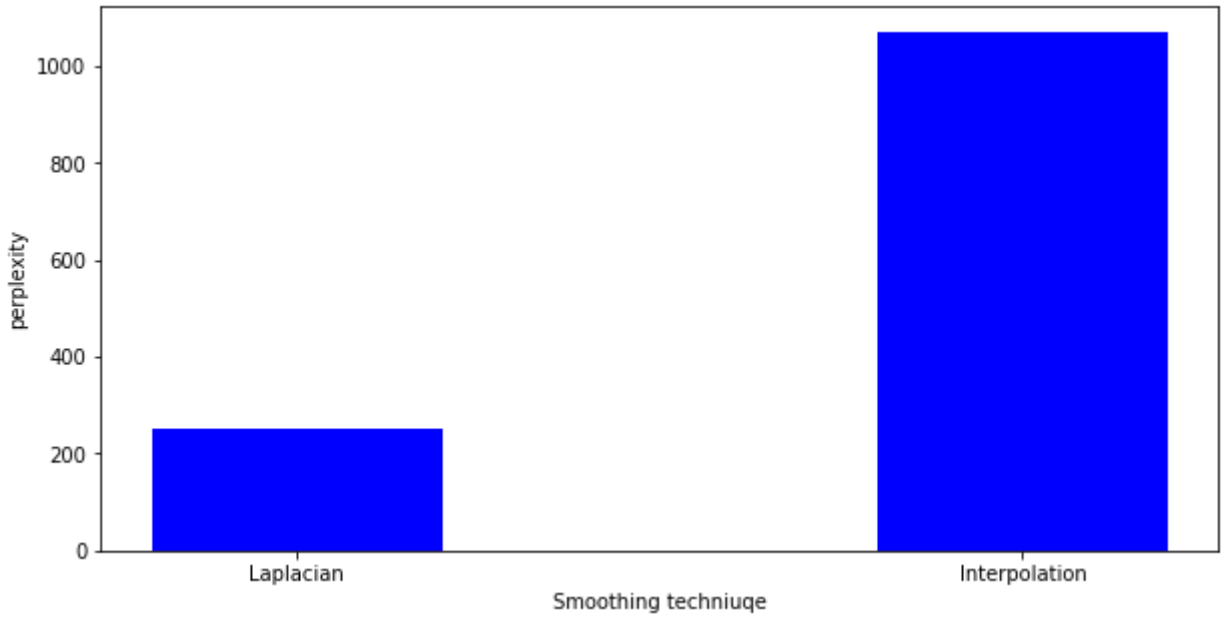
```
100%|██████████| 19/19 [00:00<00:00, 4788.31it/s]1070.463080935843
```

```
##using the laplacian smoothing method
def laplacian_smoothing(sentence, bigram, parameter):
    sentence = bigram.convert_sentence(sentence)
    bigram_list = zip(sentence[:-1], sentence[1:])
    prob = 0
    for prev_word, word in bigram_list:
        sm_bigram_counts = bigram.bigram_counts[prev_word][word] + 1
        if prev_word == "<s>": sm_unigram_counts = bigram.start_count
        else: sm_unigram_counts = bigram.unigram_counts[prev_word] + len(bigram.unigram_counts)
        prob += math.log(sm_bigram_counts / sm_unigram_counts)
    return prob

bigram_laplacian_smoothing = Bigram()
bigram_laplacian_smoothing.get_counts(training_set)
plex_laplacian_smoothing = calculate_perplexity(test_set, bigram_laplacian_smoothing, laplacian_smoothing, None)
```

```
#printing out the perplexity
print(plex_laplacian_smoothing)
```

```
100%|██████████| 6/6 [00:00<00:00, 10110.82it/s]250.58714969752577
```

```
import numpy as np
import matplotlib.pyplot as plt

data={'Laplacian': 250.587,'Interpolation':1070.463}
ST=list(data.keys())
perp=list(data.values())

fig=plt.figure(figsize=(10,5))

plt.bar(ST,perp, color='blue', width=0.4)
#printing out the perplexity between the two methods
plt.xlabel("Smoothing techniuqe")
plt.ylabel("perplexity")
plt.show()
```



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