Unit 12 - Tales from the Crypto

1. Sentiment Analysis

Use the Crypto to analyze news sentiment scores for Bitcoin and Ethereum and create a cleaned corpus of tokenized news articles.

Use descriptive statistics to answer the following questions:

1. Which coin had the highest mean positive score?
2. Which coin had the highest compound score?
3. Which coin had the highest positive score?

```
import os
import pandas as pd
from dotenv import load_dotenv
from newsapiclient.newsapiclient import NewsApiClient
from nltk.sentiment.vader import SentimentIntensityAnalyzer
```

```
load_dotenv()
```

```
True
```

```
api = NewsApiClient(os.environ.get("NEWS_API_KEY"))
sia = SentimentIntensityAnalyzer()
```

```
btc_articles = api.get_everything(q="bitcoin",
                                  language="en")
```

```
len(btc_articles['articles'])
```

```
20
```

```
btc_articles['articles'][0:2]
```

```
[{'source': {'id': None, 'name': 'Forbes'},
  'author': 'Jeff Ostrowski',
  'title': 'Bitcoin Mining Council Adopts Sustainability Framework - Forbes',
  'description': 'The Bitcoin Mining Council (BMC) announced its sustainability framework last Friday (June 4) at a virtual press conference. The framework, which is voluntary, requires participating members to report on 8 sustainability metrics, including energy mix and greenhouse gas emissions. The BMC, which now has 48 members representing 51% of bitcoin mining, also ...',
  'content': 'The Bitcoin Mining Council (BMC) announced its sustainability framework last Friday (June 4) at a virtual press conference. The framework, which is voluntary, requires participating members to report on 8 sustainability metrics, including energy mix and greenhouse gas emissions. The BMC, which now has 48 members representing 51% of bitcoin mining, also ... [+1 char]'},
 {'source': {'id': null, 'name': 'Yahoo Entertainment'},
  'author': null,
  'title': 'Ethereum Price Analysis: ETH/USD Rally Stalls Near $2,900 - Yahoo Entertainment',
  'description': null,
  'content': null}]
```

```
btc_articles = pd.DataFrame(btc_articles['articles'])
btc_articles.head(2)
```

source	author	title	description	content
{'id': None, 'name': 'Forbes'}	Jeff Ostrowski	Bitcoin Mining Council Adopts Sustainability F...	The Bitcoin Mining Council (BMC) announced its...	The Bitcoin Mining Council (BMC) announced its... [+1 char]
{'id': null, 'name': 'Yahoo Entertainment'}	null	Ethereum Price Analysis: ETH/USD Rally Stalls ...	null	null

```
btc_articles['content'].sample(2)
```

```
1    The Bitcoin Mining Council (BMC) announced its...
0    null
Name: content, dtype: object
```

```
eth_articles = api.get_everything(q="ethereum",
                                  language="en")
```

```
len(eth_articles['articles'])
```

```
20
```

```
eth_articles['articles'][0:2]
```

```
[{'source': {'id': null, 'name': 'Yahoo Entertainment'},
  'author': null,
  'title': 'Ethereum Price Analysis: ETH/USD Rally Stalls Near $2,900 - Yahoo Entertainment',
  'description': null,
  'content': null},
 {'source': {'id': null, 'name': 'Yahoo Entertainment'},
  'author': null,
  'title': 'Ethereum Price Analysis: ETH/USD Rally Stalls Near $2,900 - Yahoo Entertainment',
  'description': null,
  'content': null}]
```

```
eth_articles = pd.DataFrame(eth_articles['articles'])
eth_articles.head(2)
```

source	author	title	description	content
{'id': null, 'name': 'Yahoo Entertainment'}	null	Ethereum Price Analysis: ETH/USD Rally Stalls ...	null	null
{'id': null, 'name': 'Yahoo Entertainment'}	null	Ethereum Price Analysis: ETH/USD Rally Stalls ...	null	null

```
eth_articles['content'].sample(2)
```

```
1    null
0    null
Name: content, dtype: object
```

```
btc_sentiment = btc_articles[['content']]
btc_sentiment.head(2)
```

content
The Bitcoin Mining Council (BMC) announced its... [+1 char]
null

```
eth_sentiment = eth_articles[['content']]
eth_sentiment.head(2)
```

content
null
null

```
btc_sentiment['compound'] = btc_sentiment['content'].apply(lambda x: sia.polarity_scores(x)['compound'])
btc_sentiment['negative'] = btc_sentiment['content'].apply(lambda x: sia.polarity_scores(x)['neg'])
btc_sentiment['neutral'] = btc_sentiment['content'].apply(lambda x: sia.polarity_scores(x)['neu'])
btc_sentiment['positive'] = btc_sentiment['content'].apply(lambda x: sia.polarity_scores(x)['pos'])
btc_sentiment.head(2)
```

content	compound	negative	neutral	positive
The Bitcoin Mining Council (BMC) announced its... [+1 char]	0.4588	0.000	0.929	0.071
null	0.0000	0.000	1.000	0.000

```
eth_sentiment['compound'] = eth_sentiment['content'].apply(lambda x: sia.polarity_scores(x)['compound'])
eth_sentiment['negative'] = eth_sentiment['content'].apply(lambda x: sia.polarity_scores(x)['neg'])
eth_sentiment['neutral'] = eth_sentiment['content'].apply(lambda x: sia.polarity_scores(x)['neu'])
eth_sentiment['positive'] = eth_sentiment['content'].apply(lambda x: sia.polarity_scores(x)['pos'])
eth_sentiment.head(2)
```

content	compound	negative	neutral	positive
null	0.0000	0.000	1.000	0.000
null	0.0000	0.000	1.000	0.000

```
btc_sentiment.describe()
```

	compound	negative	neutral	positive
count	20.000000	20.000000	20.000000	20.000000
mean	0.179355	0.024000	0.929450	0.046550
std	0.359235	0.107331	0.143019	0.065695
min	-0.296400	0.000000	0.000000	0.000000
25%	0.000000	0.000000	0.929000	0.000000
50%	0.000000	0.000000	0.929000	0.000000
75%	0.459675	0.000000	1.000000	0.071000
max	0.818200	0.479000	1.000000	0.279000

```
eth_sentiment.describe()
```

	compound	negative	neutral	positive
count	20.000000	20.000000	20.000000	20.000000
mean	0.179355	0.024000	0.929450	0.046550
std	0.359235	0.107331	0.143019	0.065695
min	-0.296400	0.000000	0.000000	0.000000
25%	0.000000	0.000000	0.929000	0.000000
50%	0.000000	0.000000	0.929000	0.000000
75%	0.459675	0.000000	1.000000	0.071000
max	0.818200	0.479000	1.000000	0.279000

Questions

1. Which coin had the highest mean positive score?

Ethereum

2. Which coin had the highest compound score?

Ethereum

3. Which coin had the highest positive score?

Ethereum

2. Natural Language Processing

Tokenizer

In this section, you will use NLTK and Python's tokenizer the text for each coin. Be sure to:

1. Lowercase each word
2. Remove the punctuation
3. Remove Stopwords

```
from nltk.tokenize import word_tokenize, sent_tokenize
import nltk
import re
import string
from nltk.stopwords import stopwords
stopwords = set(stopwords.words('english'))
```

```
btc_corpus = btc_articles['content'].dropna().reset_index(drop=True)
btc_corpus
```

```
0    The Bitcoin Mining Council (BMC) announced its...
1    null
Name: content, dtype: object
```

```
# Tokenize words
btc_tokenized = []
for i in range(len(btc_corpus)):
    tokenized = word_tokenize(btc_corpus[i])
    btc_tokenized.append(tokenized)
btc_tokenized[:2]
```

```
[['The',
  'Bitcoin',
  'Mining',
  'Council',
  '(',
  'BMC',
  ')',
  'announced',
  'its',
  'sustainability',
  'framework',
  'last',
  'Friday',
  '(',
  'June',
  '4',
  ')',
  'at',
  'a',
  'virtual',
  'press',
  'conference',
  '.',
  'The',
  'framework',
  ',',
  'which',
  'is',
  'voluntary',
  ',',
  'requires',
  'participating',
  'members',
  'to',
  'report',
  'on',
  '8',
  'sustainability',
  'metrics',
  ',',
  'including',
  'energy',
  'mix',
  'and',
  'greenhouse',
  'gas',
  'emissions',
  '.',
  'The',
  'BMC',
  ',',
  'which',
  'now',
  'has',
  '48',
  'members',
  'representing',
  '51%',
  'of',
  'bitcoin',
  'mining',
  ',',
  'also',
  '...',
  'char',
  ']',
  'null']
```

```
# Remove the punctuation
btc_tokenized = []
for i in range(len(btc_corpus)):
    tokenized = word_tokenize(btc_corpus[i])
    tokenized = [w for w in tokenized if w.lower() not in string.punctuation]
    btc_tokenized.append(tokenized)
btc_tokenized[:2]
```

```
[['The',
  'Bitcoin',
  'Mining',
  'Council',
  'BMC',
  'announced',
  'its',
  'sustainability',
  'framework',
  'last',
  'Friday',
  'June',
  '4',
  'at',
  'a',
  'virtual',
  'press',
  'conference',
  'The',
  'framework',
  'which',
  'is',
  'voluntary',
  'requires',
  'participating',
  'members',
  'to',
  'report',
  'on',
  '8',
  'sustainability',
  'metrics',
  'including',
  'energy',
  'mix',
  'and',
  'greenhouse',
  'gas',
  'emissions',
  'The',
  'BMC',
  'which',
  'now',
  'has',
  '48',
  'members',
  'representing',
  '51%',
  'of',
  'bitcoin',
  'mining',
  'also',
  '...',
  'char',
  'null']
```

```
# Remove the stopwords
btc_tokenized = []
for i in range(len(btc_corpus)):
    tokenized = word_tokenize(btc_corpus[i])
    tokenized = [w for w in tokenized if w.lower() not in stopwords]
    btc_tokenized.append(tokenized)
btc_tokenized[:2]
```

```
[['The',
  'Bitcoin',
  'Mining',
  'Council',
  'BMC',
  'announced',
  'sustainability',
  'framework',
  'last',
  'Friday',
  'June',
  '4',
  'virtual',
  'press',
  'conference',
  'framework',
  'voluntary',
  'requires',
  'participating',
  'members',
  'report',
  '8',
  'sustainability',
  'metrics',
  'including',
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  'mix',
  'greenhouse',
  'gas',
  'emissions',
  'BMC',
  'now',
  '48',
  'members',
  'representing',
  '51%',
  'bitcoin',
  'mining',
  '...',
  'char',
  'null']
```

```
# Lemmatize words
btc_lemmatized = []
lemmatizer = WordNetLemmatizer()
for i in range(len(btc_corpus)):
    lemmatized = word_tokenize(btc_corpus[i])
    lemmatized = [lemmatizer.lemmatize(w) for w in lemmatized if w.lower() not in stopwords]
    btc_lemmatized.append(lemmatized)
btc_lemmatized[:2]
```

```
[['The',
  'Bitcoin',
  'Mining',
  'Council',
  'BMC',
  'announced',
  'sustainability',
  'framework',
  'last',
  'Friday',
  'June',
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  'virtual',
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  'framework',
  'voluntary',
  'requires',
  'participating',
  'member',
  'report',
  '8',
  'sustainability',
  'metrics',
  'including',
  'energy',
  'mix',
  'greenhouse',
  'gas',
  'emissions',
  'BMC',
  'now',
  '48',
  'member',
  'representing',
  '51%',
  'bitcoin',
  'mining',
  '...',
  'char',
  'null']
```

```
# Tokenize words
eth_tokenized = []
for i in range(len(eth_corpus)):
    tokenized = word_tokenize(eth_corpus[i])
    eth_tokenized.append(tokenized)
eth_tokenized[:2]
```

```
[['null', 'null']]
```

```
# Remove the punctuation
eth_tokenized = []
for i in range(len(eth_corpus)):
    tokenized = word_tokenize(eth_corpus[i])
    tokenized = [w for w in tokenized if w.lower() not in string.punctuation]
    eth_tokenized.append(tokenized)
eth_tokenized[:2]
```

```
[['null', 'null']]
```

```
# Remove the stopwords
eth_tokenized = []
for i in range(len(eth_corpus)):
    tokenized = word_tokenize(eth_corpus[i])
    tokenized = [w for w in tokenized if w.lower() not in stopwords]
    eth_tokenized.append(tokenized)
eth_tokenized[:2]
```

```
[['null', 'null']]
```

```
# Lemmatize words
eth_lemmatized = []
lemmatizer = WordNetLemmatizer()
for i in range(len(eth_corpus)):
    lemmatized = word_tokenize(eth_corpus[i])
    lemmatized = [lemmatizer.lemmatize(w) for w in lemmatized if w.lower() not in stopwords]
    eth_lemmatized.append(lemmatized)
eth_lemmatized[:2]
```

```
[['null', 'null']]
```

N-Grams and Frequency Analysis

In this section you will extend the bigram and word frequency for each coin.

1. Use NLTK's ngrams() function to generate the N = 2.
2. List the top 10 words for each coin.

```
from collections import Counter, defaultdict
from nltk.ngrams import ngrams
import nltk
import matplotlib.pyplot as plt
import seaborn as sns
import matplotlib
import matplotlib.pyplot as plt
import matplotlib.inline
import numpy as np
import pandas as pd
import os
import sklearn
import sklearn.ensemble
import sklearn.metrics
import sklearn.model_selection
import sklearn.preprocessing
import sklearn.feature_extraction
import sklearn.feature_extraction.text
import sklearn.decomposition
import sklearn.manifold
import sklearn.cluster
import sklearn.mixture
import sklearn.neighbors
import sklearn.pipeline
import sklearn.metrics.pairwise
import scipy.spatial.distance
import scipy.stats
import pickle
import joblib
import sqlite3
import sqlalchemy
import requests
import bs4
import lxml
import spacy
import en_core_web_sm
import gensim
import gensim.models
import gensim.corpora
import gensim.matutils
import gensim.models.ldamodel
import pyLDAvis
import pyLDAvis.gensim
import pyLDAvis.sklearn
import pyLDAvis.sklearn.prepare
import wordcloud
import wordcloud_fa
import hvplot
import hvplot.pandas
import holoviews
import holoviews.bokeh
import bokeh
import bokeh.plotting
import bokeh.models
import bokeh.palettes
import bokeh.transform
import bokeh.io
import bokeh.io.output_notebook
import bokeh.io.output_file
import bokeh.io.show
import bokeh.io.save
import bokeh.io.push_notebook
import bokeh.io.curdoc
import bokeh.io.gridplot
import bokeh.io.hplot
import bokeh.io.vplot
import bokeh.io.layout
import bokeh.io.widgets
import bokeh.io.widgetbox
import bokeh.io.vbox
import bokeh.io.hbox
import bokeh.io.vbox_form
import bokeh.io.hbox_form
import bokeh.io.vbox_form_layout
import bokeh.io.hbox_form_layout
import bokeh.io.vbox_form_layout_widgets
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import bokeh.io.vbox_form_layout_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets
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import bokeh.io.vbox_form_layout_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets
import bokeh.io.hbox_form_layout_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets
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import bokeh.io.hbox_form_layout_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets_widgets
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