## crypto\_sentiment

May 29, 2021

## 1 Unit 12 - Tales from the Crypto

## 1.1 1. Sentiment Analysis

Use the newsapi to pull the latest news articles for Bitcoin and Ethereum and create a DataFrame of sentiment scores for each coin.

Use descriptive statistics to answer the following questions: 1. Which coin had the highest mean positive score? 2. Which coin had the highest negative score? 3. Which coin had the highest positive score?

```
[47]: # Initial imports
      import os
      import pandas as pd
      from dotenv import load dotenv
      from newsapi import NewsApiClient
      import nltk as nltk
      nltk.download('vader_lexicon')
      nltk.download('wordnet')
      nltk.download('stopwords')
      nltk.download('punkt')
      from nltk.sentiment.vader import SentimentIntensityAnalyzer
      from nltk.corpus import stopwords, reuters
      from nltk.tokenize import word_tokenize
      from nltk.stem import WordNetLemmatizer
      from wordcloud import WordCloud
      import re
      analyzer = SentimentIntensityAnalyzer()
      %matplotlib inline
```

```
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[nltk_data] /Users/martinrasumoff/nltk_data...
[nltk_data] Package vader_lexicon is already up-to-date!
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     [nltk_data]
     [nltk_data] Downloading package stopwords to
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     [nltk data]
     [nltk data]
                   Unzipping corpora/stopwords.zip.
     [nltk data] Downloading package punkt to
                     /Users/martinrasumoff/nltk data...
     [nltk_data]
     [nltk data]
                   Unzipping tokenizers/punkt.zip.
 [2]: # Read your api key environment variable
      load_dotenv('example.env')
      news_api = os.getenv("news_api")
      news_api
 [2]: '79a0cda5b8ed483a8a49574abeb92960'
 [5]: # Create a newsapi client
      newsapi = NewsApiClient(api_key=news_api)
[14]: # Fetch the Bitcoin news articles
      btc_headlines = newsapi.get_everything(q="bitcoin", language="en",_
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adorable, goats noting their names are Max and Bitcoin.\nAnd to that I say: OK
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Bitcoin on a roller coaster this month-and exposed weaknesses in the
cryptocurrency market along the way.',
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generally come with crypto as a currency, PayPal's bitcoin ambitions keep on
ramping up. On Wednesday, Jose Fernandez da Ponte-the company's VP of all things
blockchain-confirmed in an interview that PayP...',
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pipelines in the United States, found that out the hard way this week. It
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Michele Doying / The Verge\r\nIran is temporarily banning cryptocurrency mining
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Elon Musk's wild week of whipping crypto markets. If you're reading this on the
TechCrunch site, you can get this in y...',
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Wednesday, citing concerns about the use of fossil fuel for bitcoin mining.',
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8, 2021. REUTERS/Dado Ruvic/File PhotoTesla Inc (TSLA.... [+696 chars]'},
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Bell. Sign up here to get this email in your inbox every morning. \nSign up for
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      2 Tesla stops taking Bitcoin for vehicle purchas...
      3 Coinbase is down amid massive cryptocurrency p...
      4 Mark Zuckerberg has a goat named Bitcoin and w...
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      4 Mark Zuckerberg posted a picture of his two, f...
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                                                 urlToImage
                                                                      publishedAt \
      0 https://techcrunch.com/wp-content/uploads/2017... 2021-05-12T22:46:10Z
      1 https://techcrunch.com/wp-content/uploads/2021... 2021-05-04T14:30:39Z
      2 https://techcrunch.com/wp-content/uploads/2021...
                                                          2021-05-15T01:49:36Z
      3 https://cdn.cnn.com/cnnnext/dam/assets/2105010... 2021-05-01T17:24:45Z
      4 https://techcrunch.com/wp-content/uploads/2021... 2021-05-03T18:08:48Z
                                                    content
      O Vitalik Buterin, the creator of Ethereum, on W...
      1 Their investors call them disruptive innovator...
      2 Solana isn't known yet outside of the crypto c...
      3 New York (CNN Business)Bitcoin prices continue...
```

4 The creators behind CryptoPunks, one of the mo...

```
[17]: # Describe the Bitcoin Sentiment
      btc_analyzer = SentimentIntensityAnalyzer()
      btc_sentiments = []
      for article in btc_headlines["articles"]:
          try:
              text = article["content"]
              date = article["publishedAt"][:10]
              sentiment = analyzer.polarity_scores(text)
              compound = sentiment["compound"]
              pos = sentiment["pos"]
              neu = sentiment["neu"]
              neg = sentiment["neg"]
              btc_sentiments.append({
                  "text": text,
                  "date": date,
                  "compound": compound,
                  "positive": pos,
                  "negative": neg,
                  "neutral": neu
              })
          except AttributeError:
              pass
      # Create DataFrame
      btc_df = pd.DataFrame(btc_sentiments)
      # Reorder DataFrame columns
      cols = ["date", "text", "compound", "positive", "negative", "neutral"]
      btc_df = btc_df[cols]
      btc_df.head()
```

```
[17]: date text compound \
0 2021-05-12 Just weeks after Tesla started accepting Bitco... 0.3818
1 2021-05-07 Shares of Square are up more than 6% today aft... 0.2960
2 2021-05-12 Image: Tesla\r\n\n\n\n\n Tesla has stopped acce... 0.4939
3 2021-05-19 Illustration by Alex Castro / The Verge\r\n\n ... 0.0000
4 2021-05-11 Mark Zuckerberg posted a picture of his two, f... 0.8455

positive negative neutral
```

```
0.071
                       0.00
                               0.929
      0
      1
            0.058
                       0.00
                               0.942
                       0.05
      2
            0.134
                               0.816
      3
            0.000
                       0.00
                               1.000
      4
            0.217
                       0.00
                               0.783
[20]: print(f"Mean positive Score: {btc_df['positive'].mean()}")
     Mean positive Score: 0.04883
[22]: # Describe the Ethereum Sentiment
      # Describe the Bitcoin Sentiment
      eth_analyzer = SentimentIntensityAnalyzer()
      eth_sentiments = []
      for article in eth_headlines["articles"]:
              text = article["content"]
              date = article["publishedAt"][:10]
              sentiment = analyzer.polarity_scores(text)
              compound = sentiment["compound"]
              pos = sentiment["pos"]
              neu = sentiment["neu"]
              neg = sentiment["neg"]
              eth_sentiments.append({
                  "text": text,
                  "date": date,
                  "compound": compound,
                  "positive": pos,
                  "negative": neg,
                  "neutral": neu
              })
          except AttributeError:
              pass
      # Create DataFrame
      eth_df = pd.DataFrame(eth_sentiments)
      # Reorder DataFrame columns
      cols = ["date", "text", "compound", "positive", "negative", "neutral"]
      eth_df = eth_df[cols]
      eth_df.head()
```

```
[22]:
                                                                   text compound \
               date
                                                                         0.2263
        2021-05-12 Vitalik Buterin, the creator of Ethereum, on W...
      1 2021-05-04 Their investors call them disruptive innovator...
                                                                        -0.2144
      2 2021-05-15 Solana isn't known yet outside of the crypto c...
                                                                         0.5499
      3 2021-05-01 New York (CNN Business)Bitcoin prices continue...
                                                                         0.0000
      4 2021-05-03
                    The creators behind CryptoPunks, one of the mo...
                                                                         0.4754
         positive negative neutral
            0.060
                      0.000
                               0.940
      0
      1
            0.054
                      0.111
                               0.835
      2
            0.106
                      0.000
                               0.894
      3
            0.000
                      0.000
                               1.000
      4
                      0.000
                               0.909
            0.091
[27]: print(f"BTC Mean positive Score: {btc_df['positive'].mean()}")
      print(f"ETH Mean positive Score: {eth_df['positive'].mean()}")
      print(f"BTC Highest Coumpund Score: {btc_df['compound'].max()}")
      print(f"ETH Highest Compund Score: {eth_df['compound'].max()}")
```

print(f"BTC Mean positive Score: {btc\_df['positive'].max()}")
print(f"ETH Mean positive Score: {eth df['positive'].max()}")

BTC Mean positive Score: 0.04883

ETH Mean positive Score: 0.053999999999998

BTC Highest Coumpund Score: 0.8455 ETH Highest Compund Score: 0.8225 BTC Mean positive Score: 0.275 ETH Mean positive Score: 0.256

### 1.1.1 Questions:

Q: Which coin had the highest mean positive score?

A: ETH with a score of 0.05399

Q: Which coin had the highest compound score?

A: BTC with a score of 0.8455

Q. Which coin had the highest positive score?

A: BTC with a score of 0.275

# 1.2 ## 2. Natural Language Processing

#### 1.2.1 Tokenizer

In this section, you will use NLTK and Python to tokenize the text for each coin. Be sure to: 1. Lowercase each word. 2. Remove Punctuation. 3. Remove Stopwords.

```
[48]: from nltk.tokenize import word_tokenize, sent_tokenize from nltk.corpus import stopwords from nltk.stem import WordNetLemmatizer, PorterStemmer from string import punctuation import re
```

```
[49]: # Instantiate the lemmatizer
lemmatizer = WordNetLemmatizer()

# Create a list of stopwords
sw = set(stopwords.words('english'))

# Expand the default stopwords list if necessary
# YOUR CODE HERE!
```

```
[110]: # Complete the tokenizer function
       def tokenizer(text):
           """Tokenizes text."""
           # Remove the punctuation from text
           regex = re.compile("[^a-zA-Z]")
           re_clean = regex.sub('', text)
           # Create a tokenized list of the words
           words = word_tokenize(re_clean)
           # Lemmatize words into root words
           lem = [lemmatizer.lemmatize(word) for word in words]
           # Convert the words to lowercase & # Remove the stop words
           output = [word.lower() for word in lem if word.lower() not in sw]
           return output
       def tokenizer2(text):
           """Tokenizes text."""
           # Remove the punctuation from text
           regex = re.compile("[^a-zA-Z]")
```

```
re_clean = regex.sub('', text)
          # Create a tokenized list of the words
          words = word_tokenize(re_clean)
          # Lemmatize words into root words
          lem = [lemmatizer.lemmatize(word) for word in words]
          # Convert the words to lowercase & # Remove the stop words
          output = [word.lower() for word in lem if word.lower() not in sw]
          return ' '.join(output)
[71]: | # Create a new tokens column for Bitcoin
      btc_df["tokens"] = ""
      for row in range(len(btc_df["text"])):
          input_words = tokenizer(btc_df.iloc[row]["text"])
          btc_df.at[row, 'tokens'] = input_words
      btc_df
[71]:
                                                                          compound \
                date
                                                                    text
          2021-05-12 Just weeks after Tesla started accepting Bitco...
                                                                          0.3818
          2021-05-07 Shares of Square are up more than 6% today aft...
      1
                                                                          0.2960
          2021-05-12 Image: Tesla\r\n\n \n\n Tesla has stopped acce...
      2
                                                                          0.4939
      3
          2021-05-19 Illustration by Alex Castro / The Verge\r\n\n ...
                                                                          0.0000
          2021-05-11 Mark Zuckerberg posted a picture of his two, f...
      4
                                                                          0.8455
      . .
      95 2021-05-19 Institutional investors are switching out of b...
                                                                          0.0000
      96 2021-05-12 Cryptocurrency ether hit a record high on Wedn...
                                                                          0.4588
          2021-05-19 (Kitco News) It is red across the board in the...
      97
                                                                          0.1779
      98 2021-05-11 By Reuters Staff\r\n(Adds details on bitcoin, ...
                                                                          0.3818
          2021-05-06
                      Jack Dorsey, CEO of Square and CEO of Twitter,...
                                                                          0.0000
          positive negative neutral \
      0
             0.071
                        0.00
                                0.929
      1
             0.058
                        0.00
                                0.942
      2
             0.134
                        0.05
                                0.816
      3
             0.000
                        0.00
                                1.000
                        0.00
                                0.783
      4
             0.217
             0.000
                        0.00
                                1.000
      95
             0.097
                        0.00
                                0.903
      96
                                0.954
                        0.00
      97
             0.046
```

```
98
             0.082
                         0.00
                                 0.918
      99
             0.000
                         0.00
                                 1.000
                                                       tokens
          [week, tesla, started, accepting, bitcoin, cur...
      0
      1
          [shares, square, today, american, fintech, com...
      2
          [image, tesla, tesla, ha, stopped, accepting, ...
      3
          [illustration, alex, castro, verge, cryptocurr...
          [mark, zuckerberg, posted, picture, two, frank...
      4
      . .
          [institutional, investor, switching, bitcoin, ...
      95
      96
          [cryptocurrency, ether, hit, record, high, wed...
      97
          [kitco, news, red, across, board, crypto, spac...
      98
          [reuters, staffadds, detail, bitcoin, update, ...
          [jack, dorsey, ceo, square, ceo, twitter, spea...
      [100 rows x 7 columns]
[72]: # Create a new tokens column for Ethereum
      eth_df["tokens"] = ""
      for row in range(len(eth_df["text"])):
          input_words = tokenizer(eth_df.iloc[row]["text"])
          eth_df.at[row, 'tokens'] = input_words
      eth df
[72]:
                date
                                                                            compound \
                                                                      text
      0
          2021-05-12 Vitalik Buterin, the creator of Ethereum, on W...
                                                                            0.2263
          2021-05-04 Their investors call them disruptive innovator...
      1
                                                                           -0.2144
      2
          2021-05-15 Solana isn't known yet outside of the crypto c...
                                                                            0.5499
          2021-05-01 New York (CNN Business)Bitcoin prices continue...
      3
                                                                            0.0000
                      The creators behind CryptoPunks, one of the mo...
      4
          2021-05-03
                                                                            0.4754
      . .
          2021-05-19
                      Bitcoin, Ethereum and other major cryptocurren...
      95
                                                                           -0.1779
      96
          2021-05-26
                      Opinions expressed by Entrepreneur contributor...
                                                                            0.3182
          2021-05-19
                      Bitcoin tumbled below the $40,000 mark on Wedn...
      97
                                                                           -0.0772
      98
          2021-05-08
                      Back in 2015, David Grider was working at an i...
                                                                            0.4767
                      Mark Cuban.\r\nBrian Snyder/Reuters\r\n<li...</pre>
          2021-04-30
                                                                            0.1779
          positive negative neutral
                        0.000
                                 0.940
      0
             0.060
                       0.111
      1
             0.054
                                 0.835
      2
             0.106
                       0.000
                                 0.894
             0.000
                       0.000
      3
                                 1.000
      4
             0.091
                       0.000
                                 0.909
```

```
95
       0.062
                 0.083
                           0.855
96
       0.076
                 0.000
                           0.924
97
       0.068
                 0.136
                           0.796
       0.091
                 0.000
                           0.909
98
99
       0.055
                  0.000
                           0.945
                                                 tokens
0
    [vitalik, buterin, creator, ethereum, wednesda...
    [investor, call, disruptive, innovator, detrac...
1
2
    [solana, isnt, known, yet, outside, crypto, co...
    [new, york, cnn, businessbitcoin, price, conti...
3
    [creator, behind, cryptopunks, one, popular, n...
. .
    [bitcoin, ethereum, major, cryptocurrencies, p...
95
    [opinions, expressed, entrepreneur, contributo...
96
    [bitcoin, tumbled, mark, wednesday, threeandah...
97
    [back, david, grider, wa, working, investment,...
98
    [mark, cubanbrian, snyderreutersullimark, cuba...
[100 rows x 7 columns]
```

# 1.2.2 NGrams and Frequency Analysis

In this section you will look at the ngrams and word frequency for each coin.

- 1. Use NLTK to produce the n-grams for N=2.
- 2. List the top 10 words for each coin.

```
[73]: from collections import Counter
    from nltk import ngrams

[101]: # Generate the Bitcoin N-grams where N=2
    btc_words = []

    for row in range(len(btc_df)):
        text = btc_df.iloc[row]["text"].split(" ")
        for word in text:
            btc_words.append(word)

#print(btc_words)
btc_bigrams = ngrams(btc_words, 2)
btc_bigrams
```

[101]: <zip at 0x7fc070af9a00>

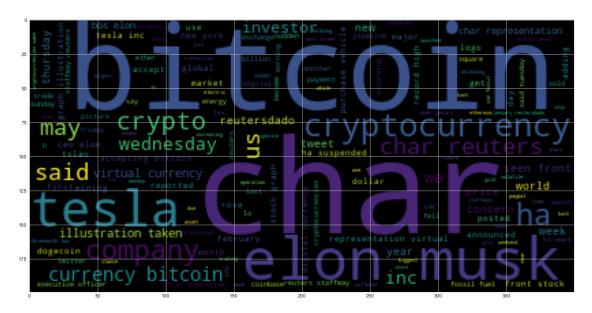
```
[103]: # Generate the Ethereum N-grams where N=2
       eth_words = []
       for row in range(len(eth_df)):
           text = eth_df.iloc[row]["text"].split(" ")
           for word in text:
               eth words.append(word)
       #print(btc words)
       eth_bigrams = ngrams(eth_words, 2)
       eth bigrams
[103]: <zip at 0x7fc070b48a40>
[84]: # Function token_count generates the top 10 words for a given coin
       def token_count(tokens, N=3):
           """Returns the top N tokens from the frequency count"""
           return Counter(tokens).most_common(N)
[102]: # Use token count to get the top 10 words for Bitcoin
       token_count(btc_bigrams, 10)
[102]: [(('Elon', 'Musk'), 25),
        (('in', 'the'), 16),
        (('in', 'a'), 13),
        (('chars]', 'By'), 12),
        (('(Reuters)', '-'), 12),
        (('to', 'a'), 11),
        (('By', 'Reuters'), 11),
        (('seen', 'in'), 10),
        (('in', 'this'), 10),
        (('of', 'the'), 9)]
[104]: # Use token_count to get the top 10 words for Ethereum
       token count(eth bigrams, 10)
[104]: [(('of', 'the'), 17),
        (('of', 'a'), 14),
        (('in', 'the'), 14),
        (('in', 'this'), 13),
        (('virtual', 'currency'), 12),
        (('illustration', 'taken'), 12),
        (('of', 'virtual'), 11),
        (('this', 'illustration'), 11),
        (('representation', 'of'), 10),
        (('seen', 'in'), 10)]
```

### 1.2.3 Word Clouds

In this section, you will generate word clouds for each coin to summarize the news for each coin

```
[105]: from wordcloud import WordCloud
       import matplotlib.pyplot as plt
       plt.style.use('seaborn-whitegrid')
       import matplotlib as mpl
       mpl.rcParams['figure.figsize'] = [20.0, 10.0]
[113]: def process_text(doc):
           sw = set(stopwords.words('english'))
           regex = re.compile("[^a-zA-Z]")
           re_clean = regex.sub('', doc)
           words = word_tokenize(re_clean)
           lem = [lemmatizer.lemmatize(word) for word in words]
           output = [word.lower() for word in lem if word.lower() not in sw]
           return ' '.join(output)
[114]: big_string = ' '.join(btc_words)
       input_words = process_text(big_string)
[115]: # Generate the Bitcoin word cloud
       wc = WordCloud().generate(input_words)
       plt.imshow(wc)
```

[115]: <matplotlib.image.AxesImage at 0x7fc070c116a0>



```
[116]: # Generate the Ethereum word cloud
big_string = ' '.join(eth_words)
input_words = process_text(big_string)
```

```
[117]: wc = WordCloud().generate(input_words)
plt.imshow(wc)
```

[117]: <matplotlib.image.AxesImage at 0x7fc070cbd4c0>



# 1.3 3. Named Entity Recognition

In this section, you will build a named entity recognition model for both Bitcoin and Ethereum, then visualize the tags using SpaCy.

```
[123]: import spacy
from spacy import displacy

[124]: # Load the spaCy model
nlp = spacy.load('en_core_web_sm')
```

#### 1.3.1 Bitcoin NER

```
[127]: # Concatenate all of the Bitcoin text together
btc_string = ""

for row in range(len(btc_df)):
    btc_string += btc_df.iloc[row]["text"]

[128]: # Run the NER processor on all of the text
btc_doc = nlp(btc_string)
    # Add a title to the document

[129]: # Render the visualization
displacy.render(btc_doc, style='ent')

<IPython.core.display.HTML object>
[131]: # List all Entities
```

```
[131]: # List all Entities
print([ent.text for ent in btc_doc.ents])
```

['Just weeks', 'Tesla', 'Bitcoin', 'Elon Musk', 'Square', 'more than 6%', 'today', 'American', '\$5.06 billion', '2021', '3.36', 'Tesla', 'Elon Musk', 'Alex Castro', 'The Verge\r\n\n \n\n Cryptocurrency', 'Coinbase', 'this morning', 'Coinbase', 'Bin', 'Zuckerberg', 'two', 'Max', 'Bitcoin', '+1482 chars]Last week', 'Musk', 'Dogecoin', 'Elon Musk', 'March', 'Musk', 'Tesla', 'Earlier this year', 'EV', '1.5', 'Elon Musk', 'Bitcoin', 'Bitcoin', 'Ethereum', 'Altcoins', 'Tuesday night', 'Wednesday', 'morning', 'months', 'hundreds of billions', 'Babel Finance', 'Monday', 'hours-long', 'this morning', 'May 19th', 'CNN', 'Saturday', 'about 6%', 'nearly \$58,000', 'PayPals', 'Wednesday', 'Jose Fernandez da Pontethe', 'more than 5,500 miles', 'the United States', 'Photo', 'Michele Doying', 'Verge', 'Iran', 'Last week', 'Trump', 'This week', 'Elon Musk's', 'Musk', 'Dogecoin', 'Twitter', 'Australian', 'London High Court', '16', 'around 4 billion pounds', 'about \$50,000', 'Asian', 'Thursday', 'as much as 17%', 'Elon Musk', 'Tesla Inc', 'Bitcoin', 'U.S.', 'January 8, 2021', 'Dado Ruvic/File PhotoTesla Inc', 'Reuters', 'May 12', 'Reuters', 'Elon Musk', 'Coinbase', 'Dogecoin', 'PayPal', 'Soon', 'PayPal', 'U.S.', 'Bitcoin', 'Elon Musk', 'Bitcoin', 'Bitcoin', 'Monday', 'February', 'Elon Musk', 'Tesla', 'the weekend', 'Bitcoin', 'Marseille', 'France', 'February 7, 2021', 'Eric GaillardBitcoin', '6.54%', '57,098.08', 'Friday', '3,504.11', 'U.S.', 'Bitcoin', 'U.S. Dollar', 'May 26, 2020', '6.8%', '\$56,852.03', '1000', 'GMT', 'Wednesday', 'chars] WASHINGTON', 'Reuters Breakingviews', 'U.S.', 'Bitcoins', 'Millions of dollars', 'Elon Musk', 'Bitcoins', 'a few month', 'Musk', 'Bitcoin', 'The Tesla Inc', 'three-month', 'Monday', "Elon Musk's", 'the weekend', 'Bitcoin', '45,000', 'Sunday', 'Elon Musk', 'Tesla', 'Bitcoin', 'three-month', 'Monday', "Elon Musk's", 'Reuters', 'SINGAPORE', 'Reuters', 'three-month', 'Monday', 'Elon Musks', 'the weekend', 'Reuters', 'Bitcoin', 'March 15, 2021', 'Pipeline', 'first', 'Bitcoin', 'Bitcoin', 'Reuters', 'May 11', 'Reuters', 'Peter Thielbacked', 'U.S.', 'Palantir Technologies Inc', 'Tuesday', "Hong Kong's", 'first', 'Hong Kong', 'February 28, 2014', 'Bobby Yip Concise', 'Musk', 'Bitcoin', 'Tesla', 'first quarter', 'Indonesia', 'first', 'today', 'hundreds', 'US', 'this year', 'CNBC', 'Wednesday', 'NYDIG', 'Fidelity Nati', 'Musk', 'About a quarter', 'Bitcoins', 'the span of a week', 'Bitcoin', 'as much as 29%', 'Wednesday', 'the China Banking Association', '3 p.m. PDT', 'Daily Crunch', 'Tom Brady', 'Twitter', '0.3%', '1.1%', 'third', 'World FX', 'TOK', '5.63 %', '49,337.72', '0800', 'GMT', 'Sunday', '2,628.83', 'Bitcoin', '77.9%', 'year', '27,734', '1800', 'GMT', 'May 19', 'Reute', 'Reuters', 'Bitcoin', 'May 20, 2021', 'Reuters', 'chars]By', 'Reuters', 'May 6', 'Reuters', 'second', 'Bitcoin', 'Thursday', '3,591.65', 'the Bitstamp Exchange', 'about 3', 'May 13', 'Reuters', 'Elon Musk', 'Tesla', 'Musk', 'Reuters', 'May 13', 'Reuters', 'Elon Musks', 'Some Tes', 'Generation Holdings Inc', 'Friday', 'New York', 'June 1', 'Medium', 'Tusk', 'Yangs', 'David J. Phillip', 'Mark Cuban', 'Wednesday', 'Elon Musk', 'Tesla', 'Sachs Group Inc', 'Bloomberg News', 'Thursday', 'Goldman', 'fifth', 'U.S.', 'Musk', 'Tesla', 'Musk', 'Wednesday', 'Reuters', 'Reuters', 'Friday', 'New York', 'June 1', 'second', 'Bitcoin', 'Thursday', '3,591.65', 'the Bitstamp Exchange', 'about 3.0%', '3,568.92', 'Bitcoin', 'Bitcoin', 'January 8, 2021', 'CME Group Inc', 'Tuesday', 'Bitcoin', 'March 15, 2021', 'Dado Ruvic', "Elon Musk's", 'Elon Musk', 'a volatile week', 'Tesla Inc.', 'Musk\xa0', 'Elon Musk', 'Crew Dragon', 'the Kennedy Space Center', 'Cape Canave', 'Bitcoin', 'Marseille', 'France', 'February 7, 2021', "Eric GaillardBitcoin's", 'weeklong', '\$40,000 mark', 'Bitcoin', 'May 19, 2021', 'Dado Ruvic/IllustrationBitcoin', '3%', 'Friday', 'Bitcoin', 'ATM', 'Union City', 'New Jersey', 'U.S.', 'May 19, 2021', '8.9%', '34,156', '1000', 'GMT', 'Sunday', 'Entrepreneur', 'Mark Cuban', 'Bitcoin', 'Elon Musk', 'Thyagaraju Adinarayan', 'LONDON', 'Reuters', '40,000', 'Thursday', 'a day', 'Tesla', 'Elon Musk', 'Wednesday', 'European', 'Thursday', 'U.S.', 'Tesla', 'Elon Musk', 'Wednesday', 'Dow Jones Indices', 'Tuesday', 'Banksy', 'Love', 'Air', 'first', 'Dogecoin', 'April 20, 2021', 'Elon Musk', 'Wednesday', 'Tesla Inc', '13, 2019', 'Costa Mesa', 'Sean Culkin', 'the Los Angeles Chargers', 'the Hoag Performance Center', 'Costa Mesa', 'California', '200-fold', 'the past year', 'Elon Musk', 'E3', 'Los Angeles', 'California', 'U.S.', 'June 13, 2019', "Mike Blake/File Photo/File PhotoElon Musk's", 'the morning of', 'April 17', 'two', 'Westchester', 'New York', 'overnight', '65,000', 'last month', 'the United St', 'Wood', 'CIO of ARK Investment Management', 'Elon Musk', 'Tesla', 'Ark Invest', 'File', 'Hannibal Hanschke/', 'AP', 'File', 'Sydney', 'Australia', 'Jonas Liebschner', 'five and a half month', 'Bitcoin', 'January 8, 2021', '5.16%', 'Saturda', '10%', '33,747.21', '1400', 'GMT', '10 a.m. ET', 'Sunday', '3,753.33', 'Bitcoin', '48%', "the year'", 'Reuters', 'SINGAPORE', 'May 3', 'Reuters', 'Monday', '3,000', 'Reuters', 'May 6', 'Reuters', 'quarterly', 'Thursday', 'Bitcoin', 'Elon Musk', 'Bitcoin', 'Elon Musk', 'Thursday', 'Entrepreneur', 'SNL', 'Bitcoin', 'February 9, 2021', 'Dado Ruvic/File Photo/File PhotoTesla Inc', 'Elon Musk', 'Bitcoin', 'Craig Wright', 'Australian', '\$5.6 billion', 'London', '111,000', 'Bitcoins', 'first', 'six months', 'JPMorgan', 'Tuesday', 'Wednesday', '30,000', 'first', 'late January', 'Bitcoin', 'Reuters', 'May 11', 'Reuters', 'Peter Thiel-backed', 'U.S.', 'Tuesday', 'Dorsey', 'Square', 'Twitter', 'November 19, 2015', 'Lucas JacksonPayments', 'Square Inc',

```
'quarterly']
```

### 1.3.2 Ethereum NER

```
[132]: # Concatenate all of the Ethereum text together
eth_string = ""

for row in range(len(eth_df)):
    eth_string += eth_df.iloc[row]["text"]
```

```
[134]: # Run the NER processor on all of the text
eth_doc = nlp(eth_string)

# Add a title to the document
# YOUR CODE HERE!
```

```
[135]: # Render the visualization
displacy.render(eth_doc, style='ent')
```

<IPython.core.display.HTML object>

```
[136]: # List all Entities
print([ent.text for ent in eth_doc.ents])
```

['Vitalik Buterin', 'Ethereum', 'Wednesday', 'Ethereum', '\$1.5 billion', 'Buterin', '500', 'ETH', 'North Carolina', 'Josh Stein', 'Madison Campbell', 'Liesel Vaidya', 'Anatoly Yakovenko', 'chars] New York', 'CNN', 'Saturday', 'about 6%', 'nearly \$58,000', 'CryptoPunks', 'one', 'NFT', 'Meebits', '20,000', '3D', 'Ethereum', 'Altcoins', 'Tuesday night', 'Wednesday', 'morning', 'months', 'hundreds of billions', 'Reuters', 'February 19, 2021', 'SINGAPORE', 'February 19, 2021', 'Dado Ruvic/IllustrationCryptocurrency', 'Dfinity', 'July 2018', 'Swiss', 'Dominic Williams', 'StockMarketUS Stock Futures Edge Higher', 'Monday', 'U.S.', 'Monday', 'Spanish', 'AI', 'Cryptocurrencies', 'today', 'Vitalik Buterin', '27-year-old', 'February 19, 2021', 'Dado Ruvic/IllustrationCryptocurrency', 'Dow Jones Indices', 'Reuters', 'SINGAPORE', 'May 3', 'Reuters', 'Monday', '3,000', 'last weeks', 'Europe', 'Tuesday', 'Banksy', 'Love', 'Air', 'first', 'chars] NEW YORK', 'May 7', 'Reuters', 'this year', 'Reuters', 'SINGAPORE', 'May 3', 'Reuters', 'Monday', '3,000', 'this year', 'this summer', '+5218', 'Reuters', 'February 19, 2021', 'SINGAPORE', 'today', 'April 14', 'Alex Castro', 'The Verge\r\n\n \n\n Cryptocurrency', 'Coinbase', 'this morning', 'Coinbase', 'Bin', 'Ethereum\r\n', 'Getty Images', 'AsiaPac', 'Bitcoin', 'Ethereum', 'number two', '2021', 'February 19, 2021', 'Dado Ruvic/IllustrationBitcoin', 'two', 'Bitcoin', 'March 15, 2021', 'Dado Ruvic', 'Dow Jones Indices', 'chars] "We', 'Wednesday', 'Spanish', 'AI', 'Cryptocurrencies', '99.95%', 'Carl Beekhuizen', 'the Ethereum Foundation',

'Beekhuizen', 'Bitcoin', 'U.S. Dollar', 'May 26, 2020', 'Dado Ruvic/File PhotoBitcoin', 'last week', 'one-day', 'March last year', 'Wednesday', '\$1 trillion', 'Ethereum', 'above \$3,000', 'Monday', 'this year', 'Monday', '\$3,000 mark', 'Bitcoin', 'year-to-date', 'Ethereum', 'about one hundred billion trillion dollars', 'Reuters', 'May 4', 'Reuters', 'Global Inc', 'Tuesday', 'Ruvic/Reuters\r\n', 'Ethereum', 'above \$3,000', 'Monday', 'Reuters', 'Bitcoin', 'March 15, 2021', 'Reuters', 'Ethereum', 'February 19, 2021', 'Dado Ruvic/IllustrationCryptocurrency', '4,000', 'Ruvic/Reuters', 'as much as 5%', 'Monday', '3,203', 'Ruvic/Reuters', 'one-day', 'two years', 'Monday', 'second', '4,000', 'first', 'Ethereum', '7%', 'Spanish', 'AI', 'This week', 'March 2020', 'Last week', 'Trump', 'This week', 'Elon Musk's', 'Nakao/Getty Images\r\nInvestors', 'Dow Jones', 'Tuesday', 'Europe', '2016', 'Ethereum, Pol', 'Ferdman/Getty Images', 'Mark Cuban', 'Ethereum', 'Polygon', 'Polygon', 'tEhereum', 'NFT', 'Disaster Girl', 'NFT', 'over \$500,000', 'Foundation', "Disaster Girl'", 'Indonesia', 'first', 'today', 'Arriens/NurPhoto', 'Getty Images\r\nCryptocurrency', 'Wednesday', 'Photo', 'S3studio/', 'Getty Images', 'May', '\$1.93 billion', 'Entrepreneur', 'Images/John Phillips', '27-year-old', 'Ethereum', 'Vitalik Buterin', '350%', 'Di Ionio', 'Ethereum', 'Photo', 'Decentral\r\nEthereum', 'Anthony Di Iorio', 'the kilowatt-hour', 'one', 'about 12 cents', 'the past few days', 'Vitalik Buterin', 'Ethereum', 'two weeks', 'Bitcoin', '13 per cent', 'second', 'Eth', 'this year', 'America', 'Millions of dollars', 'the morning of', 'April 17', 'two', 'Westchester', 'New York', 'overnight', 'Bitcoin', 'Marseille', 'France', 'February 7, 2021', 'Eric GaillardBitcoin', '6.54%', '57,098.08', 'Friday', '3,504.11', 'Bitcoin', 'U.S. Dollar', 'May 26, 2020', '6.8%', '\$56,852.03', '1000', 'GMT', 'Wednesday', 'LHR', '18', '18', 'Nvidia', 'GeForce', '3000', '5.63 %', '49,337.72', '0800', 'GMT', 'Sunday', '2,628.83', 'Bitcoin', '77.9%', 'year', '27,734', 'nine-week', 'Thursday', 'U.S. Treasury', 'the first quarter', '10%', '33,747.21', '1400', 'GMT', '10 a.m. ET', 'Sunday', '3,753.33', 'Bitcoin', '48%', "the year'", 'Entrepreneur', 'Earlier this year', 'U.S. Treas', 'chars] NurPhoto/Getty Images', 'The Chicago Board Options Exchange', 'the US Securities and Exchange Commission', 'Monday', 'Fidelity', 'PayPals', 'Wednesday', 'Jose Fernandez da Pontethe', 'recent years', 'the first four months of the year', 'a bad week', 'Elon Musk', 'Bitcoins', '12k', 'Tesla', 'Bitcoin', 'Framework Ventures', 'Friday', '\$100 million', 'second', 'Bitcoin', 'ATM', 'Union City', 'New Jersey', 'U.S.', 'May 19, 2021', '8.9%', '34,156', '1000', 'GMT', 'Sunday', 'Images/John Phillips\r\nEthereum', 'Vitalik Buterin', '90%', 'Shiba Inu', '10%', 'Sund', 'Vitalik Buterin', '90%', 'Shiba Inu', '10%', 'Sunday', 'evening', 'Over 40%', 'Elon Musk', 'Bitcoin', 'Bitcoin', 'about 20%', 'a few hours', 'about 12%', 'CNN Business', 'Julia Horowitz', 'Finary', 'French', 'NFT', 'Infinite Objects', 'Novogratz', 'Lucas Jackson', 'Reuters', 'Billionaire', 'Mike Novogratz', 'between \$40,00...', 'Wednesday', 'thousands', 'Entrepreneur', 'a manic Monday', 'half a trillion dollars', 'Bitcoin', 'a rough day', 'Wednesday', '10', 'Things Before the Opening Bell', 'Wednesday', 'thousands', 'this year', 'Nvidia', 'GeForce', '3060', '30,000', 'first', 'late January', 'Bitcoin', 'three-month', 'Monday', "Elon Musk's", 'the weekend', 'Reuters', 'SINGAPORE', 'May 27', 'Reuters', 'Thursday', 'last weeks', 'Bitcoin', 'January 8, 2021', '5.16%', 'Saturda', 'Druckenmiller', 'REUTERS',

'Brendan McDermid\r\n', '>Stanley Druckenmiller', 'the Federal Reserve', 'Musk', 'Ringo H.W. Chiu', 'Elon Musk', 'Wednesday night', 'Reuters', 'SINGAPORE', 'Reuters', 'three-month', 'Monday', 'Elon Musks', 'the weekend', 'Bitcoin', 'May 20, 2021', 'Dado Ruvic/IllustrationCryptocurrencies', 'Thursday', 'Ethereum', 'Wednesday', 'China', 'Tesla', 'Entrepreneur', 'Polygon', 'Ethereum', '\$40,000 mark', 'Wednesday', 'three', 'China', '2015', 'David Grider', 'first', 'Cuban', 'Brian Snyder', 'Reuters', 'Mark Cuban', '\$1 million', 'Netflix', 'Amazon', '\$1 million']