EDA

June 3, 2022

1 Crypto Trading Bot EDA- TEAM 139

1.1 Description

The project consists of a cryptocurrency investment tool that will make trading decisions seeking to maximize profit on a portfolio with a given investment time horizon. To achieve this goal, we will develop a price prediction model based on two components: public information from the cryptocurrency market, and a natural language processing model that captures relevant signals coming from social media such as Twitter. Finally, we will design a dashboard to monitor the results of our investment tool.

Here we present an exploratory analysis of the cryptocurrency data retrieved from different sources.

1.2 Information sources

Market economic information. For this, the historical records of each cryptocurrency and the supply and demand at exact times would be needed. This information will be obtained from the following API:

1. https://finance.yahoo.com/. In its free version, we have a total of 5000 requests/day.
2. https://polygon.io/ . In its free version, we have a total of 5 requests-minute.
3. https://www.alphavantage.co/. In its free version, we have a total of 500 requests/day.

The following code will import care of importing the necessary configuration from the APIs

[63]:
```
from app.log import logging_config
from os.path import dirname, join
from dotenv import load_dotenv
import logging
from app.util.message import starting_message
from app import yahoo_finance, Polygon, Alphavantage
import pandas as pd
import time
from datetime import datetime
```

[64]:
```
#print(join(dirname(__file__), '.env'))
#load_dotenv(dotenv_path=join(dirname(__file__), '.env'))
load_dotenv()
from os import environ
print(environ.get("POLYGON_KEY"))
```

```
print(environ.get("ALPHA_KEY"))
```

```
PWRjSfmBc9xYnPZMQhA9ukDOuOIId9OD
4RBB1VWACSPNF8DH
```

[65]:
```
logging_config.init_logging()
__LOG = logging.getLogger(__name__)
__LOG.info('...... Initialization Completed  ......')
__LOG.info(starting_message())
```

2 Yahoo Finance

Yfinance is a public package that can be installed using "pip install finance". It gets daily and real-time market information from different cryptocurrency symbols. This package allows us to access the **open**, **maximum**, **minimum**, and **close** prices from the cryptocurrency symbol of our interest for a selected time window. Additionally, we can get the traded **volume** for the same period.

[66]:
```
status, yahoo_data = yahoo_finance.market_value('BTC-USD')
if status:
    print(status)

yahoodf = pd.DataFrame(yahoo_data, columns=['Open', 'High', 'Low', 'Close',␣
 ↪'Adj Close', 'Volume'])
#yahoodf['Date'] = yahoodf.index
yahoodf = yahoodf.reset_index(level=0)
yahoodf.head()
```

```
[**********************100%**********************]  1 of 1 completed
True
```

[66]:

	Date	Open	High	Low	Close	Adj Close	Volume
0	2019-12-16	7153.663086	7518.033203	6540.049316	7511.588867	7511.588867	165399102665
1	2019-12-23	7508.902344	7656.176270	7189.934082	7422.652832	7422.652832	161758217053
2	2019-12-30	7420.272949	7544.497070	6914.996094	7411.317383	7411.317383	149690652648
3	2020-01-06	7410.452148	8396.738281	7409.292969	8192.494141	8192.494141	184901289966
4	2020-01-13	8189.771973	9164.362305	8079.700684	8706.245117	8706.245117	241668743794

The following are the columns in the dataset:

1. **Date**: The date requested of the cryptocurrency symbol data.

2. **Open**: The open price for the symbol in the given time period.
3. **High**: The highest price for the symbol in the giben time period.
4. **Low**: The lowest price for the symbol in the giben time period.
5. **Close**: The close price for the symbol in the given time period.
6. **Adj Close**: Adjusted close price for the symbol in the given time period.
7. **Volume**: The trading volume of the symbol in the given time period.

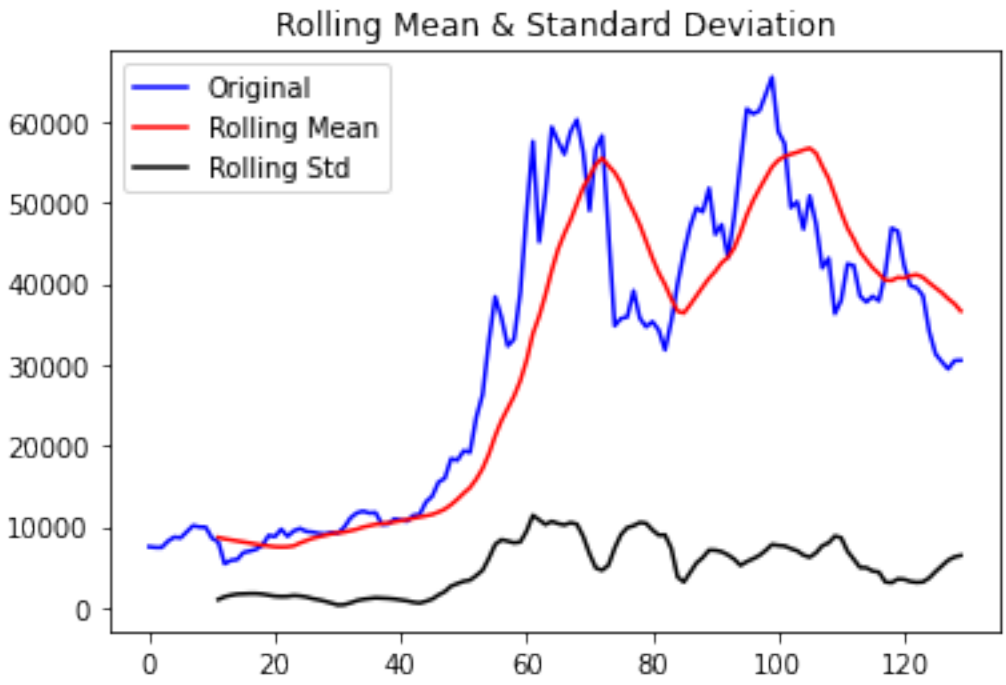
[67]:
```
import matplotlib.pyplot as plt
from statsmodels.tsa.stattools import adfuller
def test_stationarity(timeseries):

    #Determing rolling statistics
    rolmean = pd.Series(timeseries).rolling(window=12).mean()
    rolstd = pd.Series(timeseries).rolling(window=12).std()

    #Plot rolling statistics:
    orig = plt.plot(timeseries, color='blue',label='Original')
    mean = plt.plot(rolmean, color='red', label='Rolling Mean')
    std = plt.plot(rolstd, color='black', label = 'Rolling Std')
    plt.legend(loc='best')
    plt.title('Rolling Mean & Standard Deviation')
    plt.show(block=False)

    #Perform Dickey-Fuller test:
    print ('Results of Dickey-Fuller Test:')
    dftest = adfuller(timeseries, autolag='AIC')
    dfoutput = pd.Series(dftest[0:4], index=['Test Statistic','p-value','#Lags␣
 ↪Used','Number of Observations Used'])
    for key,value in dftest[4].items():
        dfoutput['Critical Value (%s)'%key] = value
    print (dfoutput)
```

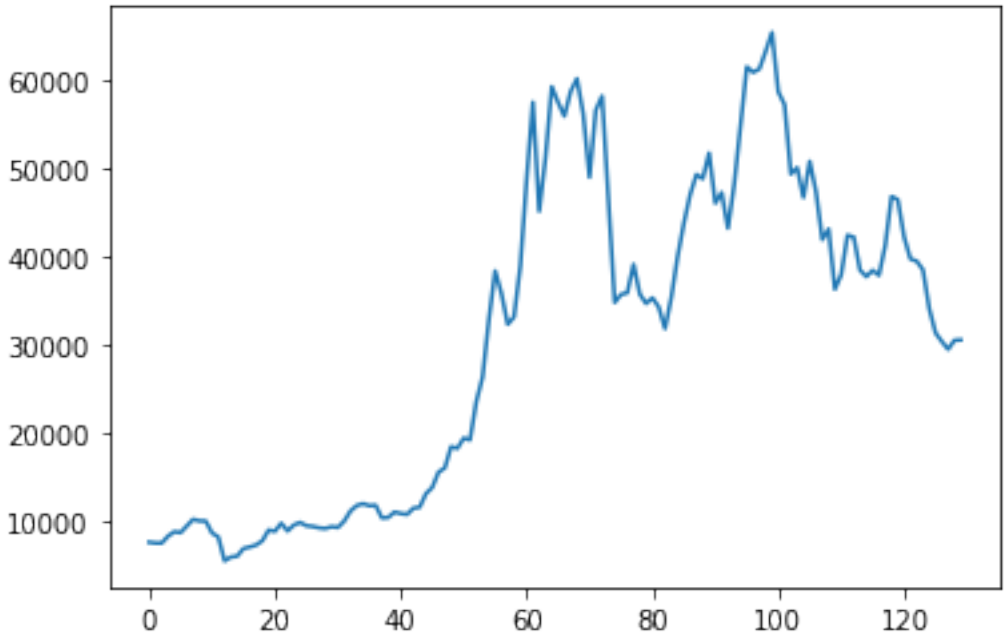
[68]:
```
test_stationarity(yahoodf.Close)
```




```
Results of Dickey-Fuller Test:
Test Statistic                  -1.596519
p-value                          0.485342
#Lags Used                       4.000000
Number of Observations Used    125.000000
Critical Value (1%)             -3.483779
Critical Value (5%)             -2.884954
Critical Value (10%)            -2.579257
dtype: float64
```

[69]:
```
moving_avg = pd.Series(yahoodf.Close).rolling(window=800).mean()
plt.plot(yahoodf.Close)
plt.plot(moving_avg, color='red')
```

[69]: [<matplotlib.lines.Line2D at 0x1980930d840>]



[70]:
```
yahoodf.dtypes
```

[70]:
```
Date         datetime64[ns]
Open                float64
High                float64
Low                 float64
Close               float64
Adj Close           float64
Volume                int64
dtype: object
```

[71]:
```
#Numeric Variables
yahoodf[['Open','High', 'Low', 'Close', 'Adj Close', 'Volume']].describe()
```

[71]:

	Open	High	Low	Close	Adj Close	Volume
count	130.000000	130.000000	130.000000	130.000000	130.000000	1.300000e+02
mean	30444.030874	32746.064078	28052.277926	30626.786512	30626.786512	
std	18584.397620	19793.374854	16918.084969	18471.415764	18471.415764	
min	5385.229492	6844.261719	4106.980957	5392.314941	5392.314941	
25%	10156.919189	10670.465332	9907.100586	10291.202637	10291.202637	
50%	34466.568359	37149.000000	30468.601562	34444.916016	34444.916016	
75%	46437.929688	48618.506836	42641.817383	46455.435547	46455.435547	
max	65521.289062	68789.625000	62333.914062	65466.839844	65466.839844	

```
mean   2.625356e+11
std    1.117944e+11
min    2.778075e+10
25%    1.883245e+11
50%    2.400504e+11
75%    3.015578e+11
max    7.666798e+11
```

At first glance, there do not appear to be any outlier problems in the sample. However, the cryptocurrency price variables mean is lower than the median, so the price distribution over the 131 dates consulted is not symmetrical. It seems that cryptocurrency price information presents a wide range of values below the median.

[72]:
```
pd.DatetimeIndex(yahoodf['Date']).year.value_counts()
```

[72]:
```
2020    52
2021    52
2022    23
2019     3
Name: Date, dtype: int64
```

2.1 Polygon

Polygon is a financial market data platform. Here we can get access to cryptocurrency information constantly, dynamically, and in real-time. Additionally, this platform has an API in which we can get news for each currency we need to analyze.

We start by consuming the relevant information for market status, news and daily closings of the cryptocurrency market.

2.1.1 Market Status

Get the current trading status of the exchanges and overall financial markets.

[73]:
```
polygon=Polygon(environ.get("POLYGON_KEY"))
#print('polygon')
status, polygon_data = polygon.get_market_status()
if status:
    #print(polygon_data)
    polygon_market_status = pd.DataFrame.from_dict(polygon_data)
polygon_market_status = polygon_market_status.reset_index(level=0)
polygon_market_status
```

[73]:

	index	market	earlyHours	afterHours	serverTime
0	nyse	closed	False	False	2022-06-03T02:17:36-04:00
1	nasdaq	closed	False	False	2022-06-03T02:17:36-04:00
2	otc	closed	False	False	2022-06-03T02:17:36-04:00
3	fx	closed	False	False	2022-06-03T02:17:36-04:00

```
4  crypto  closed       False       False  2022-06-03T02:17:36-04:00

  exchanges currencies
0    closed        NaN
1    closed        NaN
2    closed        NaN
3       NaN       open
4       NaN       open
```

Here is a description of the imported columns:

1. **index**: Exchanges and overall financial markets.
2. **market**: The status of the market as a whole.
3. **earlyHours**: Whether or not the market is in pre-market hours.
4. **afterHours**: Whether or not the market is in post-market hours.
5. **serverTime**: The current time of the server.
6. **exchanges**: The status of the Nasdaq, NYSE and OTC market.
7. **currencies**: The status of the crypto market.

We start with exploring the type of each of the columns in the dataframe:

[74]:
```
polygon_market_status['serverTime'] = pd.
  ↪to_datetime(polygon_market_status['serverTime'])
polygon_market_status.dtypes
```

[74]:
```
index                                        object
market                                       object
earlyHours                                     bool
afterHours                                     bool
serverTime    datetime64[ns, pytz.FixedOffset(-240)]
exchanges                                    object
currencies                                   object
dtype: object
```

Next with the general distribution of the data in the dataframe:

[75]:
```
polygon_market_status.describe()
```

```
C:\Users\julia\AppData\Local\Temp\ipykernel_2260\3545403409.py:1: FutureWarning:
Treating datetime data as categorical rather than numeric in `.describe` is
deprecated and will be removed in a future version of pandas. Specify
`datetime_is_numeric=True` to silence this warning and adopt the future behavior
now.
  polygon_market_status.describe()
```

[75]:
```
        index  market earlyHours afterHours                 serverTime  \
count       5       5          5          5                          5
unique      5       1          1          1                          1
top      nyse  closed      False      False  2022-06-03 02:17:36-04:00
```

```
freq       1       5          5          5                           5
first    NaN     NaN        NaN        NaN  2022-06-03 02:17:36-04:00
last     NaN     NaN        NaN        NaN  2022-06-03 02:17:36-04:00

       exchanges currencies
count          3          2
unique         1          1
top       closed       open
freq           3          2
first        NaN        NaN
last         NaN        NaN
```

2.1.2 Ticker News

Get the most recent news articles relating to a stock ticker symbol, including a summary of the article and a link to the original source.

[76]:
```
status, polygon_data = polygon.get_news_ticker('2021-08-16', 'ETH')
if status:
    #print(polygon_data)
    polygon_news_ticker = pd.DataFrame.from_dict(polygon_data['results'])
for i in polygon_news_ticker.index:
    polygon_news_ticker_pbs = polygon_news_ticker['publisher'][i]['name']
    polygon_news_ticker['publisher'][i] = polygon_news_ticker_pbs
polygon_news_ticker
```

[76]:
```
                                          id                  publisher  \
0  3gsHFlxYpqd4mO7JVsy9xGKW7RvSIWWN_pH6gBsxZ8M  Zacks Investment Research
1  Gbai-oSYsx-7b5hHh50sRZryB4mfuaHaEGryAZ6LQy0  Zacks Investment Research

                                              title                 author  \
0  Top Ranked Momentum Stocks to Buy for August 16th  Zacks Equity Research
1    Top Ranked Income Stocks to Buy for August 16th  Zacks Equity Research

          published_utc                                        article_url  \
0  2021-08-16T14:39:00Z  https://www.zacks.com/commentary/1782237/top-r…
1  2021-08-16T13:30:00Z  https://www.zacks.com/commentary/1782122/top-r…

                  tickers                                            amp_url  \
0   [DDS, ETH, AAWW, MHO]  https://www.zacks.com/amp/commentary/1782237/t…
1  [WSR, NYCB, ETH, FANH]  https://www.zacks.com/amp/commentary/1782122/t…

                                        image_url  \
0  https://staticx-tuner.zacks.com/images/article…
1  https://staticx-tuner.zacks.com/images/article…

                                         description
```

```
0  DDS, AAWW, ETH, and MHO made it to the Zacks R…
1  NYCB, WSR, FANH, and ETH made it to the Zacks …
```

Here is a description of the imported columns:

1. **id**: Unique identifier for the article.
2. **publisher**: The publisher's name.
3. **title**: The title of the news article.
4. **author**: The article's author.
5. **published_utc**: The date the article was published on.
6. **article_url**: A link to the news article.
7. **tickers**: The ticker symbols associated with the article.
8. **amp_url**: The mobile friendly Accelerated Mobile Page (AMP) URL.
9. **image_url**: The article's image URL.
10. **description**: A description of the article.

We start with exploring the type of each of the columns in the dataframe:

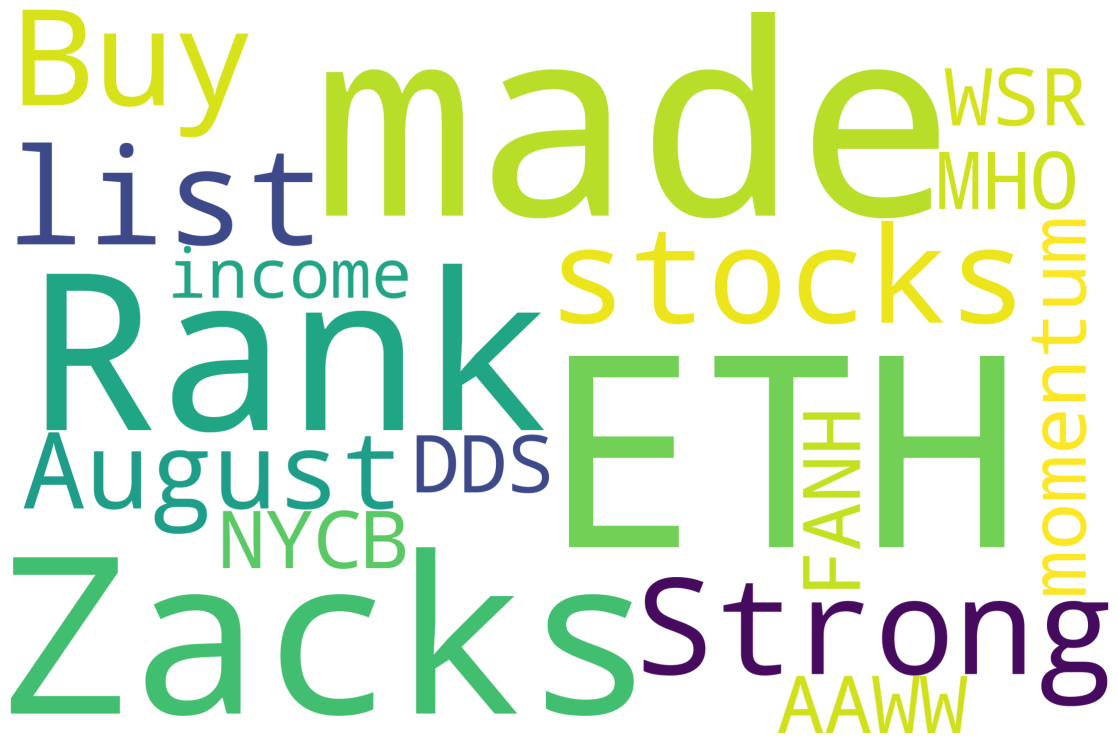
[77]:
```
polygon_news_ticker.dtypes
```

[77]:
```
id               object
publisher        object
title            object
author           object
published_utc    object
article_url      object
tickers          object
amp_url          object
image_url        object
description      object
dtype: object
```

[78]:
```
import matplotlib.pyplot as plt
from wordcloud import WordCloud, STOPWORDS

text = ''
for x in polygon_news_ticker['description']:
    text = text + ' ' + x

wordcloud = WordCloud(width = 3000, height = 2000, random_state=1,␣
 ↪background_color='white', collocations=False, stopwords = STOPWORDS).
 ↪generate(text)
plt.figure(figsize=(40, 30))
plt.imshow(wordcloud)
plt.axis("off")
plt.show()
```



2.1.3 Ticker News (Older)

Get the oldest related news articles with a summary of the article and a link to the original source.

[79]:
```
status, polygon_data_on = polygon.get_old_news('2022-05-31')
#print(status)
if status:
    #print(polygon_data)
    polygon_old_news = pd.DataFrame.from_dict(polygon_data_on["results"])
#polygon_old_news
polygon_old_news = polygon_old_news[['title', 'author', 'published_utc',␣
 ↪'tickers', 'description', 'keywords']]
n_columns_news = {'title':'Title', 'author':'Author', 'published_utc':'Date',␣
 ↪'tickers':'Tickers', 'description':'Description', 'keywords':'Keywords'}
polygon_old_news.rename(columns = n_columns_news, inplace = True)
polygon_old_news.head()
```

[79]:

	Title
0	The Limestone Boat Company Announces First Qua…
1	Shiba Inu (SHIB) Founder Ryoshi Abruptly Delet…
2	Apple Will Have To Face Antitrust Lawsuit From…
3	Why Alibaba, Nio, Chinese Peers Are Struggling…
4	Coinbase Institutional Clients Raised Bitcoin …

```
                                Author                 Date  \
0  The Limestone Boat Company Limited  2022-05-31T01:51:00Z
1                    Samyuktha Sriram  2022-05-31T02:52:56Z
2                   Shivdeep Dhaliwal  2022-05-31T03:16:09Z
3                       Navdeep Yadav  2022-05-31T04:07:22Z
4                    Samyuktha Sriram  2022-05-31T04:20:15Z

                 Tickers                                        Description  \
0                  [BOAT]  Limestone continues to grow unit production, r…
1                  [TWTR]  Ryoshi, the pseudonymous creator behind meme c…
2                  [AAPL]  Apple Inc's (NASDAQ: AAPL) attempts to have an…
3  [BABA, JD, NIO, XPEV]  Shares of U.S.-listed Chinese companies were n…
4                  [COIN]  Data shows that institutions on Coinbase Globa…

                                          Keywords
0          [Earnings Releases and Operating Results]
1  [News, Cryptocurrency, Social Media, Top Stori…
2                         [News, Legal, Tech, Media]
3  [News, Asia, Top Stories, Markets, Movers, Tec…
4                    [News, Cryptocurrency, Markets]
```

Here is a description of the imported columns:

1. **Title**: The title of the news article.
2. **Author**: The article's author.
3. **Date**: The date the article was published on.
4. **Tickers**: The ticker symbols associated with the article.
5. **Description**: A description of the article.
6. **Keyword**: The keywords associated with the article (which will vary depending on the publishing source).

We start by exploring the type of each of the columns along with the data count in the dataframe:

[80]:
```
polygon_old_news['Date'] = pd.to_datetime(polygon_old_news['Date'])
polygon_old_news.dtypes
```

[80]:
```
Title                       object
Author                      object
Date           datetime64[ns, UTC]
Tickers                     object
Description                 object
Keywords                    object
dtype: object
```

[81]:
```
polygon_old_news.describe()
```

```
C:\Users\julia\AppData\Local\Temp\ipykernel_2260\2004128356.py:1: FutureWarning:
Treating datetime data as categorical rather than numeric in `.describe` is
```

```
deprecated and will be removed in a future version of pandas. Specify
`datetime_is_numeric=True` to silence this warning and adopt the future behavior
now.
  polygon_old_news.describe()
```

[81]:
```
                                                    Title  \
count                                                1000
unique                                                992
top     Why This 1 Growth Stock Could Be a Great Addit…
freq                                                    3
first                                                 NaN
last                                                  NaN

                        Author                       Date Tickers  \
count                     1000                       1000    1000
unique                     369                        644     861
top     Zacks Equity Research  2022-05-31 20:05:00+00:00  [TSLA]
freq                       311                         19       9
first                      NaN  2022-05-31 01:51:00+00:00     NaN
last                       NaN  2022-06-01 13:40:08+00:00     NaN

                                                Description     Keywords
count                                                   980          563
unique                                                  950          147
top     Whether you're a value, growth, or momentum in…  [investing]
freq                                                     11          119
first                                                   NaN          NaN
last                                                    NaN          NaN
```

[82]:
```
countAnalisis_polygon_old_news = polygon_old_news[["Title", "Author", "Date",␣
↪"Tickers", "Description", "Keywords"]].count()
countAnalisis_polygon_old_news
```

[82]:
```
Title          1000
Author         1000
Date           1000
Tickers        1000
Description     980
Keywords        563
dtype: int64
```

2.1.4 Ticker News (Date)

Get news articles on a given date including a summary of the article and a link to the original source.

[83]:
```
status, polygon_data_on = polygon.get_news('2022-05-31')
#print(status)
if status:
    #print(polygon_data)
    polygon_get_news = pd.DataFrame.from_dict(polygon_data_on["results"])
#polygon_get_news.head()
polygon_get_news = polygon_get_news[['title', 'author', 'published_utc',␣
 ↪'tickers', 'description', 'keywords']]
polygon_get_news.rename(columns = n_columns_news, inplace = True)
polygon_get_news.head()
```

[83]:

	Title	Author	Date	Tickers	Description	Keywords
0	IDT (IDT) Q3 2022 Earnings Call Transcript	newsfeedback@fool.com (Motley Fool Transcribing)	2022-06-03T06:00:22Z	[IDT]	IDT earnings call for the period ending March …	[earningscall-transcripts]
1	Okta (OKTA) Q1 2023 Earnings Call Transcript	newsfeedback@fool.com (Motley Fool Transcribing)	2022-06-03T06:00:19Z	[OKTA]	OKTA earnings call for the period ending March…	[earningscall-transcripts]
2	Where Did All The Sellers Go And Where Are We …	Jani Ziedins	2022-06-03T06:00:00Z	[MSFT]	NaN	NaN
3	Coinbase To Rescind Several Job Offers Amid Be…	Samyuktha Sriram	2022-06-03T05:05:06Z	[COIN]	Major cryptocurrency exchange Coinbase Global …	[News, Short Sellers, Cryptocurrency, Markets]
4	An Optimist Would Say Tesla Is Worth $400, May…	Paul Franke	2022-06-03T04:45:58Z	[F, GM, HMC, RACE, STLA, TM, TTM, TSLA]	Tesla's normalized math-based valuation remain…	NaN

Here is a description of the imported columns:

1. **Title**: The title of the news article.
2. **Author**: The article's author.
3. **Date**: The date the article was published on.
4. **Tickers**: The ticker symbols associated with the article.
5. **Description**: A description of the article.
6. **Keyword**: The keywords associated with the article (which will vary depending on the publishing source).

We start by exploring the type of each of the columns along with the data count in the dataframe:

[84]:
```
polygon_get_news['Date'] = pd.to_datetime(polygon_get_news['Date'])
polygon_get_news.dtypes
```

[84]:
```
Title                       object
Author                      object
Date           datetime64[ns, UTC]
Tickers                     object
Description                 object
Keywords                    object
dtype: object
```

[85]:
```
polygon_get_news.describe()
```

```
C:\Users\julia\AppData\Local\Temp\ipykernel_2260\740367754.py:1: FutureWarning:
Treating datetime data as categorical rather than numeric in `.describe` is
deprecated and will be removed in a future version of pandas. Specify
`datetime_is_numeric=True` to silence this warning and adopt the future behavior
now.
  polygon_get_news.describe()
```

[85]:

	Title	Author	Date	Tickers	Description	Keywords
count	1000	1000	1000	1000	985	489
unique	997	301	615	852		
top	Breaking Down the Tech Sector's Earnings Outlook	Zacks Equity Research	2022-06-02 20:05:00+00:00	[DJIA]		
freq	2	379	20	8		
first	NaN	NaN	2022-06-01 21:45:19+00:00	NaN		
last	NaN	NaN	2022-06-03 06:00:22+00:00	NaN		

```
unique                                                  963          131
top     Here at Zacks, our focus is on the proven Zack…  [investing]
freq                                                      9          131
first                                                   NaN          NaN
last                                                    NaN          NaN
```

2.1.5 Ticker News (Daily)

Get news articles given a date or a series of dates including a summary of the article and a link to the original source.

[86]:
```
daily_results = pd.DataFrame()
#dates3 = ['2022-01-07', '2022-01-14', '2022-01-21', '2022-01-28',␣
 ↪'2022-02-04', '2022-02-11', '2022-02-18', '2022-02-25', '2022-03-04',␣
 ↪'2022-03-11', '2022-03-18', '2022-03-25', '2022-04-01', '2022-04-08',␣
 ↪'2022-04-15', '2022-04-22', '2022-04-29', '2022-05-06', '2022-05-13',␣
 ↪'2022-05-20', '2022-05-27']
dates = ['2022-01-07', '2022-01-14', '2022-01-21', '2022-01-28', '2022-02-04',␣
 ↪'2022-02-11', '2022-02-18', '2022-02-25', '2022-03-04', '2022-03-11',␣
 ↪'2022-03-18', '2022-03-25', '2022-04-01', '2022-04-08', '2022-04-15',␣
 ↪'2022-04-22', '2022-04-29', '2022-05-06', '2022-05-13', '2022-05-20',␣
 ↪'2022-05-27']
```

[87]:
```
for element in dates:
    #print(element)
    status, polygon_data = polygon.daily_result('BTC', element)
    if status:
        #print(polygon_data)
        polygon_daily_result = pd.DataFrame.from_dict(polygon_data)
    polygon_daily_result = polygon_daily_result.head(1)
    #polygon_daily_result

    polygon_daily_result_open = pd.DataFrame.
 ↪from_dict(polygon_daily_result['openTrades'][0])

    n_columns_news3 = {'x':'ExchangeOpen', 'p':'PriceOpen', 's':'VolumeOpen',␣
 ↪'c':'ConditionCodesOpen', 'i':'IdOpen', 't':'TimestampOpen'}
    polygon_daily_result_open.rename(columns = n_columns_news3, inplace = True)
    #polygon_daily_result_open.head()

    polygon_daily_result_close = pd.DataFrame.
 ↪from_dict(polygon_daily_result['closingTrades'][0])


    n_columns_news2 = {'x':'ExchangeClose', 'p':'PriceClose', 's':
 ↪'VolumeClose', 'c':'ConditionCodesClose', 'i':'IdClose', 't':
 ↪'TimestampClose'}
```

```
    polygon_daily_result_close.rename(columns = n_columns_news2, inplace = True)
    #polygon_daily_result_close.head()

    polygon_daily_result = polygon_daily_result[['symbol', 'isUTC', 'day',␣
 ↪'open', 'close']]
    #polygon_daily_result.join(polygon_daily_result_open)
    polygon_daily_result = pd.
 ↪concat([polygon_daily_result,polygon_daily_result_open], axis = 1)
    polygon_daily_result = pd.
 ↪concat([polygon_daily_result,polygon_daily_result_close], axis = 1)
    #polygon_daily_result.head()

    daily_results = daily_results.append(polygon_daily_result,␣
 ↪ignore_index=True)
    time.sleep(15)

daily_results['DateOpen'] = pd.to_datetime(daily_results['TimestampOpen']/1000,␣
 ↪unit='s')
daily_results['DateClose'] = pd.to_datetime(daily_results['TimestampClose']/
 ↪1000, unit='s')
daily_results.head()
```

[87]:

	symbol	isUTC	day	open	close	ExchangeOpen
0	BTC-USD	True	2022-01-07T00:00:00Z	43081.79	41564.61	1
1	BTC-USD	True	2022-01-14T00:00:00Z	42576.27	43086.89	1
2	BTC-USD	True	2022-01-21T00:00:00Z	40671.77	36456.96	1
3	BTC-USD	True	2022-01-28T00:00:00Z	37188.37	37741.59	1
4	BTC-USD	True	2022-02-04T00:00:00Z	37367.00	41614.66	2

	PriceOpen	VolumeOpen	ConditionCodesOpen	IdOpen	TimestampOpen
0	43081.79	0.000675	2	260333638	1641513600010
1	42576.27	0.001000	2	263672878	1642118400058
2	40671.77	0.000120	2	266526967	1642723200089
3	37188.37	0.000080	1	271657003	1643328000218
4	37367.00	0.005000	2	991190639	1643932800019

	ExchangeClose	PriceClose	VolumeClose	ConditionCodesClose	IdClose
0	1	41564.61	0.000247	1	260893471
1	1	43086.89	0.000779	1	264133049
2	1	36456.96	0.001000	2	267665914
3	1	37741.59	0.000960	1	272374175
4	1	41614.66	0.006329	2	276280906

	TimestampClose	DateOpen	DateClose
0	1641599999913	2022-01-07 00:00:00.009999872	2022-01-07 23:59:59.913000192
1	1642204799588	2022-01-14 00:00:00.058000128	2022-01-14 23:59:59.588000000

```
2   1642809599827 2022-01-21 00:00:00.088999936 2022-01-21 23:59:59.826999808
3   1643414399859 2022-01-28 00:00:00.217999872 2022-01-28 23:59:59.859000064
4   1644019199952 2022-02-04 00:00:00.019000064 2022-02-04 23:59:59.952000000
```

Here is a description of the imported columns:

1. **symbol**: The symbol pair that was evaluated from the request.
2. **isUTC**: Whether or not the timestamps are in UTC timezone.
3. **day**: The date requested.
4. **open**: The open price for the symbol in the given time period.
5. **close**: The close price for the symbol in the given time period.
6. **ExchangeOpen**: The exchange that this crypto trade happened on.
7. **PriceOpen**: The price of the trade. This is the actual dollar value per whole share of this trade. A trade of 100 shares with a price of $2.00 would be worth a total dollar value of $200.00.
8. **VolumeOpen**: The size of a trade (also known as volume).
9. **ConditionCodesOpen**: A list of condition codes.
10. **IdOpen**: The Trade ID which uniquely identifies a trade. These are unique per combination of ticker, exchange, and TRF. For example: A trade for AAPL executed on NYSE and a trade for AAPL executed on NASDAQ could potentially have the same Trade ID.
11. **TimestampOpen**: The Unix Msec timestamp for the start of the aggregate window.
12. **ExchangeClose**: The exchange that this crypto trade happened on.
13. **PriceClose**: The price of the trade. This is the actual dollar value per whole share of this trade. A trade of 100 shares with a price of $2.00 would be worth a total dollar value of $200.00.
14. **VolumeClose**: The size of a trade (also known as volume).
15. **ConditionCodesClose**: A list of condition codes.
16. **IdClose**: The Trade ID which uniquely identifies a trade. These are unique per combination of ticker, exchange, and TRF. For example: A trade for AAPL executed on NYSE and a trade for AAPL executed on NASDAQ could potentially have the same Trade ID.
17. **TimestampClose**: The Unix Msec timestamp for the start of the aggregate window.
18. **DateOpen**: The Date for the start of the aggregate window (Open).
19. **DateClose**: The Date for the start of the aggregate window (Close).

We start by exploring the type of each of the columns along with the data count in the dataframe:

[88]:
```
daily_results['day'] = pd.to_datetime(daily_results['day'])
daily_results.dtypes
```

[88]:
```
symbol                              object
isUTC                                 bool
day                  datetime64[ns, UTC]
open                              float64
close                             float64
ExchangeOpen                        int64
PriceOpen                         float64
VolumeOpen                        float64
ConditionCodesOpen                  int64
```

```
IdOpen                            object
TimestampOpen                      int64
ExchangeClose                      int64
PriceClose                       float64
VolumeClose                      float64
ConditionCodesClose                int64
IdClose                           object
TimestampClose                     int64
DateOpen                  datetime64[ns]
DateClose                 datetime64[ns]
dtype: object
```

[89]:
```
daily_results.describe()
```

[89]:
```
                open         close  ExchangeOpen     PriceOpen  VolumeOpen  \
count     21.000000     21.000000      21.00000     21.000000   21.000000
mean   39252.024525  38882.240485       2.52381  39252.024525    0.035497
std     4729.788359   4807.107933       4.82306   4729.788359    0.135182
min    28941.950000  28598.310000       1.00000  28941.950000    0.000080
25%    37367.000000  37741.590000       1.00000  37367.000000    0.000294
50%    40483.380000  39712.250000       1.00000  40483.380000    0.000710
75%    42576.270000  41774.980000       2.00000  42576.270000    0.004700
max    45525.250000  46296.340000      23.00000  45525.250000    0.621366

       ConditionCodesOpen  TimestampOpen  ExchangeClose    PriceClose  \
count           21.000000   2.100000e+01      21.000000     21.000000
mean             1.476190   1.647562e+12       1.047619  38882.240485
std              0.601585   3.752685e+09       0.218218   4807.107933
min              0.000000   1.641514e+12       1.000000  28598.310000
25%              1.000000   1.644538e+12       1.000000  37741.590000
50%              2.000000   1.647562e+12       1.000000  39712.250000
75%              2.000000   1.650586e+12       1.000000  41774.980000
max              2.000000   1.653610e+12       2.000000  46296.340000

       VolumeClose  ConditionCodesClose  TimestampClose
count    21.000000            21.000000    2.100000e+01
mean      0.002375             1.523810    1.647648e+12
std       0.003583             0.511766    3.752685e+09
min       0.000009             1.000000    1.641600e+12
25%       0.000436             1.000000    1.644624e+12
50%       0.001000             2.000000    1.647648e+12
75%       0.002710             2.000000    1.650672e+12
max       0.014692             2.000000    1.653696e+12
```

2.1.6 Previous Close

Get the previous day's open, high, low, and close (OHLC) for the specified cryptocurrency pair.

[90]:
```
status, polygon_data = polygon.previous_close()
if status:
    #print(polygon_data)
    polygon_previous_close = pd.DataFrame.from_dict(polygon_data['results'])
n_columns_news4 = {'T':'ExchangeSymbol', 'v':'TradingVolume', 'vw':
 ↪'AvgPriceVolume', 'o':'OpenPrice', 'c':'ClosePrice', 'h':'HighestPrice', 'l':
 ↪'LowestPrice', 't':'TimeStamp', 'n':'#TransactionAggregateWindow'}
polygon_previous_close.rename(columns = n_columns_news4, inplace = True)
polygon_previous_close['Date'] = pd.
 ↪to_datetime(polygon_previous_close['TimeStamp']/1000, unit='s')
#polygon_previous_close['Date'] = datetime.
 ↪fromtimestamp(polygon_previous_close['TimeStamp'])
polygon_previous_close
```

[90]:

	ExchangeSymbol	TradingVolume	AvgPriceVolume	OpenPrice	ClosePrice	HighestPrice	LowestPrice	TimeStamp	#TransactionAggregateWindow	Date
0	X:BTCUSD	26915.770604	30025.4906	29785.1	30433.75	31449.2	29558.61	1654214399999	599554	2022-06-02 23:59:59.999000064

Here is a description of the imported columns:

1. **ExchangeSymbol**: The exchange symbol that this item is traded under.
2. **TradingVolume**: The trading volume of the symbol in the given time period.
3. **AvgPriceVolume**: The volume weighted average price.
4. **OpenPrice**: The open price for the symbol in the given time period.
5. **ClosePrice**: The close price for the symbol in the given time period.
6. **HighestPrice**: The highest price for the symbol in the given time period.
7. **LowestPrice**: The lowest price for the symbol in the given time period.
8. **TimeStamp**: The Unix Msec timestamp for the start of the aggregate window.
9. **TransactionAggregateWindow**: The number of transactions in the aggregate window.
10. **Date**: The Date from the TimeStamp.

We start by exploring the type of each of the columns along with the data count in the dataframe:

[91]:
```
polygon_previous_close.dtypes
```

[91]:
```
ExchangeSymbol                object
TradingVolume                float64
AvgPriceVolume               float64
OpenPrice                    float64
ClosePrice                   float64
HighestPrice                 float64
LowestPrice                  float64
TimeStamp                      int64
```

```
#TransactionAggregateWindow              int64
Date                              datetime64[ns]
dtype: object
```

[92]:
```
polygon_previous_close.describe()
```

[92]:

	TradingVolume	AvgPriceVolume	OpenPrice	ClosePrice	HighestPrice	\
count	1.000000	1.0000	1.0	1.00	1.0	
mean	26915.770604	30025.4906	29785.1	30433.75	31449.2	
std	NaN	NaN	NaN	NaN	NaN	
min	26915.770604	30025.4906	29785.1	30433.75	31449.2	
25%	26915.770604	30025.4906	29785.1	30433.75	31449.2	
50%	26915.770604	30025.4906	29785.1	30433.75	31449.2	
75%	26915.770604	30025.4906	29785.1	30433.75	31449.2	
max	26915.770604	30025.4906	29785.1	30433.75	31449.2	

	LowestPrice	TimeStamp	#TransactionAggregateWindow
count	1.00	1.000000e+00	1.0
mean	29558.61	1.654214e+12	599554.0
std	NaN	NaN	NaN
min	29558.61	1.654214e+12	599554.0
25%	29558.61	1.654214e+12	599554.0
50%	29558.61	1.654214e+12	599554.0
75%	29558.61	1.654214e+12	599554.0
max	29558.61	1.654214e+12	599554.0

3 AlphaAvantage

Alpha Vantage is an API resource which gives us information constantly, dynamically, and in real-time. We have access to different endpoints, in order:

1. **Currency_exchange_rate:** To get the real time exchange rate for any crypto currency based on USD currency.
2. **Digital_currency_daily:** To get the daily historical time series for a digital currency traded on a specific market.
3. **Crypto_intraday:** To get the intraday time series (timestamp, opne, high, low, close, volume) of the cryptocurrency specified.

[93]:
```
alphavantage=Alphavantage(environ.get("ALPHA_KEY"))
#print('polygon')
status, alphavantage_data = alphavantage.intraday('ETH')
if status:
    #print(alphavantage_data)
    alphavantage_intradayETH = pd.DataFrame.from_dict(alphavantage_data['Time␣
 ↪Series Crypto (5min)'])
alphavantage_intradayETH = alphavantage_intradayETH.T
alphavantage_intradayETH = alphavantage_intradayETH.reset_index(level=0)
```

```
n_columns_rename = {'index':'DateTime','1. open':'Open', '2. high':'High', '3.␣
↪low':'Low', '4. close':'Close', '5. volume':'Volume'}
alphavantage_intradayETH.rename(columns = n_columns_rename, inplace = True)
alphavantage_intradayETH
```

[93]:

	DateTime	Open	High	Low	Close	Volume
0	2022-06-03 06:30:00	1820.12000	1820.96000	1819.22000	1819.23000	972
1	2022-06-03 06:25:00	1819.23000	1821.85000	1818.48000	1820.12000	1231
2	2022-06-03 06:20:00	1820.58000	1820.66000	1817.60000	1819.22000	1370
3	2022-06-03 06:15:00	1823.78000	1823.79000	1819.90000	1820.59000	2090
4	2022-06-03 06:10:00	1826.41000	1827.11000	1823.78000	1823.79000	970
..	…	…	…	…	…	…
95	2022-06-02 22:35:00	1833.74000	1841.84000	1833.73000	1841.83000	1645
96	2022-06-02 22:30:00	1837.07000	1839.58000	1831.79000	1833.74000	3045
97	2022-06-02 22:25:00	1843.60000	1844.47000	1836.63000	1837.07000	3063
98	2022-06-02 22:20:00	1845.99000	1847.76000	1842.20000	1843.60000	4478
99	2022-06-02 22:15:00	1841.48000	1846.00000	1834.90000	1846.00000	3896

[100 rows x 6 columns]

[94]:
```
alphavantage_intradayETH["Open"] = pd.
↪to_numeric(alphavantage_intradayETH["Open"])
alphavantage_intradayETH["High"] = pd.
↪to_numeric(alphavantage_intradayETH["High"])
alphavantage_intradayETH["Low"] = pd.to_numeric(alphavantage_intradayETH["Low"])
alphavantage_intradayETH["Close"] = pd.
↪to_numeric(alphavantage_intradayETH["Close"])
alphavantage_intradayETH["Volume"] = pd.
↪to_numeric(alphavantage_intradayETH["Volume"])
alphavantage_intradayETH['DateTime'] = pd.
↪to_datetime(alphavantage_intradayETH['DateTime'])
alphavantage_intradayETH.dtypes
```

[94]:
```
DateTime    datetime64[ns]
Open               float64
High               float64
Low                float64
Close              float64
Volume               int64
dtype: object
```

[95]:
```
alphavantage_intradayETH.describe()
```

[95]:

	Open	High	Low	Close	Volume
count	100.000000	100.000000	100.000000	100.000000	100.000000
mean	1830.684800	1832.519700	1828.637700	1830.461700	1712.390000
std	6.706739	7.113493	6.329847	6.713813	816.193158

```
min    1816.820000  1820.450000  1816.480000  1816.820000   704.000000
25%    1825.452500  1826.977500  1823.755000  1825.300000  1190.750000
50%    1830.615000  1832.125000  1828.715000  1830.400000  1528.000000
75%    1834.822500  1837.572500  1833.450000  1834.575000  1892.750000
max    1845.990000  1847.760000  1842.200000  1846.000000  5216.000000
```

[96]:
```
status, alphavantage_data = alphavantage.intraday('BTC')
if status:
    #print(alphavantage_data)
    alphavantage_intradayBTC = pd.DataFrame.from_dict(alphavantage_data['Time␣
 ↪Series Crypto (5min)'])
alphavantage_intradayBTC = alphavantage_intradayBTC.T
alphavantage_intradayBTC = alphavantage_intradayBTC.reset_index(level=0)
alphavantage_intradayBTC.rename(columns = n_columns_rename, inplace = True)
alphavantage_intradayBTC
```

[96]:
```
                DateTime         Open         High          Low        Close  \
0   2022-06-03 06:30:00  30468.70000  30476.35000  30455.93000  30455.93000
1   2022-06-03 06:25:00  30461.91000  30475.61000  30452.25000  30468.69000
2   2022-06-03 06:20:00  30468.72000  30468.72000  30444.57000  30461.91000
3   2022-06-03 06:15:00  30511.99000  30512.00000  30467.22000  30468.71000
4   2022-06-03 06:10:00  30541.88000  30543.95000  30511.65000  30511.99000
..                  …            …            …            …            …
95  2022-06-02 22:35:00  30411.92000  30513.82000  30411.10000  30513.82000
96  2022-06-02 22:30:00  30440.42000  30476.17000  30399.40000  30411.91000
97  2022-06-02 22:25:00  30499.77000  30505.44000  30434.42000  30440.41000
98  2022-06-02 22:20:00  30529.60000  30572.88000  30489.22000  30499.76000
99  2022-06-02 22:15:00  30476.78000  30530.88000  30413.80000  30529.59000

   Volume
0      61
1      71
2      96
3     106
4      81
..    …
95    118
96    165
97    148
98    298
99    290

[100 rows x 6 columns]
```

[97]:
```
alphavantage_intradayBTC["Open"] = pd.
 ↪to_numeric(alphavantage_intradayBTC["Open"])
```

```
alphavantage_intradayBTC["High"] = pd.
 ↪to_numeric(alphavantage_intradayBTC["High"])
alphavantage_intradayBTC["Low"] = pd.to_numeric(alphavantage_intradayBTC["Low"])
alphavantage_intradayBTC["Close"] = pd.
 ↪to_numeric(alphavantage_intradayBTC["Close"])
alphavantage_intradayBTC["Volume"] = pd.
 ↪to_numeric(alphavantage_intradayBTC["Volume"])
alphavantage_intradayBTC['DateTime'] = pd.
 ↪to_datetime(alphavantage_intradayBTC['DateTime'])
alphavantage_intradayBTC.dtypes
```

[97]:
```
DateTime    datetime64[ns]
Open               float64
High               float64
Low                float64
Close              float64
Volume               int64
dtype: object
```

[98]:
```
alphavantage_intradayBTC.describe()
```

[98]:

	Open	High	Low	Close	Volume
count	100.000000	100.00000	100.000000	100.000000	100.000000
mean	30506.533300	30529.82970	30483.685500	30506.323600	121.570000
std	58.758674	60.28146	58.404353	58.902487	65.359187
min	30391.130000	30407.27000	30359.540000	30391.140000	46.000000
25%	30469.207500	30486.50500	30444.427500	30468.705000	78.000000
50%	30497.460000	30520.00000	30482.055000	30497.455000	105.000000
75%	30544.255000	30566.37000	30530.460000	30544.262500	144.500000
max	30648.010000	30699.00000	30621.860000	30648.010000	453.000000

[99]:
```
# This works as long as the market is active
status, alphavantage_data = alphavantage.daily('BTC')
print(status)
if status:
    print(status)
    alphavantage_dailyBTC = pd.DataFrame.from_dict(alphavantage_data)
alphavantage_dailyBTC
#alphavantage_dailyBTC = alphavantage_dailyBTC.T
#n_columns_rename = {'1. open':'Open', '2. high':'High', '3. low':'Low', '4.␣
 ↪close':'Close', '5. volume':'Volume',}
#alphavantage_dailyBTC
```

```
False
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
```

```
c:\Users\julia\Downloads\DS4A\DS4A_project\EDA.ipynb Cell 77' in <cell line: 7> )
      <a href='vscode-notebook-cell:/c%3A/Users/julia/Downloads/DS4A/
 ↪DS4A_project/EDA.ipynb#ch0000163?line=4'>5</a>     print(status)
      <a href='vscode-notebook-cell:/c%3A/Users/julia/Downloads/DS4A/
 ↪DS4A_project/EDA.ipynb#ch0000163?line=5'>6</a>     alphavantage_dailyBTC = pd
 ↪DataFrame.from_dict(alphavantage_data)
----> <a href='vscode-notebook-cell:/c%3A/Users/julia/Downloads/DS4A/
 ↪DS4A_project/EDA.ipynb#ch0000163?line=6'>7</a> alphavantage_dailyBTC

NameError: name 'alphavantage_dailyBTC' is not defined
```

[100]:
```
status, alphavantage_data = alphavantage.exchange_rate('BTC')
if status:
    #print(alphavantage_data)
    alphavantage_exchange_rateBTC = pd.DataFrame.from_dict(alphavantage_data)
alphavantage_exchange_rateBTC
alphavantage_exchange_rateBTC = alphavantage_exchange_rateBTC.T
n_columns_rename2 = {'1. From_Currency Code':'FromCurrencyCode', '2.␣
 ↪From_Currency Name':'FromCurrencyName', '3. To_Currency Code':
 ↪'ToCurrencyCode', '4. To_Currency Name':'ToCurrencyName', '5. Exchange Rate':
 ↪'ExchangeRate', '6. Last Refreshed':'LastRefreshed', '7. Time Zone':
 ↪'TimeZone', '8. Bid Price':'BidPrice', '9. Ask Price':'AskPrice'}
alphavantage_exchange_rateBTC.rename(columns = n_columns_rename2, inplace =␣
 ↪True)
alphavantage_exchange_rateBTC
```

[100]:

	FromCurrencyCode	FromCurrencyName	\
Realtime Currency Exchange Rate	BTC	Bitcoin	

	ToCurrencyCode	ToCurrencyName	\
Realtime Currency Exchange Rate	CNY	Chinese Yuan	

	ExchangeRate	LastRefreshed	\
Realtime Currency Exchange Rate	202877.34679200	2022-06-03 06:35:48	

	TimeZone	BidPrice	AskPrice
Realtime Currency Exchange Rate	UTC	202877.28018600	202877.34679200

[101]:
```
alphavantage_exchange_rateBTC["ExchangeRate"] = pd.
 ↪to_numeric(alphavantage_exchange_rateBTC["ExchangeRate"])
alphavantage_exchange_rateBTC["BidPrice"] = pd.
 ↪to_numeric(alphavantage_exchange_rateBTC["BidPrice"])
alphavantage_exchange_rateBTC["AskPrice"] = pd.
 ↪to_numeric(alphavantage_exchange_rateBTC["AskPrice"])
alphavantage_exchange_rateBTC = alphavantage_exchange_rateBTC.
 ↪astype({"FromCurrencyCode": str,"FromCurrencyName": str,"ToCurrencyCode":␣
 ↪str,"ToCurrencyName": str,"TimeZone": str})
```

```
alphavantage_exchange_rateBTC['LastRefreshed'] = pd.
 ↪to_datetime(alphavantage_exchange_rateBTC['LastRefreshed'])
alphavantage_exchange_rateBTC.dtypes
```

[101]:
```
FromCurrencyCode            object
FromCurrencyName            object
ToCurrencyCode              object
ToCurrencyName              object
ExchangeRate               float64
LastRefreshed       datetime64[ns]
TimeZone                    object
BidPrice                   float64
AskPrice                   float64
dtype: object
```

[102]:
```
alphavantage_exchange_rateBTC.describe()
```

[102]:

	ExchangeRate	BidPrice	AskPrice
count	1.000000	1.000000	1.000000
mean	202877.346792	202877.280186	202877.346792
std	NaN	NaN	NaN
min	202877.346792	202877.280186	202877.346792
25%	202877.346792	202877.280186	202877.346792
50%	202877.346792	202877.280186	202877.346792
75%	202877.346792	202877.280186	202877.346792
max	202877.346792	202877.280186	202877.346792

[103]:
```
status, alphavantage_data = alphavantage.exchange_rate('ETH')
if status:
    #print(alphavantage_data)
    alphavantage_exchange_rateETH = pd.DataFrame.from_dict(alphavantage_data)
alphavantage_exchange_rateETH
alphavantage_exchange_rateETH = alphavantage_exchange_rateETH.T
n_columns_rename2 = {'1. From_Currency Code':'FromCurrencyCode', '2.␣
 ↪From_Currency Name':'FromCurrencyName', '3. To_Currency Code':
 ↪'ToCurrencyCode', '4. To_Currency Name':'ToCurrencyName', '5. Exchange Rate':
 ↪'ExchangeRate', '6. Last Refreshed':'LastRefreshed', '7. Time Zone':
 ↪'TimeZone', '8. Bid Price':'BidPrice', '9. Ask Price':'AskPrice'}
alphavantage_exchange_rateETH.rename(columns = n_columns_rename2, inplace =␣
 ↪True)
alphavantage_exchange_rateETH
```

[103]:

	FromCurrencyCode	FromCurrencyName	ToCurrencyCode	ToCurrencyName	ExchangeRate
Realtime Currency Exchange Rate	ETH	Ethereum	CNY	Chinese Yuan	12118.29564000

```
                                        LastRefreshed TimeZone        BidPrice  \
Realtime Currency Exchange Rate  2022-06-03 06:35:55      UTC  12118.29564000

                                        AskPrice
Realtime Currency Exchange Rate  12118.36224600
```

[104]:
```
alphavantage_exchange_rateETH["ExchangeRate"] = pd.
 ↪to_numeric(alphavantage_exchange_rateETH["ExchangeRate"])
alphavantage_exchange_rateETH["BidPrice"] = pd.
 ↪to_numeric(alphavantage_exchange_rateETH["BidPrice"])
alphavantage_exchange_rateETH["AskPrice"] = pd.
 ↪to_numeric(alphavantage_exchange_rateETH["AskPrice"])
alphavantage_exchange_rateETH = alphavantage_exchange_rateETH.
 ↪astype({"FromCurrencyCode": str,"FromCurrencyName": str,"ToCurrencyCode":␣
 ↪str,"ToCurrencyName": str,"TimeZone": str})
alphavantage_exchange_rateETH['LastRefreshed'] = pd.
 ↪to_datetime(alphavantage_exchange_rateETH['LastRefreshed'])
alphavantage_exchange_rateETH.dtypes
```

[104]:
```
FromCurrencyCode            object
FromCurrencyName            object
ToCurrencyCode              object
ToCurrencyName              object
ExchangeRate               float64
LastRefreshed       datetime64[ns]
TimeZone                    object
BidPrice                   float64
AskPrice                   float64
dtype: object
```

[105]:
```
alphavantage_exchange_rateETH.describe()
```

[105]:

	ExchangeRate	BidPrice	AskPrice
count	1.00000	1.00000	1.000000
mean	12118.29564	12118.29564	12118.362246
std	NaN	NaN	NaN
min	12118.29564	12118.29564	12118.362246
25%	12118.29564	12118.29564	12118.362246
50%	12118.29564	12118.29564	12118.362246
75%	12118.29564	12118.29564	12118.362246
max	12118.29564	12118.29564	12118.362246

4 Git Hub Repository

The complete code of the project is hosted in the public Git Hub repository at the following link: https://github.com/andres-pb/DS4A_project.git

5 Front-End Mockup

This section presents an interactive frontend design of how the final result of the application is expected to be.

[1]:
```
from IPython.core.display import display, HTML
display(HTML('<iframe style="border: 1px solid rgba(0, 0, 0, 0.1);" width="720"␣
 ↪height="470" src="https://app.uizard.io/p/873bcebc/embed" allowfullscreen></
 ↪iframe>'))
```

```
/opt/conda/lib/python3.8/site-packages/IPython/core/display.py:717: UserWarning:
Consider using IPython.display.IFrame instead
  warnings.warn("Consider using IPython.display.IFrame instead")
```

```
<IPython.core.display.HTML object>
```