stock_market_sa

March 31, 2023

1 Stock Market Sentiment Analysis

Resources used:

https://www.youtube.com/watch?v=QpzMWQvxXWk
https://medium.com/the-handbook-of-coding-in-finance/sentiment-analysis-of-stock-market-in-python-part-1-web-scraping-financial-news-51b7f603f320
Regex101 to better work with regular expressions.

2 Importing Libraries

[2]:
```
import pandas as pd
import numpy as np
import matplotlib
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline

sns.set_style("darkgrid")
matplotlib.rcParams['font.size'] = 14
matplotlib.rcParams['figure.figsize'] = (15, 5)
matplotlib.rcParams['figure.facecolor'] = '#00000000'

import warnings
warnings.simplefilter(action='ignore')

import spacy

import requests
from bs4 import BeautifulSoup
import re
```

3 Extracting HTML Contents

It will be used the website: https://finviz.com/

Finding the user agent.

[3]:
```
user_agent = 'You can find it by typing "My user agent" in the search bar of␣
↪your browser'
```

[4]:
```
company = 'AAPL'
url = 'https://finviz.com/quote.ashx?t={}&p=d'.format(company)
request = requests.get(url, headers={'User-Agent':user_agent})
```

Checking the URL

[5]:
```
url
```

[5]:
```
'https://finviz.com/quote.ashx?t=AAPL&p=d'
```

Checking whether the request was created properly.

[6]:
```
request.ok
```

[6]:
```
True
```

4 Parsing the Web Content

[7]:
```
parser = BeautifulSoup(request.text, 'html.parser')
news_html = parser.find_all('a',{'class':'tab-link-news'})
news_html[:2]
```

[7]:
```
[<a class="tab-link-news" href="https://finance.yahoo.com/news/gm-plans-phase-
apple-carplay-140319001.html" onclick="trackAndOpenNews(event, 'Reuters',
'https://finance.yahoo.com/news/gm-plans-phase-apple-carplay-140319001.html');"
rel="nofollow" target="_blank">GM plans to phase out Apple CarPlay in EVs, with
Google's help</a>,
 <a class="tab-link-news"
href="https://finance.yahoo.com/m/ee5a6876-747d-3e36-9caf-8e2b34d91721/apple-is-
still-a-buy-despite.html" onclick="trackAndOpenNews(event, 'Motley Fool',
'https://finance.yahoo.com/m/ee5a6876-747d-3e36-9caf-8e2b34d91721/apple-is-
still-a-buy-despite.html');" rel="nofollow" target="_blank">Apple Is Still a Buy
Despite Market Rumors of an Impending Recession</a>]
```

In order to take only the news, it is possible to use a regular expression.
It seems that the news'contents are included between target="_blank" and .

[8]:
```
regex = "target=\"_blank\"\>(.*)\<\/a\>"
regex_news = [re.findall(regex, str(sentence)) for sentence in news_html]
regex_news
```

[8]:
```
[["GM plans to phase out Apple CarPlay in EVs, with Google's help"],
 ['Apple Is Still a Buy Despite Market Rumors of an Impending Recession'],
 ['3 Things About Apple That Smart Investors Know'],
 ['US Appeals Court Rules In Favor Of Apple In Patent Infringement Case Against
```

VirnetX'],
 ['Which Is the Better Dividend Stock: Viatris or Apple?'],
 ['Apple Stores Worst Deals? Employees Reveal 3 Tactics That Make You Spend More Money'],
 ['How Much Amazon, Apple, Meta and the Biggest Tech Companies Are Worth'],
 ["Why Isn't Warren Buffett Buying Microsoft Stock Hand Over Fist?"],
 ['The first quarter of the year sent investors back to the future: Morning Brief'],
 ["87% of Warren Buffett's More Than $6.1 Billion in Dividend Income Comes From These 7 Stocks"],
 ['Streaming platforms vie for MLB broadcast deals this season as opening day takes the plate'],
 ["'The odds are definitely growing' for a possible TikTok ban in the U.S.: Analyst"],
 ['An Analyst Offers a New Reason Why Apple Should Buy Disney: Its Too Big to Fail'],
 ['Investors giving an eye toward big tech in search for quality in S&P stocks: Analyst'],
 ['Taylor Swifts Net Worth: How the Anti-Hero Star Made Her Fortune'],
 ['The Nasdaq-100 Just Entered a Bull Market. Why Its Time to Sell Apple and Microsoft.'],
 ['Apple wins U.S. appeal over patents in $502 million VirnetX verdict'],
 ['Apple wins U.S. appeal over patents in $502 mln VirnetX verdict'],
 ['Why C3.ai Stock Popped Today'],
 ['Over 150,000 people have been let go so far this year. Are layoffs a confession of bad management?'],
 ['TikTok Wont Be the Last Chinese Firm Targeted. Where the Next Fronts Might Be.'],
 ['Apples WWDC Will Happen in Early June. Some Hope for a VR Headset Launch.'],
 ['Daily Spotlight: Final 4Q GDP Report Due Today'],
 ['1 Red Flag for Apple In 2023, and 1 Green Flag'],
 ['A SWOT Analysis of Roku Stock: What Investors Need to Know'],
 ['The First Quarter Was a Roller Coaster. What to Expect the Rest of 2023.'],
 ['Why Warren Buffett Owns More of Apple, Bank of America, and Chevron Stocks Than You Might Think'],
 ['Apple Wants to Solve One of Musics Biggest Problems'],
 ["Warren Buffett's 4 Foundational Criteria for Major Investments, Revealed"],
 ['This Dividend-Focused ETF Is Not a Good Dividend Investment'],
 ['Netflix Tests Idea of Expanding Gaming Service to Televisions'],
 ['Is AppleCare Plus Worth It?'],
 ['Epic and Apple Make Metaverse Advances. Thats Bad News for Meta.'],
 ['Why Investors Took a Shine to Apple Stock Today'],
 ['A.I. race should pause for six months, says Elon Musk'],
 ['Todays top stories: Bank regulator hearing, Starbucks CEO testimony, Apple Developers Conference'],
 ['Best Streaming Devices: Google Chromecast, Apple TV, Amazon Fire and More'],
 ['Apple announces its annual conference dates in June, hinting unveil of VR

```
headset'],
 ['Apple Sets June Dates for Developer Conference'],
 ['Apple TV Could Allow Viewers To View Multiple Sports Simultaneously After
Rival Launches Similar Feature'],
 ["Apple to host annual developers' conference from June 5"],
 ['How Microsoft And Google Beat Apple And Amazon To The Top In Generative AI'],
 ['Apples Worldwide Developers Conference returns June 5, 2023'],
 ['Why Banks Are Waging a Digital-Wallet War With Apple'],
 ["BYD Defers US Debut, Alibaba's Split Sparks Layoff Concerns, Apple Launches
Much-Awaited 'Pay Later' Service: Today's Top Stories"],
 ["Apple Goes Offensive In Samsung's Turf, Taps NewJeans K-Pop For Latest Store
In Korea's Popular Gangnam District"],
 ['Affirm (AFRM) Shares Fall 7.3% After Apple Pay Later Launch'],
 ["Apple Inc.'s (NASDAQ:AAPL) Intrinsic Value Is Potentially 24% Below Its Share
Price"],
 ['Apple Pay Later can give Affirm and Klarna a run for their money'],
 ["This Is Warren Buffett's No. 1 Stock to Buy During a Bear Market"],
 ["Lululemon, Micron and UBS rise premarket; Macy's, Foot Locker fall"],
 ["Market Rally Holds Key Levels: LULU Stock Jumps Late, Micron Says Sales
Growth 'Close'"],
 ['Apple Gangnam will welcome first customers this Friday, March 31 in South
Korea'],
 ['Apple Launches Apple Pay Later in the US'],
 ['Apple Starts to Roll Out Pay Later Service After Delay'],
 ['Apple Rolls Out Buy Now, Pay Later Plan'],
 ['Apple Advertising Business Is Underappreciated, Analyst Says'],
 ['Apple Pay Later debuts in U.S. with no interest, no fees guarantee'],
 ["Affirm Shares Are Falling Due To Apple: Here's Why The Stock Is Reacting"],
 ['Apple launches buy now, pay later service in the US'],
 ['Apple introduces Apple Pay Later, Microsoft unveils AI-powered cybersecurity
platform'],
 ["Apple launches 'Apple Pay Later' buy-now, pay-later program"],
 ['UPDATE 3-Apple launches buy now, pay later service in U.S.'],
 ['Apple launches buy now, pay later service in U.S'],
 ['Apple introduces Apple Pay Later to allow consumers to pay for purchases over
time'],
 ['Apple (AAPL) Strengthens Streaming Service With New Content'],
 ['Apple Music Classical is here'],
 ['5G Stocks To Buy As Analysts Debate Fixed Broadband Growth'],
 ['Stocks trade mixed at the open, rate hike uncertainty weighs on markets'],
 ['2 Nasdaq 100 Stocks to Buy Hand Over Fist Right Now'],
 ['Tech sector becomes safe haven for investors amid U.S. banking crisis'],
 ['CIBC introduces additional Canadian Depositary Receipts ("CDRs")'],
 ["Is Apple Stock A Buy Before iPhone Maker's March-Quarter Earnings Report?"],
 ["If You Invested $25,000 in Warren Buffett's 5 Top Stocks 5 Years Ago, Here's
How Much You Would Have Now"],
 ['Apple CEO Tim Cook meets with new premier Li Qiang on trip to reaffirm
```

```
commitment to China market'],
 ['Apple (AAPL) Stock Sinks As Market Gains: What You Should Know'],
 ['Apple Snaps AI Startup WaveOne Specializing In Compressing Videos'],
 ['S&amp;amp;P 500 gains as investors weigh relief in banks, tech slip'],
 ['Kevin OLearys Stock Portfolio: 10 Stock Picks for 2023'],
 ['A $600 Billion Rally in Big Tech Stocks\xa0Is Not Without Risks'],
 ['From overhiring to optionality: what we can learn from layoffs'],
 ['Apple CEO Meets China Commerce Chief to Talk Supply Chain'],
 ['UPDATE 1-Chinese commerce minister in talks with Apple boss Tim Cook'],
 ['Hedge funds and C-suites: Trump-linked DWAC fires CEO | Pro Recap'],
 ['The Fed and the market are both right'],
 ['Apple CEO Tim Cook welcomed with applause at Beijing conference sponsored by
Chinese government'],
 ['Better Buy: Alibaba vs. Shopify'],
 ['3 No-Brainer Warren Buffett Stocks to Buy Right Now'],
 ["Chinese Foreign Minister Qin Gang assures US business leaders of Beijing's
support"],
 ['3 Top Growth Stocks to Buy Now That Could Be Worth $1 Trillion by 2030'],
 ['Panera Bread palm scanners provide another level of convenience, personalized
service: CEO'],
 ['Apples Tim Cook Upbeat in Beijing as China Courts Global CEOs'],
 ['Apples Tim Cook Takes Stage in China to Welcoming Applause'],
 ['Tim Cook praises Apples symbiotic relationship with China'],
 ['Worried About Banks? Buy This ETF'],
 ['3 Warren Buffett Stocks That Are Crushing the S&amp;amp;P 500 This Year. Are They
Still Smart Picks?'],
 ["Apple CEO praises China's innovation, long history of cooperation on Beijing
visit"],
 ['Apple CEO Cook Stresses Ties With China at Beijing Event'],
 ['Weekly Roundup'],
 ['1 Big Reason to Buy This Nasdaq Stock Hand Over Fist Before It Is Too Late']]
```

Storing the news into a dataframe.

[9]:
```python
# Creating the Lists to Append

news_list = []

for x in regex_news:
    news_list.append(x[0])


# Creating the Dictionary

news_dict = {}
news_dict['Company'] = company
news_dict['News'] = news_list
```

```
# Converting into a Dataframe
apple = pd.DataFrame(news_dict)
```

[10]:
```
apple
```

[10]:

	Company	News
0	AAPL	GM plans to phase out Apple CarPlay in EVs, wi…
1	AAPL	Apple Is Still a Buy Despite Market Rumors of …
2	AAPL	3 Things About Apple That Smart Investors Know
3	AAPL	US Appeals Court Rules In Favor Of Apple In Pa…
4	AAPL	Which Is the Better Dividend Stock: Viatris or…
..	…	…
95	AAPL	3 Warren Buffett Stocks That Are Crushing the …
96	AAPL	Apple CEO praises China's innovation, long his…
97	AAPL	Apple CEO Cook Stresses Ties With China at Bei…
98	AAPL	Weekly Roundup
99	AAPL	1 Big Reason to Buy This Nasdaq Stock Hand Ove…

[100 rows x 2 columns]

5 Storing the Process into a Function

[11]:
```
def company_news(firm):
    user_agent = 'Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36␣
 ↪(KHTML, like Gecko) Chrome/111.0.0.0 Safari/537.36'
    url = 'https://finviz.com/quote.ashx?t={}&p=d'.format(firm)
    request = requests.get(url, headers={'User-Agent':user_agent})
    parser = BeautifulSoup(request.text, 'html.parser')
    news_html = parser.find_all('a',{'class':'tab-link-news'})
    regex = "target=\"_blank\">(.*?)<\/a>"
    regex_news = [re.findall(regex, str(sentence)) for sentence in news_html]

    # Creating the Lists to Append

    news_list = []
    for x in regex_news:
        news_list.append(x[0])

    # Creating the Dictionary

    news_dict = {}
    news_dict['Company'] = firm
    news_dict['News'] = news_list

    # Converting into a Dataframe
```

```
    final_df = pd.DataFrame(news_dict)
    return final_df
```

[12]:
```
microsoft_df = company_news('MSFT')
microsoft_df
```

[12]:

	Company	News
0	MSFT	Italy temporarily bans ChatGPT over privacy co…
1	MSFT	Sharing patient data is something to be celebr…
2	MSFT	Investors Heavily Search Microsoft Corporation…
3	MSFT	Column: Afraid of AI? The startups selling it …
4	MSFT	25 Best Free PC Games of 2023
..	…	…
95	MSFT	Is AMD Stock a Buy?
96	MSFT	Europol sounds alarm about criminal use of Cha…
97	MSFT	Microsoft (MSFT) Might Block AI Rivals From Us…
98	MSFT	Is Salesforce Stock A Buy As Activist Investor…
99	MSFT	Publishers Prepare for Showdown With Microsoft…

[100 rows x 2 columns]

Creating a Dataframe with 5 companies from different sectors:

- **Amazon** –> AMZN
- **Netflix** –> NFLX
- **Intel Corporation** –> INTC
- **Tesla** –> TSLA
- **Eni** –> E

Creating a unique dataframe for all of them.

[13]:
```
companies_df = pd.DataFrame()
tickers = ['AMZN', 'NFLX', 'INTC', 'TSLA', 'E']

for c in tickers:
    new_df = company_news(c)
    companies_df = pd.concat([companies_df, new_df])
```

[14]:
```
companies_df
```

[14]:

	Company	News
0	AMZN	Amazon Adds a Warning Shoppers Will Really Love
1	AMZN	3 Top E-Commerce Stocks to Buy Right Now
2	AMZN	The first quarter of the year sent investors b…

```
3     AMZN         5 Bargain-Basement Stocks to Buy Right Now
4     AMZN       Why Amazon Stock Shot Nearly 2% Higher Today
..     …                                                   …
95      E  Zacks Industry Outlook Highlights Exxon Mobil,…
96      E  5 Energy Stocks From the Promising Integrated …
97      E  Eni SpA (E) Gains As Market Dips: What You Sho…
98      E  Here is Why Growth Investors Should Buy Eni Sp…
99      E            Is Eni (E) Stock Undervalued Right Now?

[500 rows x 2 columns]
```

Checking whether there are 100 news per company.

[15]:
```
companies_df.Company.value_counts()
```

[15]:
```
AMZN    100
NFLX    100
INTC    100
TSLA    100
E       100
Name: Company, dtype: int64
```

Resetting the Index

[16]:
```
companies_df = companies_df.reset_index().drop(columns='index')
companies_df
```

[16]:
```
    Company                                               News
0      AMZN    Amazon Adds a Warning Shoppers Will Really Love
1      AMZN           3 Top E-Commerce Stocks to Buy Right Now
2      AMZN  The first quarter of the year sent investors b…
3      AMZN         5 Bargain-Basement Stocks to Buy Right Now
4      AMZN       Why Amazon Stock Shot Nearly 2% Higher Today
..      …                                                   …
495      E  Zacks Industry Outlook Highlights Exxon Mobil,…
496      E  5 Energy Stocks From the Promising Integrated …
497      E  Eni SpA (E) Gains As Market Dips: What You Sho…
498      E  Here is Why Growth Investors Should Buy Eni Sp…
499      E            Is Eni (E) Stock Undervalued Right Now?

[500 rows x 2 columns]
```

Random checking if all the news are reported correctly.

[17]:
```
companies_df.News[58]
```

[17]:
```
'Amazon AWS Joins the AI Party and Announces New Nvidia Infrastructure Is
Coming'
```

[18]:
```
companies_df.News[321]
```

[18]:
```
'Tesla Used-Car Data Are Good for the Stock'
```

[19]:
```
companies_df.News[220]
```

[19]:
```
'Why Intel, Qualcomm, and Taiwan Semiconductor Manufacturing Rallied Today'
```

6 Applying Sentiment Analysis

It will be used the roBERTa model from HuggingFace.

[20]:
```
from transformers import AutoTokenizer
from transformers import AutoModelForSequenceClassification
from scipy.special import softmax
```

[21]:
```
pre_trained_model = f"cardiffnlp/twitter-roberta-base-sentiment"
tokenizer = AutoTokenizer.from_pretrained(pre_trained_model)
model = AutoModelForSequenceClassification.from_pretrained(pre_trained_model)
```

Encoding text. It will be used a PyTorch Tensor for making the model working properly.

[22]:
```
def roberta_scores(row):
    try:
        # Tokenizing the text and putting it into the model

        tokenized_text = tokenizer(row['News'], return_tensors='pt')
        model_output = model(**tokenized_text)

        # Taking only the scores from the Tensors and putting them in a NumPy␣
 ↪array

        scores = model_output[0][0].detach().numpy()

        # Applying the Softmax function to obtain the probability distribution

        scores = softmax(scores)

        # Storing the results into a dictionary

        scores_dict = {
            'negative_score':scores[0],
            'neutral_score':scores[1],
            'positive_score':scores[2]
        }

        return scores_dict
    except:
```

```
        return 'Text too big'
```

Applying the function to the “News” variable of the “companies_df”.

[23]:
```
companies_df['Sentiment_Scores'] = companies_df.apply(roberta_scores, axis=1)
```

[24]:
```
companies_df
```

[24]:
```
    Company                                                News  \
0      AMZN    Amazon Adds a Warning Shoppers Will Really Love
1      AMZN           3 Top E-Commerce Stocks to Buy Right Now
2      AMZN  The first quarter of the year sent investors b…
3      AMZN         5 Bargain-Basement Stocks to Buy Right Now
4      AMZN       Why Amazon Stock Shot Nearly 2% Higher Today
..      …                                                   …
495       E  Zacks Industry Outlook Highlights Exxon Mobil,…
496       E  5 Energy Stocks From the Promising Integrated …
497       E  Eni SpA (E) Gains As Market Dips: What You Sho…
498       E  Here is Why Growth Investors Should Buy Eni Sp…
499       E            Is Eni (E) Stock Undervalued Right Now?

                                     Sentiment_Scores
0    {'negative_score': 0.009421064, 'neutral_score…
1    {'negative_score': 0.00943878, 'neutral_score'…
2    {'negative_score': 0.0035974341, 'neutral_scor…
3    {'negative_score': 0.020916877, 'neutral_score…
4    {'negative_score': 0.00399428, 'neutral_score'…
..                                                 …
495  {'negative_score': 0.010740134, 'neutral_score…
496  {'negative_score': 0.03108356, 'neutral_score'…
497  {'negative_score': 0.037193075, 'neutral_score…
498  {'negative_score': 0.012144469, 'neutral_score…
499  {'negative_score': 0.42154813, 'neutral_score'…

[500 rows x 3 columns]
```

Creating a columns for each score.

[25]:
```
sentiment_dict = {}

for index, news in zip(companies_df.index, companies_df.Sentiment_Scores):
    sentiment_dict[index] = news

sentiment_dict
```

[25]:
```
{0: {'negative_score': 0.009421064,
  'neutral_score': 0.14996591,
  'positive_score': 0.84061307},
```

```
1: {'negative_score': 0.00943878,
 'neutral_score': 0.7341834,
 'positive_score': 0.25637782},
2: {'negative_score': 0.0035974341,
 'neutral_score': 0.4999522,
 'positive_score': 0.49645048},
3: {'negative_score': 0.020916877,
 'neutral_score': 0.84100795,
 'positive_score': 0.1380751},
4: {'negative_score': 0.00399428,
 'neutral_score': 0.19986825,
 'positive_score': 0.79613745},
5: {'negative_score': 0.041208755,
 'neutral_score': 0.9041199,
 'positive_score': 0.054671295},
6: {'negative_score': 0.013996111,
 'neutral_score': 0.24835204,
 'positive_score': 0.7376517},
7: {'negative_score': 0.013675001,
 'neutral_score': 0.46830657,
 'positive_score': 0.51801836},
8: {'negative_score': 0.11699365,
 'neutral_score': 0.8215755,
 'positive_score': 0.06143082},
9: {'negative_score': 0.61019385,
 'neutral_score': 0.37768775,
 'positive_score': 0.012118343},
10: {'negative_score': 0.0014557443,
 'neutral_score': 0.26883727,
 'positive_score': 0.729707},
11: {'negative_score': 0.19204928,
 'neutral_score': 0.65880454,
 'positive_score': 0.14914624},
12: {'negative_score': 0.005446459,
 'neutral_score': 0.47425756,
 'positive_score': 0.52029604},
13: {'negative_score': 0.023405703,
 'neutral_score': 0.19754757,
 'positive_score': 0.7790468},
14: {'negative_score': 0.051096242,
 'neutral_score': 0.39400876,
 'positive_score': 0.554895},
15: {'negative_score': 0.01217697,
 'neutral_score': 0.1747481,
 'positive_score': 0.81307477},
16: {'negative_score': 0.0097710425,
 'neutral_score': 0.4928191,
```

```
 'positive_score': 0.49740982},
17: {'negative_score': 0.01984466,
 'neutral_score': 0.7651033,
 'positive_score': 0.21505207},
18: {'negative_score': 0.050416548,
 'neutral_score': 0.90555865,
 'positive_score': 0.044024743},
19: {'negative_score': 0.01892697,
 'neutral_score': 0.8784709,
 'positive_score': 0.10260204},
20: {'negative_score': 0.01431561,
 'neutral_score': 0.27399534,
 'positive_score': 0.711689},
21: {'negative_score': 0.67783487,
 'neutral_score': 0.30462044,
 'positive_score': 0.017544603},
22: {'negative_score': 0.07250213,
 'neutral_score': 0.51904213,
 'positive_score': 0.4084558},
23: {'negative_score': 0.61815554,
 'neutral_score': 0.36988744,
 'positive_score': 0.011957092},
24: {'negative_score': 0.025558563,
 'neutral_score': 0.5810036,
 'positive_score': 0.39343786},
25: {'negative_score': 0.09299716,
 'neutral_score': 0.8806078,
 'positive_score': 0.026394926},
26: {'negative_score': 0.671785,
 'neutral_score': 0.3131032,
 'positive_score': 0.01511201},
27: {'negative_score': 0.001295219,
 'neutral_score': 0.049897835,
 'positive_score': 0.948807},
28: {'negative_score': 0.5053952,
 'neutral_score': 0.47139746,
 'positive_score': 0.02320742},
29: {'negative_score': 0.05836098,
 'neutral_score': 0.56322753,
 'positive_score': 0.3784114},
30: {'negative_score': 0.013416976,
 'neutral_score': 0.5392903,
 'positive_score': 0.4472927},
31: {'negative_score': 0.0038333347,
 'neutral_score': 0.15855494,
 'positive_score': 0.8376118},
32: {'negative_score': 0.0024692249,
```

```
 'neutral_score': 0.20918654,
 'positive_score': 0.7883442},
33: {'negative_score': 0.018086985,
 'neutral_score': 0.5722004,
 'positive_score': 0.40971273},
34: {'negative_score': 0.003972179,
 'neutral_score': 0.27099168,
 'positive_score': 0.725036},
35: {'negative_score': 0.4712293,
 'neutral_score': 0.43594438,
 'positive_score': 0.09282635},
36: {'negative_score': 0.0029526441,
 'neutral_score': 0.19902186,
 'positive_score': 0.7980254},
37: {'negative_score': 0.4469664,
 'neutral_score': 0.46354976,
 'positive_score': 0.08948375},
38: {'negative_score': 0.4967354,
 'neutral_score': 0.4663443,
 'positive_score': 0.036920268},
39: {'negative_score': 0.10573473,
 'neutral_score': 0.817664,
 'positive_score': 0.07660134},
40: {'negative_score': 0.009760183,
 'neutral_score': 0.47559047,
 'positive_score': 0.51464933},
41: {'negative_score': 0.09280071,
 'neutral_score': 0.62411284,
 'positive_score': 0.2830864},
42: {'negative_score': 0.035043716,
 'neutral_score': 0.7648832,
 'positive_score': 0.200073},
43: {'negative_score': 0.63853616,
 'neutral_score': 0.3325495,
 'positive_score': 0.028914357},
44: {'negative_score': 0.002011118,
 'neutral_score': 0.06710635,
 'positive_score': 0.9308825},
45: {'negative_score': 0.021653129,
 'neutral_score': 0.8827085,
 'positive_score': 0.09563829},
46: {'negative_score': 0.0056635994,
 'neutral_score': 0.7193225,
 'positive_score': 0.27501377},
47: {'negative_score': 0.48941585,
 'neutral_score': 0.47124237,
 'positive_score': 0.039341792},
```

```
48: {'negative_score': 0.011806904,
 'neutral_score': 0.4347279,
 'positive_score': 0.55346525},
49: {'negative_score': 0.03266451,
 'neutral_score': 0.9205408,
 'positive_score': 0.046794623},
50: {'negative_score': 0.010358575,
 'neutral_score': 0.6918909,
 'positive_score': 0.2977506},
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456: {'negative_score': 0.004448642,
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457: {'negative_score': 0.004700852,
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 'neutral_score': 0.8759321,
 'positive_score': 0.11328182},
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477: {'negative_score': 0.013452114,
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478: {'negative_score': 0.043658704,
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```

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495: {'negative_score': 0.010740134,
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496: {'negative_score': 0.03108356,
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497: {'negative_score': 0.037193075,
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498: {'negative_score': 0.012144469,
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 'positive_score': 0.3747831},
499: {'negative_score': 0.42154813,
 'neutral_score': 0.55156285,
 'positive_score': 0.026889082}}
```

[26]:
```
pd.DataFrame(sentiment_dict)
```

[26]:

	0	1	2	3	4	5	\
negative_score	0.009421	0.009439	0.003597	0.020917	0.003994	0.041209	
neutral_score	0.149966	0.734183	0.499952	0.841008	0.199868	0.904120	
positive_score	0.840613	0.256378	0.496450	0.138075	0.796137	0.054671	

```
                    6         7         8         9    …       490  \
negative_score  0.013996  0.013675  0.116994  0.610194  …  0.018928
neutral_score   0.248352  0.468307  0.821576  0.377688  …  0.946838
positive_score  0.737652  0.518018  0.061431  0.012118  …  0.034234

                   491       492       493       494       495       496  \
negative_score  0.189576  0.002145  0.175541  0.303826  0.010740  0.031084
neutral_score   0.788602  0.147636  0.774342  0.661145  0.806292  0.866747
positive_score  0.021822  0.850219  0.050117  0.035029  0.182967  0.102169

                   497       498       499
negative_score  0.037193  0.012144  0.421548
neutral_score   0.873099  0.613072  0.551563
positive_score  0.089708  0.374783  0.026889

[3 rows x 500 columns]
```

Transposing it.

[27]:
```
sentiment_df = pd.DataFrame(sentiment_dict).T
sentiment_df
```

[27]:
```
     negative_score  neutral_score  positive_score
0          0.009421       0.149966        0.840613
1          0.009439       0.734183        0.256378
2          0.003597       0.499952        0.496450
3          0.020917       0.841008        0.138075
4          0.003994       0.199868        0.796137
..              …              …               …
495        0.010740       0.806292        0.182967
496        0.031084       0.866747        0.102169
497        0.037193       0.873099        0.089708
498        0.012144       0.613072        0.374783
499        0.421548       0.551563        0.026889

[500 rows x 3 columns]
```

Merging the two dataframes.

[28]:
```
final_df = companies_df.merge(sentiment_df, left_index=True, right_index=True)
final_df
```

[28]:
```
    Company                                               News  \
0      AMZN    Amazon Adds a Warning Shoppers Will Really Love
1      AMZN           3 Top E-Commerce Stocks to Buy Right Now
2      AMZN  The first quarter of the year sent investors b…
3      AMZN         5 Bargain-Basement Stocks to Buy Right Now
```

```
4      AMZN       Why Amazon Stock Shot Nearly 2% Higher Today
..      …                                                  …
495       E  Zacks Industry Outlook Highlights Exxon Mobil,…
496       E  5 Energy Stocks From the Promising Integrated …
497       E  Eni SpA (E) Gains As Market Dips: What You Sho…
498       E  Here is Why Growth Investors Should Buy Eni Sp…
499       E            Is Eni (E) Stock Undervalued Right Now?

                                      Sentiment_Scores  negative_score  \
0    {'negative_score': 0.009421064, 'neutral_score…        0.009421
1    {'negative_score': 0.00943878, 'neutral_score'…        0.009439
2    {'negative_score': 0.0035974341, 'neutral_scor…        0.003597
3    {'negative_score': 0.020916877, 'neutral_score…        0.020917
4    {'negative_score': 0.00399428, 'neutral_score'…        0.003994
..                                                 …             …
495  {'negative_score': 0.010740134, 'neutral_score…        0.010740
496  {'negative_score': 0.03108356, 'neutral_score'…        0.031084
497  {'negative_score': 0.037193075, 'neutral_score…        0.037193
498  {'negative_score': 0.012144469, 'neutral_score…        0.012144
499  {'negative_score': 0.42154813, 'neutral_score'…        0.421548

     neutral_score  positive_score
0         0.149966        0.840613
1         0.734183        0.256378
2         0.499952        0.496450
3         0.841008        0.138075
4         0.199868        0.796137
..             …               …
495       0.806292        0.182967
496       0.866747        0.102169
497       0.873099        0.089708
498       0.613072        0.374783
499       0.551563        0.026889

[500 rows x 6 columns]
```

7 EDA

[29]:
```
final_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 500 entries, 0 to 499
Data columns (total 6 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   Company           500 non-null    object
 1   News              500 non-null    object
```

```
 2   Sentiment_Scores  500 non-null    object
 3   negative_score    500 non-null    float32
 4   neutral_score     500 non-null    float32
 5   positive_score    500 non-null    float32
dtypes: float32(3), object(3)
memory usage: 17.7+ KB
```

Checking the average values for each company.

[30]:
```
final_df.groupby('Company')[['negative_score', 'neutral_score',␣
↪'positive_score']].mean()
```

[30]:

Company	negative_score	neutral_score	positive_score
AMZN	0.143925	0.497194	0.358881
E	0.099289	0.687596	0.213116
INTC	0.140033	0.580089	0.279878
NFLX	0.098427	0.572852	0.328722
TSLA	0.174532	0.531944	0.293524

The neutral score appears to be dominant in this case.

Overall, the average negative score is always lower than the positive one.

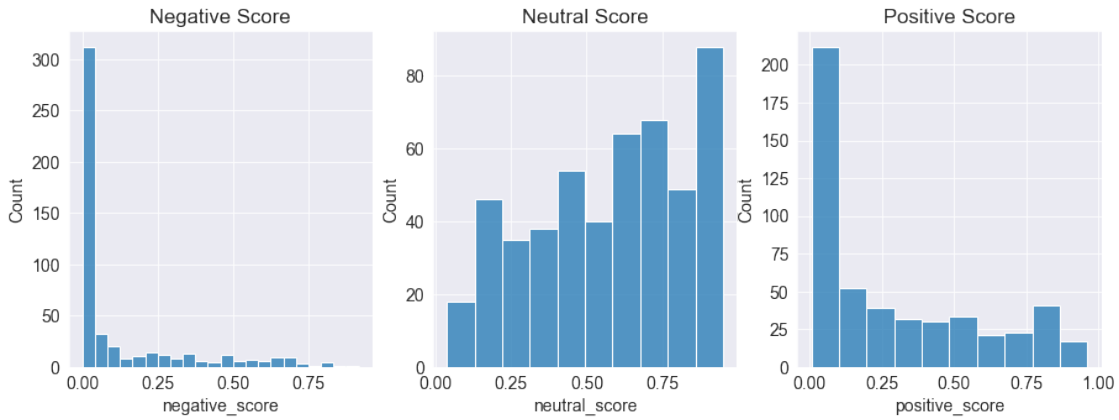
Checking the different scores'distirbution.

[31]:
```
fig, ax = plt.subplots(1,3)

ax[0].set_title('Negative Score')
sns.histplot(data=final_df, x='negative_score', ax=ax[0])

ax[1].set_title('Neutral Score')
sns.histplot(data=final_df, x='neutral_score', ax=ax[1])

ax[2].set_title('Positive Score')
sns.histplot(data=final_df, x='positive_score', ax=ax[2]);
```



Both positive and negative scores appear to be right-skewed, on the contrary the neutral score is left-skewed.

Checking the best and the worst news.

[32]:
```
final_df.sort_values('positive_score', ascending=False)[['News',␣
↪'positive_score']]
```

[32]:

	News	positive_score
479	Eni SpA (E) is an Incredible Growth Stock: 3 R…	0.961236
362	For Tesla, This Is the Most Important Delivery…	0.960551
141	Apple Has a Billion-Dollar Blockbuster Idea Mo…	0.955308
96	Amazon.com, Inc. (NASDAQ:AMZN) is a favorite a…	0.954052
27	Best Streaming Devices: Google Chromecast, App…	0.948807
..	…	…
352	UPDATE 2-Ex-Tesla worker testifies that race b…	0.009789
465	Hackers Hit Italian Oil Giant Enis Computer Ne…	0.008905
284	The Worst Is Over For PC, Smartphone Chip Stoc…	0.008291
356	Ex-Tesla worker testifies that race bias made …	0.007987
296	7 Terrible Tech Stocks to Sell in March	0.007298

[500 rows x 2 columns]

[33]:
```
final_df.News[479]
```

[33]:
```
'Eni SpA (E) is an Incredible Growth Stock: 3 Reasons Why'
```

Probably here words like “incredible” and “growth” had a great influence on the final result.

[34]:
```
final_df.sort_values('negative_score', ascending=False)[['News',␣
↪'negative_score']]
```

[34]:

	News	negative_score
296	7 Terrible Tech Stocks to Sell in March	0.917759
284	The Worst Is Over For PC, Smartphone Chip Stoc…	0.864621
344	Elon Musk's Boring Co. Neighbors Have Big Fear…	0.833369
376	Tesla Rival Lucid Has Really Bad News About It…	0.825282
356	Ex-Tesla worker testifies that race bias made …	0.818057
..	…	…
27	Best Streaming Devices: Google Chromecast, App…	0.001295
208	These Stocks Are Moving the Most Today: Intel,…	0.001176
172	Warner Bros. Discovery's (WBD) Batman Series W…	0.001172
133	These Stocks Moved the Most Today: Deutsche Ba…	0.001103
96	Amazon.com, Inc. (NASDAQ:AMZN) is a favorite a…	0.001073

[500 rows x 2 columns]

[47]:
```
final_df.loc[284, 'negative_score']
```

[47]:
```
0.86462146
```

[46]:
```
final_df.News[284]
```

[46]:
```
'The Worst Is Over For PC, Smartphone Chip Stocks, Analyst Says'
```

Here the model does not seem to have well captured the sentence's meaning. It interpreted words like "worst" and "over" as a negative aspect, while the news was good for the company.

8 Conclusion

As a preliminary analysis, from my point of view, the most difficult part was the webscraping phase. Many sites have a really complex structure and it is quite difficult to inspect them well.
Further improvements can be done in the future by including people's opinions, for example by including tweets.