



ANALYSING THE IMPACT OF INVESTOR SENTIMENT EXPRESSED IN THE COMMENTS SECTION OF YAHOO ON TESLA STOCK PRICES

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Bern 08.10.2024

AGENDA

- 1) Goal of the analysis
- 2) Why Tesla Stock
- 3) Data collection and sentiment scoring
- 4) Exploratory data analysis
- 5) Correlation and regression analysis
- 6) Conclusions

GOAL OF THE ANALYSIS

- To investigate if there is a significant association between investor sentiment on Tesla stock expressed in the comments section of Yahoo Finance and the fluctuations of Tesla share price

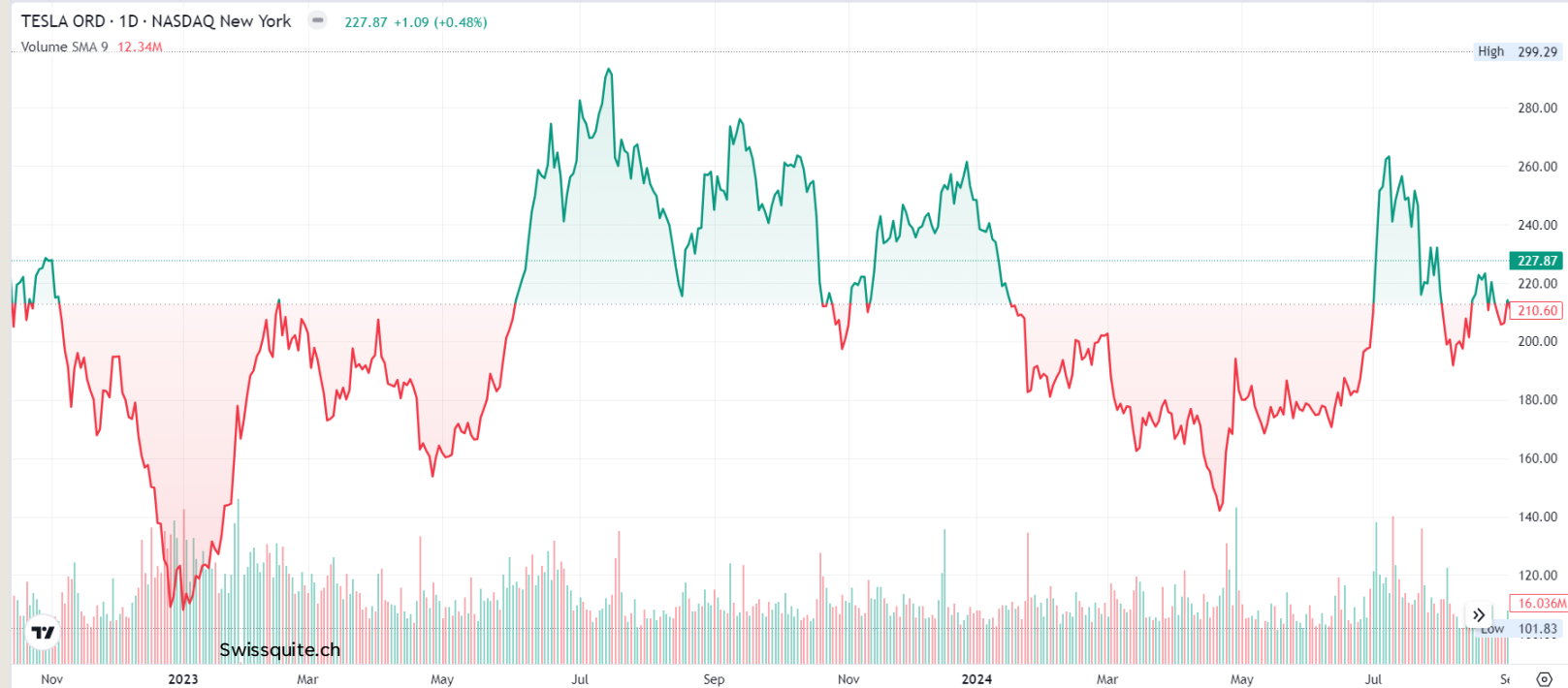
WHY WE PICKED TESLA?

The Magnificent 7 companies are among the seven dominant tech giants driving significant stock market growth through their innovation and influence, making them highly attractive to investors.



WHY WE PICKED TESLA?

- Characterized by frequent "bull runs" and sharp price drops
- Ideal for sentiment analysis due to its dynamic fluctuations which generate sentiment swings among the investors
- Very volatile stock - price range min: \$101 – max: \$299 (period 01.01.2023 – 31.08.2024)





DATA COLLECTION AND SENTIMENT SCORING

SENTIMENT DATA COLLECTION

- Web scrapped **497k** comments from Yahoo Finance:
<https://finance.yahoo.com/quote/TSLA/community/>

yahoo!finance

**THE #1 FINANCE SITE
IN THE U.S.¹**

62% of adult Americans own stocks,
reaching a 20-year high

Source: <https://www.visualcapitalist.com/american-stock-ownership-by-share-of-financial-assets/>



#1 platform for business news¹

With 93M monthly unique visitors in the
U.S.¹

¹ Comscore Media Metrix Multi-Platform,
Business/Finance News category, July 2022, U.S.



**#1 video platform in finance
category**

With 6.2M monthly unique viewers.

² Comscore Video Metrix, Desktop Content Only, July
2022, U.S.

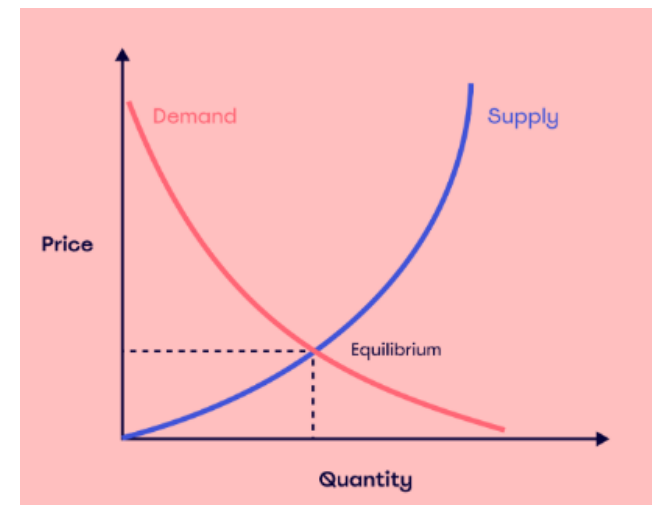
Source: <https://www.advertising.yahooinc.com/about/our-brands/yahoo-finance>



SENTIMENT ASSUMPTIONS

Comment makers represent actual or potential TESLA stock owners and express the general sentiment of the market regarding the asset

- **Positive sentiment** drives **demand** for TSLA shares, as market participants anticipate price increases based on optimistic commentary. This increased demand **pushes the stock price higher**.
- **Negative sentiment** instills fear among market participants, creating the perception that the stock price will fall. This encourages shareholders to sell, increasing **supply** and **driving the price down**.



BULL AND BEAR MARKET

WHAT'S THE DIFFERENCE?

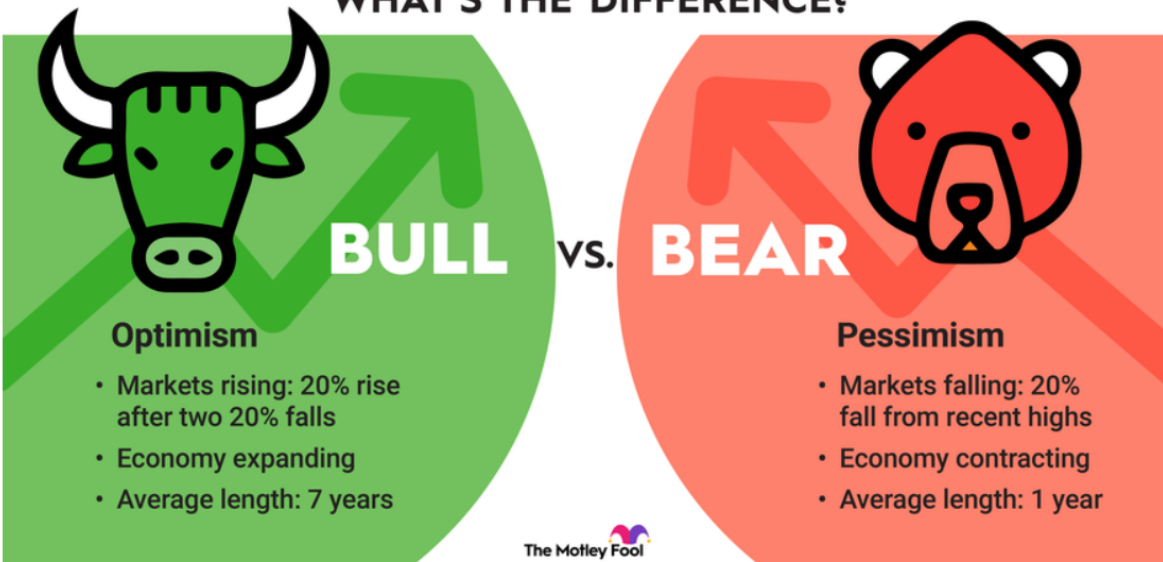
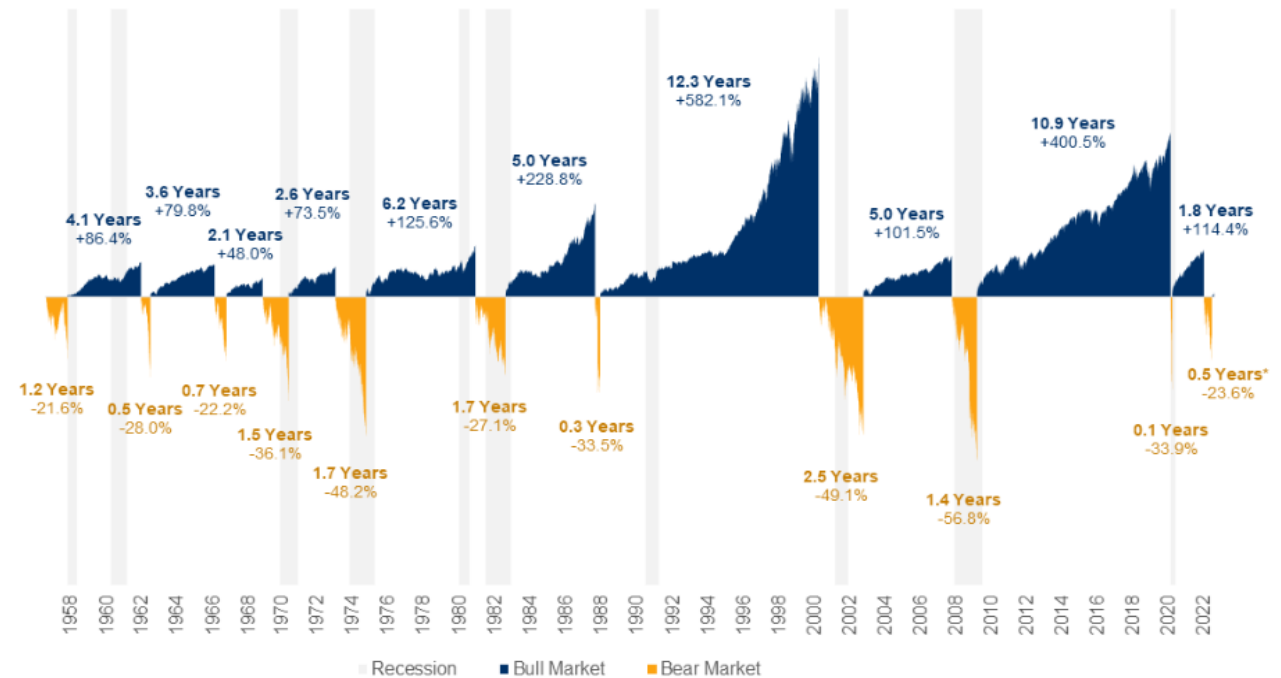


Image source: The Motley Fool

A history of U.S equity of bull & bear markets




Source: <https://www.rbcgam.com/en/ca/learn-plan/investment-basics/the-bulls-the-bears/detail>

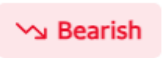
SENTIMENT SCORING

Each comment receives a sentiment score ranging from -1 (highly negative) to 1 (highly positive), based on a two-tier approach:


- **49.8% of comments** have a sentiment tag where users **explicitly** express their outlook on Tesla's future stock price, the score is assigned as follows:
 - **BULLISH** – "price will raise" - sentiment Score: **1**
 - **NEUTRAL** – "no change in price" - sentiment Score: **0**
 - **BEARISH** – "price will fall" - sentiment Score: **-1**


	Number of comments	%
BULLISH	130,466	26.2%
NEUTRAL	11,905	2.4%
BEARISH	105,301	21.2%
null	249,682	50.2%
TOTAL	497,354	100.0%

 **Vincent Hernandez**
14 hours ago


 Bearish

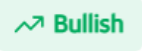
Everthing Tesla has gained in the last year gone tomorrow

 **adel**
17 hours ago


 Bullish


\$245 this week 😊

 **Brand**
15 hours ago


 Bullish

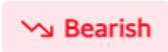
Despite some volatility in this stock, future is a sure 400 in 2 years. Buy, hold and be happy in time.

 **Ronald J**
20 hours ago

 → Neutral

Ever since Musk supported Trump, Tesla has found a bottom and started inching up. Does that surprise some of the lefties here?

 **Vincent Hernandez**
14 hours ago

 Bearish

Everthing Tesla has gained in the last year gone tomorrow

SENTIMENT SCORING

- For the remaining **50.2% of comments** without a sentiment tag, we assign a sentiment score using the **VADER** (Valence Aware Dictionary and sEntiment Reasoner) lexicon.
- **VADER** is a pre-trained sentiment analysis tool specifically designed for social media text.
- It uses a lexicon of words with pre-labeled sentiment scores and adjusts based on factors like punctuation, capitalization, and negation.
- The sentiment score range:
 - **-1**: Extremely Negative
 - **0**: Neutral
 - **1**: Extremely Positive

Mark

23 hours ago

It is difficult to believe that people are buying or even trading this stock anymore.

```
{ 'neg': 0.152, 'neu': 0.848, 'pos': 0.0, 'compound': -0.3612 }
```

AlexD

1 day ago

Tesla holding strong today.

```
{ 'neg': 0.0, 'neu': 0.476, 'pos': 0.524, 'compound': 0.5106 }
```

Henry Schneider

6 hours ago

Kamala harris knows what is AI and can support tech stocks

```
{ 'neg': 0.0, 'neu': 0.787, 'pos': 0.213, 'compound': 0.4019 }
```

jc

22 hours ago

Cybertrucks are so ugly.

```
{ 'neg': 0.586, 'neu': 0.414, 'pos': 0.0, 'compound': -0.6418 }
```

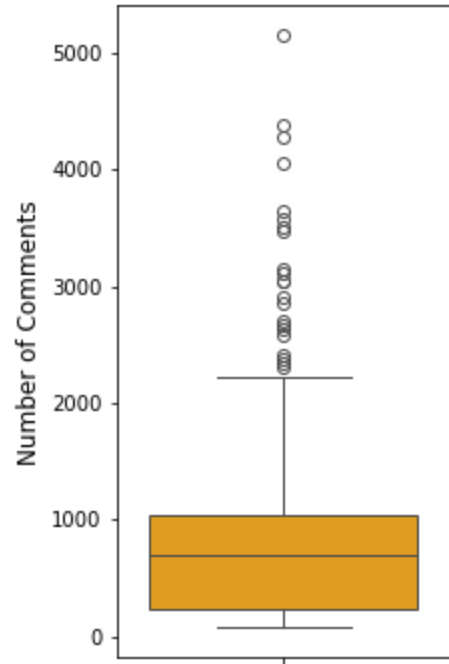


EXPLORATORY DATA ANALYSIS

COMMENTS DATA COLLECTION

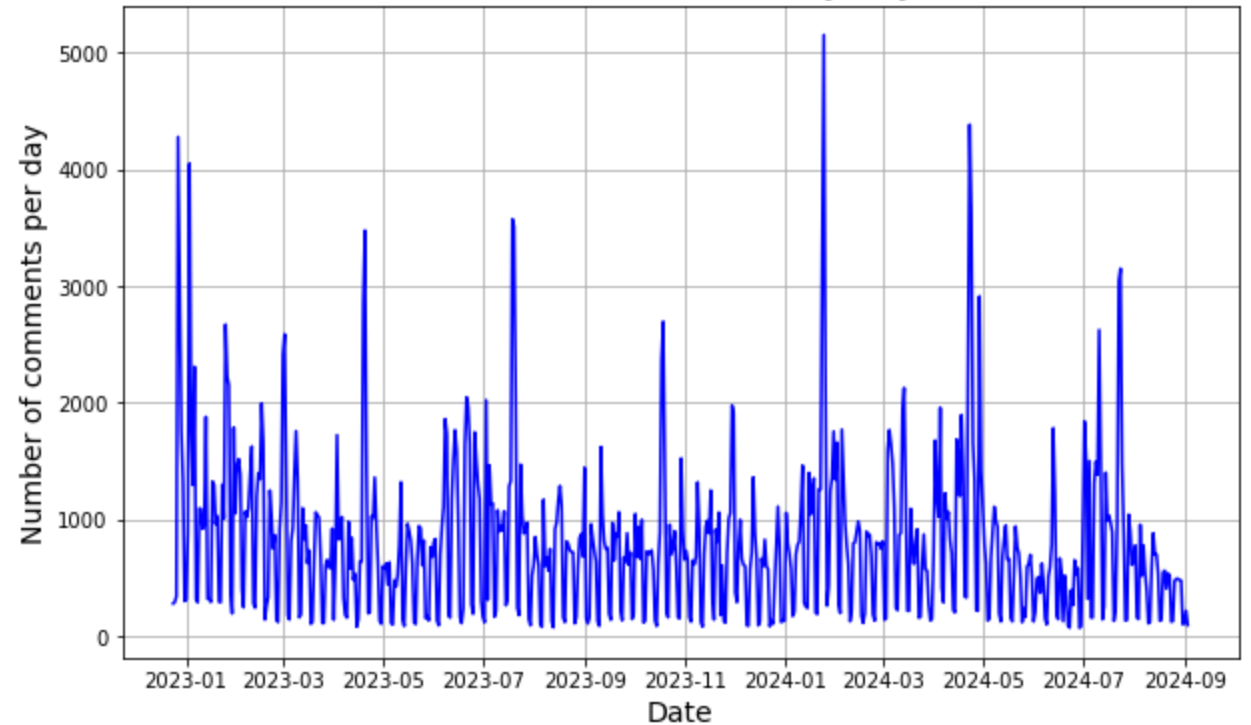
- Analysis period: 01.01.2023 - 31.08.2024, 20 months
- Web scrapped **497k** comments from Yahoo Finance:
<https://finance.yahoo.com/quote/TSLA/community/>

Number of Comments per Day

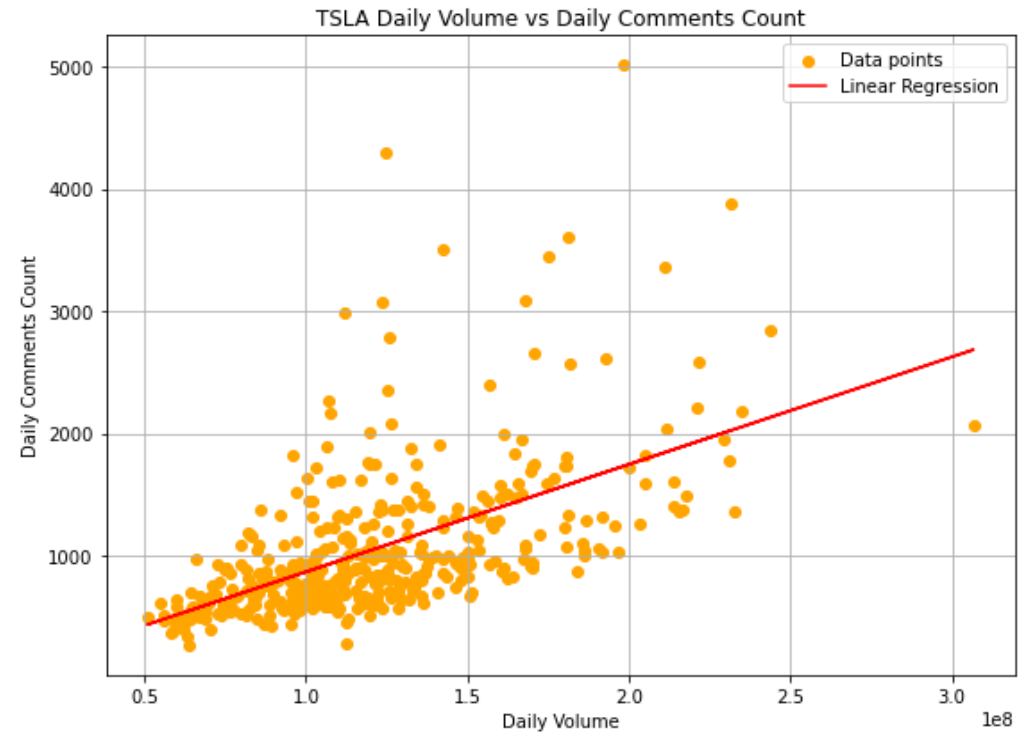


	comment_count
mean	802
std	685
min	70
25%	240
50%	699
75%	1042
max	5154

Number of comments by Day



COMMENTS DATA COLLECTION



Correlation = 0.56

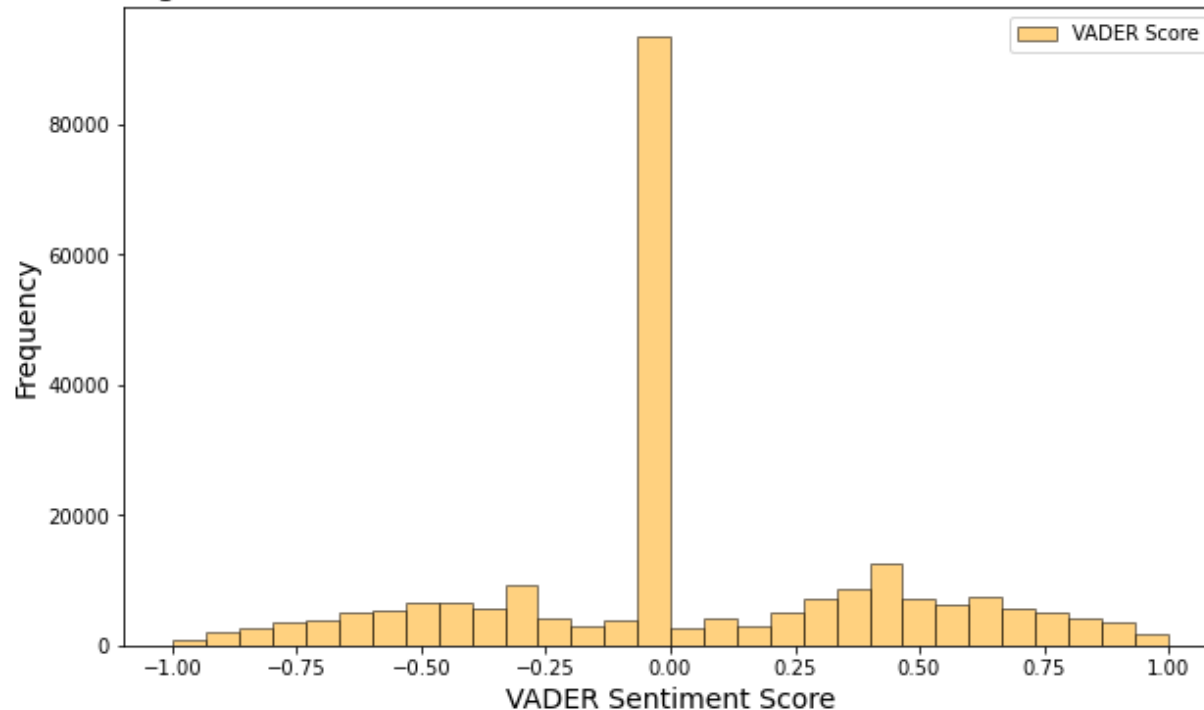
Moderate positive correlation between the daily trading volume and number of comments

SENTIMENT SCORES

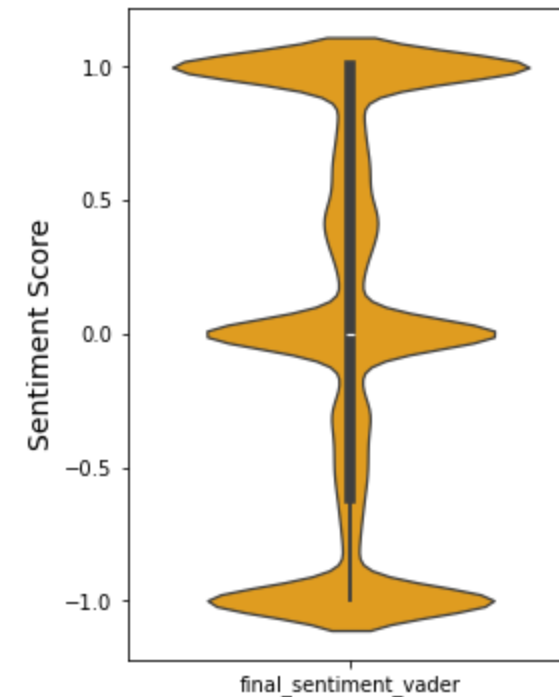
- For **49.8%** of comments with BULLISH/BEARISH/NEUTRAL sentiment tag we assign a value: -1, 0 or 1 based on the tag
- For the outstanding **50.2%** of comments without the tag we derive the sentiment score based on the VADER sentiment

	Number of comments	%
BULLISH	130,466	26.2%
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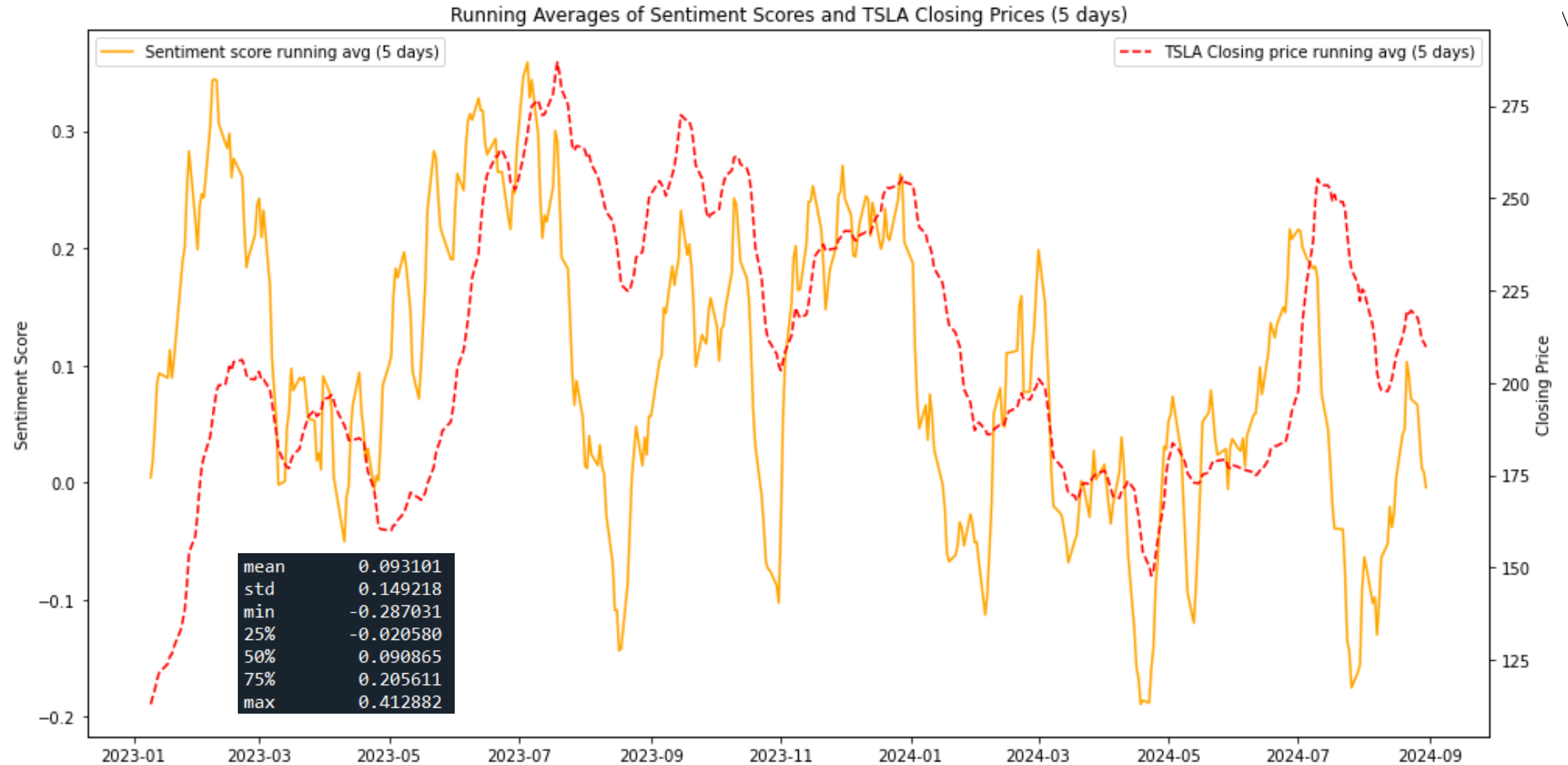
Histogram of VADER sentiment scores for comments without sentiment tag



Violin Plot of Final Sentiment



SENTIMENT VS TSLA CLOSING PRICE





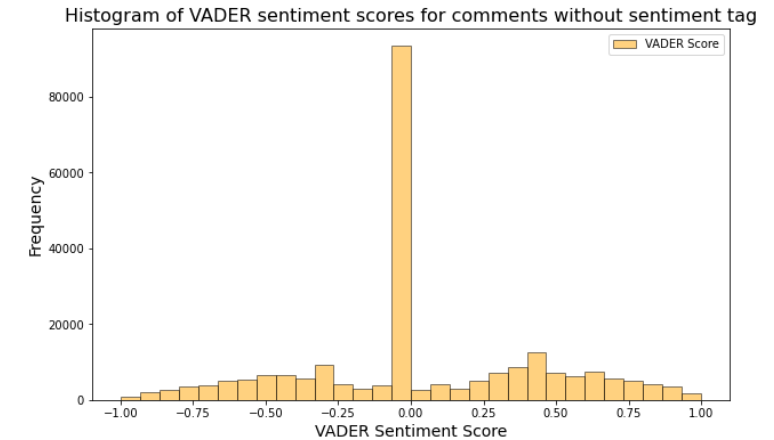
CORRELATION ANALYSIS

SPEARMAN'S CORRELATION

- Estimation of the relationship between the sentiment score (x-variable) and the stock market (y-variable)
- Normality assumption not fulfilled by our data
- Spearman's correlation: non-parametric measure of correlation (in Python: `scipy.stats.spearmanr`)
- Spearman coefficient (r_s) ranges between -1 and $+1$, with 0 implying no correlation

$$r_s = 1 - \frac{6 \sum (x_i - y_i)^2}{n(n^2 - 1)}$$

n: number of observations



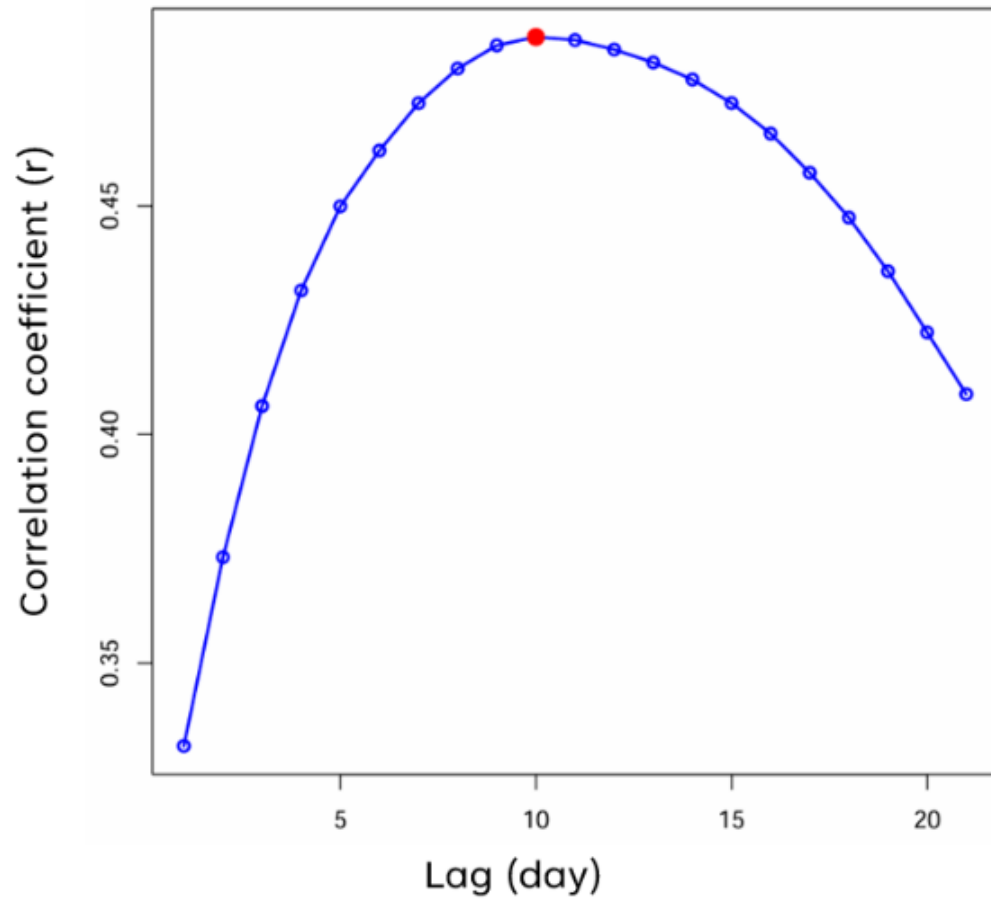
r_s value	Correlation strength
$0.0 < 0.1$	no correlation
$0.1 < 0.3$	low correlation
$0.3 < 0.5$	medium correlation
$0.5 < 0.7$	high correlation
$0.7 < 1$	very high correlation

HYPOTHESIS

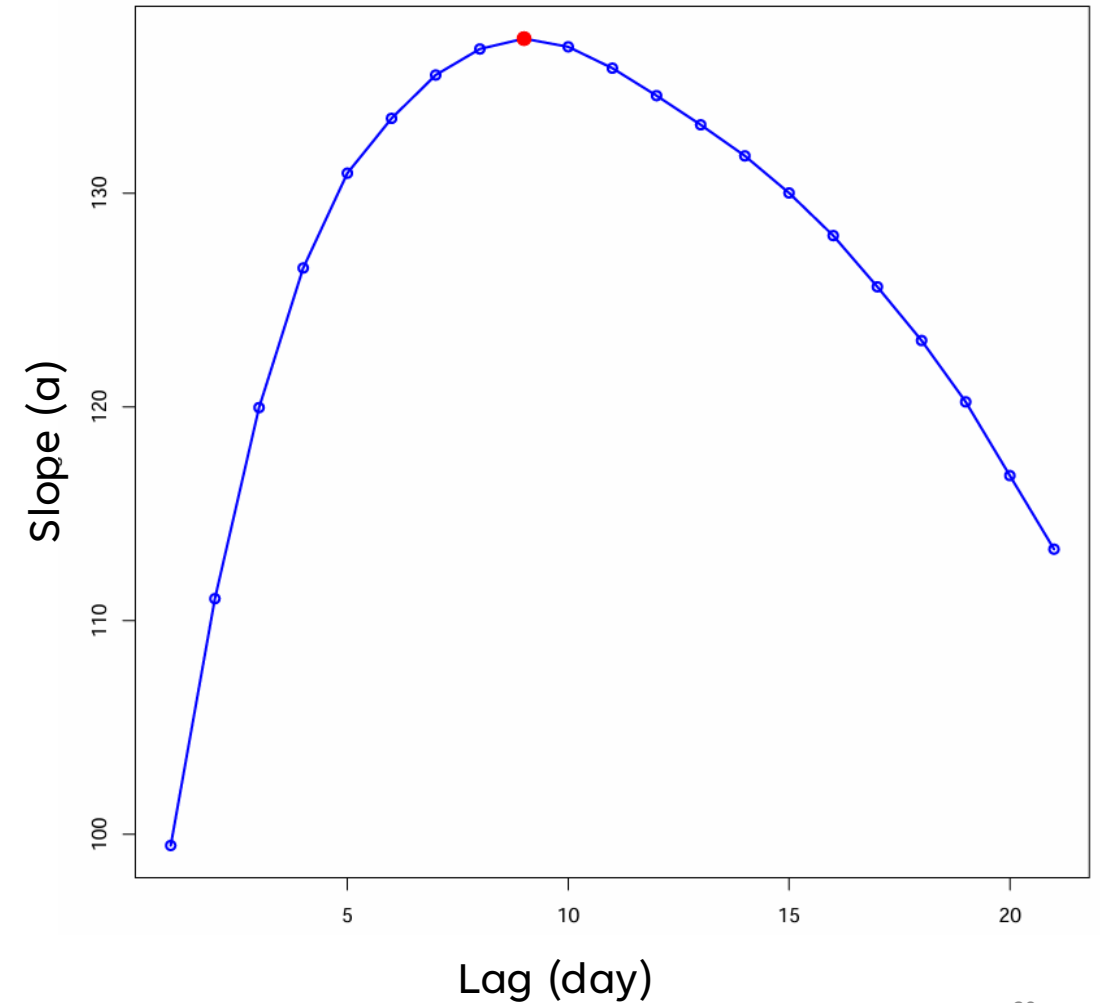
- **Null hypothesis (H_0): $r_s = 0$**
 - There is no relationship between investors' comments and TESLA stock prices (correlation coefficient (r_s) between sentiment score and stock price is equal to 0)
- **Working hypothesis (H_1): $r_s \neq 0$**
 - There is a relationship between investors' comments and TESLA stock prices (correlation coefficient (r_s) between sentiment score and stock price differs from 0).

CORRELATION AND REGRESSION ANALYSIS

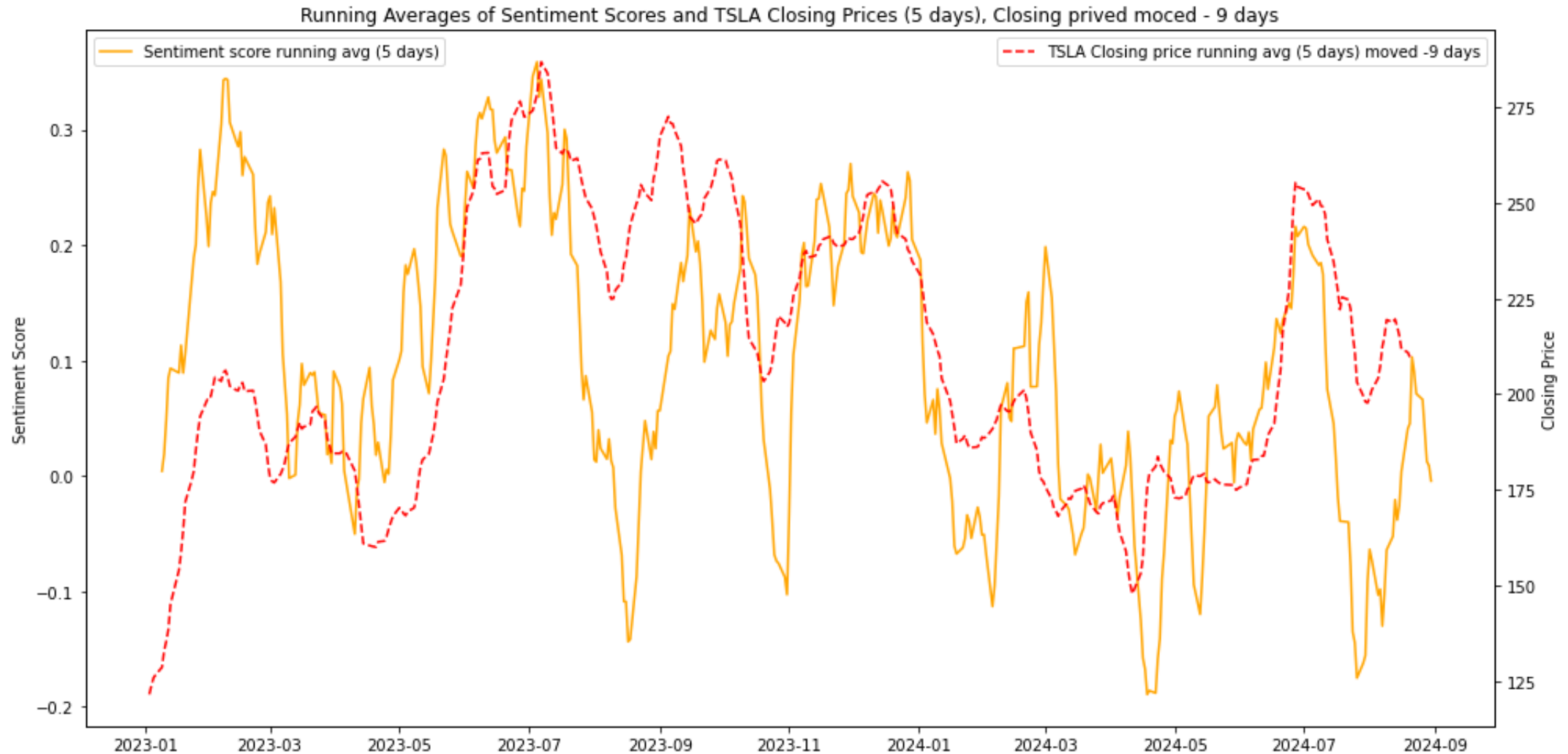
Correlation between vader_running_avg and Close_running_avg



Slope of Regression between vader_running_avg and Close_running_avg



SENTIMENT VS TSLA CLOSING PRICE ADJUSTED



A series of white, thin, overlapping geometric lines on a black background, forming various polygons and intersecting points, primarily located on the left side of the slide.

THANK YOU