

Cryptocurrency Price Analysis



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01

Introduction



Introduction



Cryptocurrencies

- World's first encounter of digitalized currency
- Internet-based medium of exchange
- Leverages on cryptographical functions for financial transactions
- Uses blockchain technology
- Decentralized
- Transparent
- Immutable
- Unrestricted from control of central authorities
- Factors affecting cryptocurrency price:
 - Demand & supply
 - Mining
 - Regulations
 - News & Media

Introduction



Bitcoin

- Satoshi Nakamoto, 2008
- World's first decentralized cryptocurrency
- World's largest cryptocurrency (market capitalization)
- Transactions are recorded in blockchain
- First real world bitcoin transaction - Papa John's Florida, USA
- Frequent price fluctuations
- Bitcoin pricing - News events

Introduction



Bitcoin

- Payment method, investment tool
- Lowered transaction fees
- Speedier transfers
- November 2016, Partnerships between MAS, R3, Bank of America Merrill Lynch, Credit Suisse, DBS Bank, JPMorgan Chase, SGX
- Develop tokenized SGD
- Inter-bank payments

Bitcoin Timeline

Early emergence

Fraction of a dollar

2008 Financial Crisis

2017

Record-breaking growth

Price peaked at USD20,000

Drastic fall

Bitcoin lost almost $\frac{1}{3}$ of its value, dropping below USD4000

2018 Crypto-Crash

2019

Maintaining

Price stability settling around USD10,000

2020

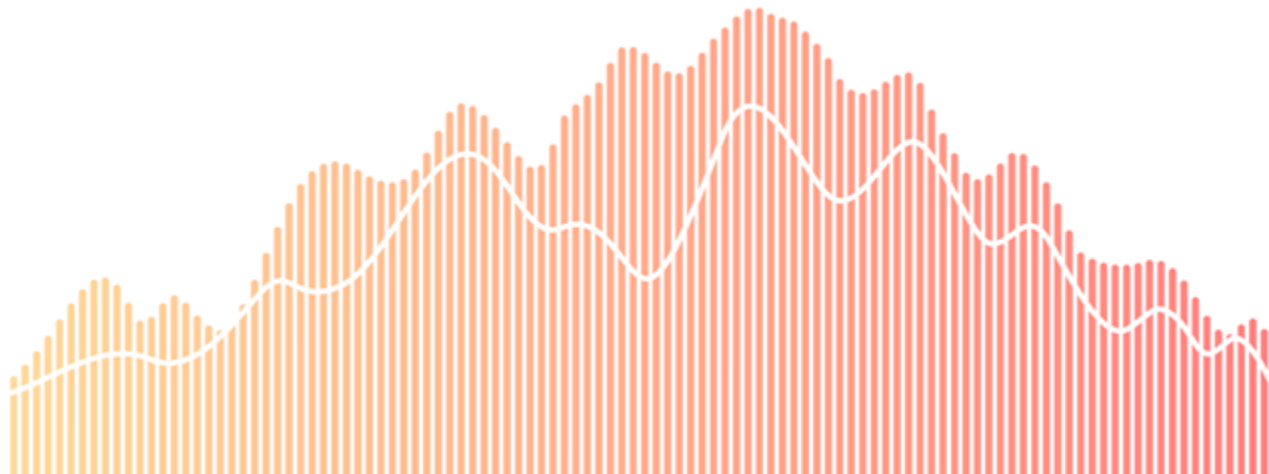
Rapid fluctuations

Amid the flurry of worldwide events, prices are unstable

Problem Statement

Cryptocurrency Price Analysis

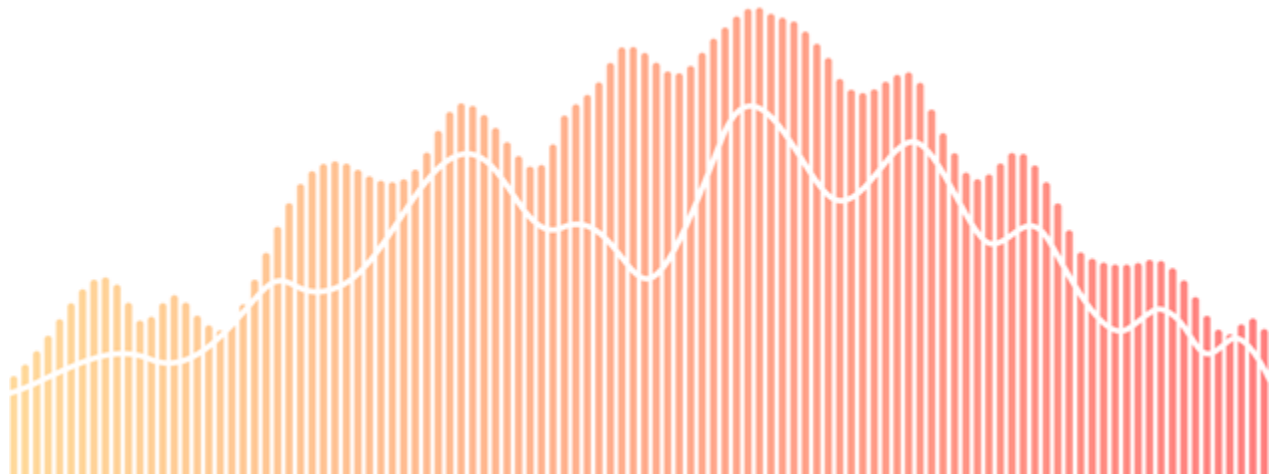
- Understanding news' events influence on bitcoin price
- Establishing correlations between bitcoin and the type of news that actually have an effect on it



Problem Statement

Cryptocurrency Price Analysis

- 12 April 2019 - 13 March 2020
- Collect bitcoin prices
- Crawl news titles of Business news, Market news, Bitcoin-related news
- Perform Sentiment Analysis
- Obtain Correlation Coefficients
- Plot Time Series



02

Research



Research

News events' extensive edge and influences on bitcoin price

General relationship between news events and bitcoin price

Sentiment Analysis

How it comes into place

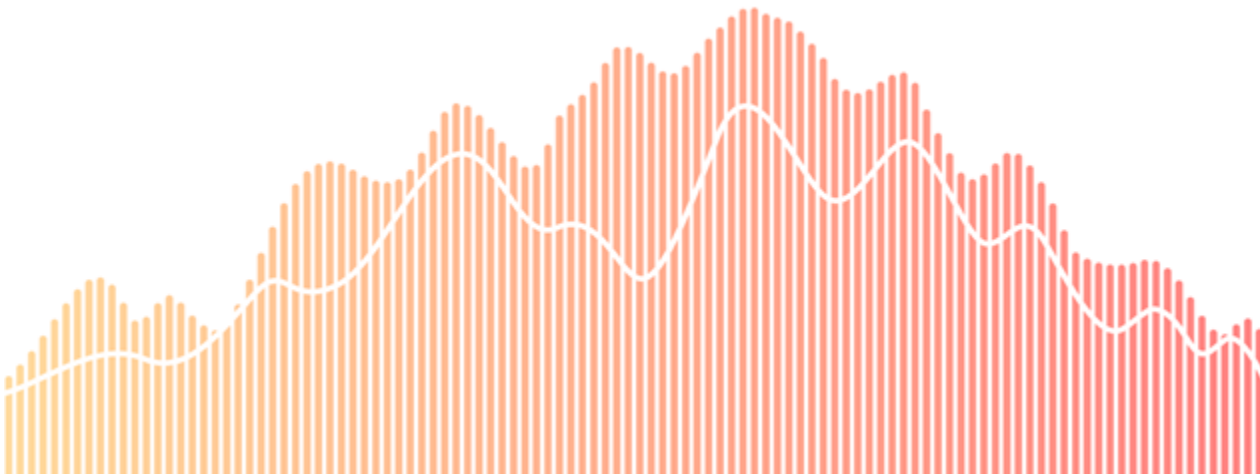
Existing works

Currently being used



Bitcoin Price

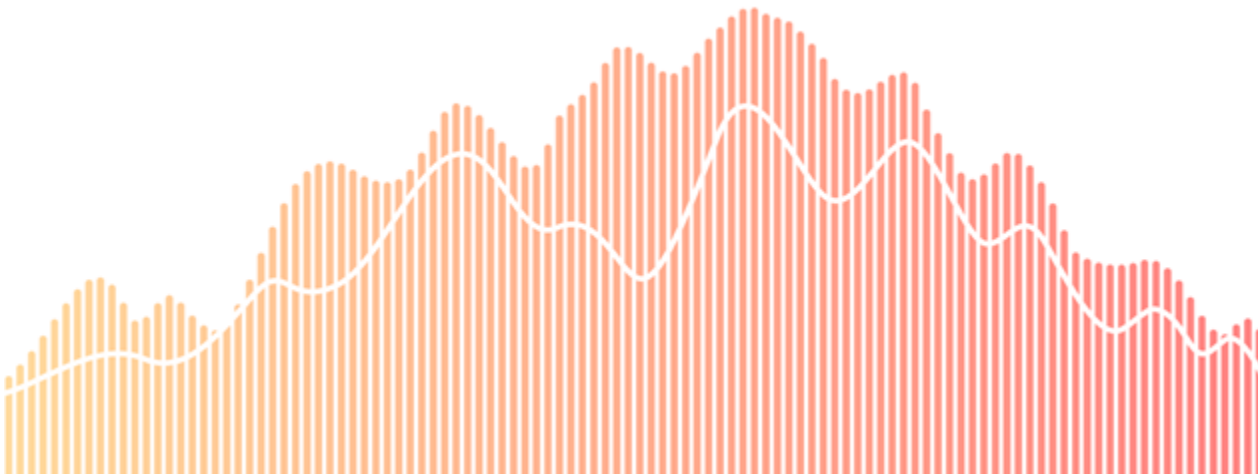
- Sensitivity to the speculative market
- Response to investors' sentiments



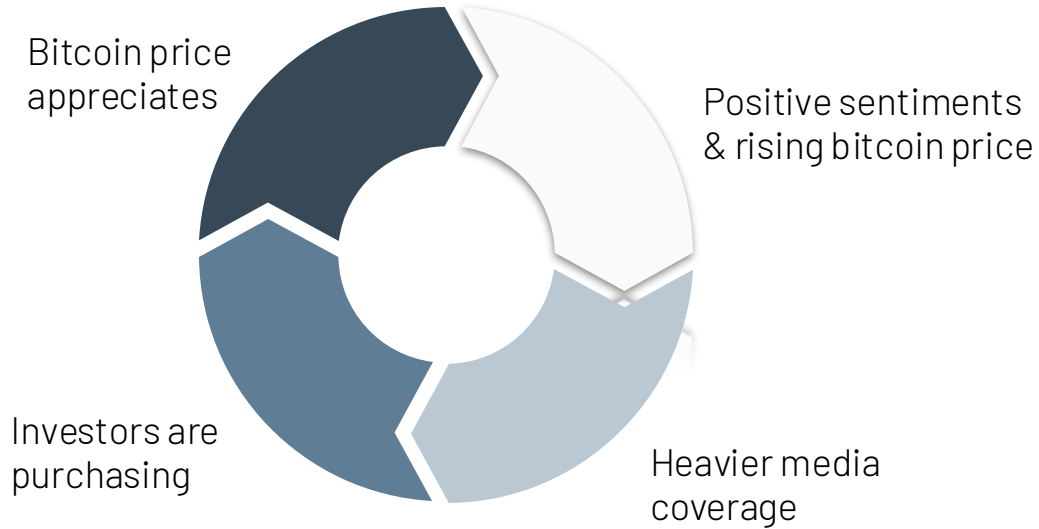
News Events



- Ability to change market sentiments
- Prompts investors
- Premeditating actions influencing how other investors see bitcoin & its future growth prospects
- Affect the outlook and perspective potential investors hold towards bitcoin
- Considerable weight to investors' confidence
- Optimism of the bitcoin market



Media Hype Cycles



Sentiment Analysis on news events

- Opportunities for a great buy
- Forewarn to sell off
- Maximising gain & Minimising loss
- Types of news events:
 - Business news
 - Market news
 - Bitcoin-related news



Sentiment Analysis on news events

- Corresponding to news events, the derivation of average bitcoin price swing indicates the average daily volatility of bitcoin price
- Obtain the general sentiment scores of news events
- Draw their correlation to bitcoin price



Existing works in the market

Twitter Sentiment Analysis

Tweets

280-words tweet

Tweet Volumes

Market movements and overall optimism.



Yardstick

Guess the predominant mood in tweets to establish trade patterns.

Trajectory

Market fluctuations, denoting variations in supply and demand

Existing works in the market

Historical Bitcoin Prices

Algorithms ◀

Machine Learning Algorithms to calculate overall predicted performance

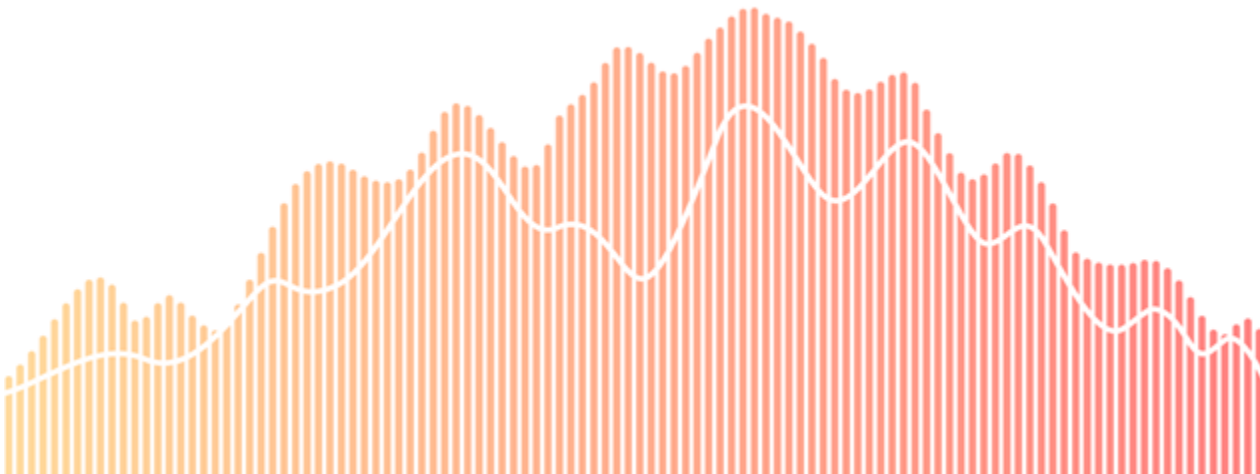


▶ Moving Average

Predicted closing bitcoin price determined by taking the average of a defined window of previously observed bitcoin prices.

Bitcoin Price Prediction

- Bitcoin price is not depicted by a single sole source
- But a mixture of factors with slightly stronger dependence on news events
- Insights derived from Sentiment Analysis are of slight significant impact
- An inkling of the returns investors could receive



03

Implementation



Workflow

CoinMarketCap

Period of 12 April 2019 to 13 March 2020.

Crawl for news events

Web Scraper

News titles of Business News, Market News, Bitcoin-related News for the period of 12 April 2019 to 13 March 2020.

Sentiment Scores

Perform Sentiment Analysis on collected news events to obtain their sentiment scores

Sentiment Analysis

Correlation Analysis

Correlation Coefficients

Perform Correlation Analysis to obtain correlation coefficients of bitcoin's price vs sentiment scores of news events

Time Series Plots

Perform Time Series Analysis to obtain time series plots of bitcoin's price vs sentiment scores of news events

Time Series Analysis

Tools & Data Sources



PyCharm

Python



RStudio

R



Microsoft Excel

Microsoft Office



CoinMarketCap

Bitcoin Price



Reuters

News Headlines

CoinMarketCap

Data Extraction

Date, Open, High, Low, Close,
Volume, Market Cap in United States
Dollar (USD)



| Date | Open | High | Low | Close | Volume | Market Cap |
|------------|---------|---------|---------|---------|----------------|----------------|
| 12/04/2019 | 5061.20 | 5103.27 | 4955.85 | 5089.54 | 13675206312.00 | 89792633045.00 |
| 13/04/2019 | 5088.85 | 5127.12 | 5061.59 | 5096.59 | 10823289598.00 | 89925574875.00 |
| 14/04/2019 | 5095.76 | 5184.02 | 5053.57 | 5167.72 | 10391952498.00 | 91188595341.00 |
| 15/04/2019 | 5167.32 | 5196.61 | 5024.07 | 5067.11 | 12290155061.00 | 89422237603.00 |
| 16/04/2019 | 5066.58 | 5238.95 | 5055.19 | 5235.56 | 11618660197.00 | 92404613297.00 |
| 17/04/2019 | 5236.14 | 5274.28 | 5219.21 | 5251.94 | 12438480677.00 | 92702617458.00 |
| 18/04/2019 | 5251.48 | 5319.99 | 5250.51 | 5298.39 | 13256489918.00 | 93532402741.00 |
| 19/04/2019 | 5298.15 | 5336.68 | 5233.34 | 5303.81 | 13780238655.00 | 93638345002.00 |
| 20/04/2019 | 5304.16 | 5358.49 | 5295.88 | 5337.89 | 13169647522.00 | 94248717444.00 |
| 21/04/2019 | 5335.88 | 5359.93 | 5257.34 | 5314.53 | 13731844223.00 | 93847052256.00 |

Data Exploration & Preparation

High data quality, no corrupted or
inaccurate records identified;
Formatted columns: Date
(DD/MM/YYYY), Open, High, Low, Close,
Volume, Market Cap (to 2 dp.)

Reuters

Financial Market Data

Most updated global news, covering
markets, business, politics,
entertainment, technology, etc.



| | |
|--|------------|
| Senate Democrats ask Fed's Powell about repo market ahead of hearing | 12/03/2020 |
| IMF approves \$20 mln loan tranche to Moldova | 12/03/2020 |
| US STOCKS-U.S. stock futures tumble as Trump's coronavirus response disappoints | 12/03/2020 |
| RPT-Surge in jobseekers to test Turkey's strained labour market | 12/03/2020 |
| CORRECTED-FOREX-Dollar slides as Trump's virus response disappoints | 12/03/2020 |
| PRESS DIGEST - Wall Street Journal - March 12 | 12/03/2020 |
| Virus volatility a shot in the arm for China's dormant derivatives market | 12/03/2020 |
| Mexico must minimize coronavirus economic drag, finance minister says | 12/03/2020 |
| GLOBAL MARKETS-Financial markets reel, stocks plunge as Trump stuns with Europe travel ban | 12/03/2020 |
| Greece reports first coronavirus death, 66 year old man | 12/03/2020 |
| Japan large manufacturers' mood sours to near 9-year low from coronavirus jolt | 12/03/2020 |
| Freed from impeachment drama, Trump to press ahead with re-election campaign | 12/03/2020 |
| Factbox: Trump impeachment - What happens next? | 12/03/2020 |
| Explainer: Why will Republicans vote to acquit Trump in his impeachment trial? | 12/03/2020 |
| Japan's record buying of foreign debt hints at pension fund support | 11/03/2020 |
| Japan shares dive deeper into bear market as Trump stuns with Europe travel ban | 11/03/2020 |
| Morning News Call - India, March 12 | 11/03/2020 |
| U.S. House Democrats unveil new coronavirus response bill | 11/03/2020 |
| BOJ Governor Kuroda to meet PM Abe - Jiji | 11/03/2020 |
| FOREX-Dollar slides after Trump bans travel from Europe to fight virus | 11/03/2020 |

Data Exploration

Data duplication was
observed but preserved.
Formatted columns: Date
(DD/MM/YYYY), Title

Sentiment Analysis

- Natural Language Processing (NLP)
- Identification, perception, categorization of tone and emotions
- Uncovering organic emotions behind textual data
- Identify sentiments
- Measure polarity
- Derive indicatives of associativity



Sentiment Analysis

VADER

- NLP Library - NLTK
- VADER - Pre-built lexicon
- Rule-based Sentiment Analysis Artificial Intelligence tool
- Measures polarity of textual data based on:
 - Tone
 - Extent of positivity & negativity
 - Magnitude of emotions



```
Producing bitcoin currency could void climate change efforts - scientists {'neg': 0.0, 'neu': 1.0, 'pos': 0.0, 'compound': 0.0} Neutral
Factbox: Ten years of bitcoin----- {'neg': 0.0, 'neu': 1.0, 'pos': 0.0, 'compound': 0.0} Neutral
Birthday blues for bitcoin as investors face year-on-year loss {'neg': 0.223, 'neu': 0.777, 'pos': 0.0, 'compound': -0.3182} Negative
Early bitcoin investors count winnings after volatile decade {'neg': 0.0, 'neu': 0.667, 'pos': 0.333, 'compound': 0.5423} Positive
UPDATE 1-Birthday blues for bitcoin as investors face year-on-year loss {'neg': 0.204, 'neu': 0.796, 'pos': 0.0, 'compound': -0.3182} Negative
Birthday blues for bitcoin as investors face year-on-year loss {'neg': 0.223, 'neu': 0.777, 'pos': 0.0, 'compound': -0.3182} Negative
RPT-Early bitcoin investors count winnings after volatile decade {'neg': 0.0, 'neu': 0.667, 'pos': 0.333, 'compound': 0.5423} Positive
Breakingviews - Bitcoin remains a triumph of hope over experience {'neg': 0.0, 'neu': 0.5, 'pos': 0.5, 'compound': 0.7184} Positive
New York regulator grants virtual license to bitcoin ATM operator {'neg': 0.0, 'neu': 0.826, 'pos': 0.174, 'compound': 0.2263} Neutral
```

Correlation Analysis

Correlation Coefficients

- Statistical method
- Strength of relationship between variables involved
- Correlation coefficient: between -1 and 1
- Strong correlation: highly dependent relationship
- Weak correlation: variables hardly related
- Analysis of:
 - Bitcoin's price vs Business News' sentiment score
 - Bitcoin's price vs Market News' sentiment score
 - Bitcoin's price vs Bitcoin News' sentiment score



| | Open | High | Low | Close | Volume | Market.Cap | Index |
|------------|-----------|-----------|-----------|-----------|------------|------------|------------|
| Open | 1.0000000 | 0.9861471 | 0.9847517 | 0.9619927 | 0.71083169 | 0.9635918 | 0.22640071 |
| High | 0.9861471 | 1.0000000 | 0.9847365 | 0.9861934 | 0.73321492 | 0.9870189 | 0.22052593 |
| Low | 0.9847517 | 0.9847365 | 1.0000000 | 0.9867188 | 0.66437117 | 0.9870303 | 0.24977097 |
| Close | 0.9619927 | 0.9861934 | 0.9867188 | 1.0000000 | 0.68653411 | 0.9996845 | 0.23846568 |
| Volume | 0.7108317 | 0.7332149 | 0.6643712 | 0.6865341 | 1.00000000 | 0.6946089 | 0.08388436 |
| Market.Cap | 0.9635918 | 0.9870189 | 0.9870303 | 0.9996845 | 0.69460889 | 1.0000000 | 0.23372691 |
| Index | 0.2264007 | 0.2205259 | 0.2497710 | 0.2384657 | 0.08388436 | 0.2337269 | 1.00000000 |

Time Series Analysis

Time Series Plots

- Series of data points indexed over a set time interval
- Candlestick chart
- Extent of price movement from past patterns
- 4 price points:
 - Open
 - High
 - Low
 - Close
- Colour coding:
 - Orange
 - Green
- Inter-variable correspondence over time
- Bitcoin's general pricing trends, direction of fluctuation



04

Results



Sentiment Scores

| Sentiment Score | Class |
|-------------------|----------|
| ▶ ≥ 0.5 | Positive |
| ▶ $\geq 0, < 0.5$ | Neutral |
| ▶ < 0 | Negative |

Sentiment Scores

Bitcoin, gas & smart power: ROMA Group plans energy expansion {'neg': 0.0, 'neu': 0.593, 'pos': 0.407, 'compound': 0.5859} Positive
REUTERS SUMMIT-Bitcoin, gas & smart power: ROMA Group plans energy expansion {'neg': 0.0, 'neu': 0.625, 'pos': 0.375, 'compound': 0.5859} Positive

Goldman Sachs to clear bitcoin futures –spokeswoman {'neg': 0.0, 'neu': 0.698, 'pos': 0.302, 'compound': 0.3818} Neutral
Cboe, CME to launch bitcoin futures contracts {'neg': 0.0, 'neu': 1.0, 'pos': 0.0, 'compound': 0.0} Neutral

Forget Bitcoin bubble – will Fevertree go pop? {'neg': 0.241, 'neu': 0.759, 'pos': 0.0, 'compound': -0.2263} Negative
Bitcoin warnings grow more strident as Singapore urges extreme caution {'neg': 0.196, 'neu': 0.804, 'pos': 0.0, 'compound': -0.296} Negative

Sentiment Scores

| Date | Sentiment Score |
|------------|-----------------|
| 27/12/2019 | 0.011 |
| 28/12/2019 | 0.076 |
| 29/12/2019 | -0.113 |
| 30/12/2019 | 0.012 |
| 31/12/2019 | -0.051 |
| 01/01/2020 | -0.016 |
| 02/01/2020 | -0.121 |
| 03/01/2020 | -0.059 |
| 04/01/2020 | -0.038 |
| 05/01/2020 | -0.022 |
| 06/01/2020 | 0.021 |
| 07/01/2020 | -0.061 |
| 08/01/2020 | -0.066 |
| 09/01/2020 | 0.035 |

Final Sentiment Score for the day

Summing up all individual sentiment scores of news titles collected in the day itself

Current Market Situation

- General feel of the situation of the world market at large: Optimistic / Pessimistic
- Sensing of public's overall inclination towards the current market situation

Sentiment Scores

18 April 2019

Correlating news events with sentiment score for the day

| Date | Score |
|------------|--------|
| 13/04/2019 | 0.062 |
| 14/04/2019 | -0.065 |
| 15/04/2019 | -0.056 |
| 16/04/2019 | 0.088 |
| 17/04/2019 | 0.077 |
| 18/04/2019 | 0.087 |
| 19/04/2019 | 0.079 |
| 20/04/2019 | 0.013 |

| | |
|---|------------|
| HNA denies embezzlement claims as it fights for control of Hong Kong Airlines | 18/04/2019 |
| Tesla's Elon Musk, SEC get another week to work out deal on Twitter use | 18/04/2019 |
| Exclusive: New York Fed cracks down on Puerto Rico banks following Venezuela sanctions | 18/04/2019 |
| National Enquirer to be sold to owner of magazine distributor | 18/04/2019 |
| Oil prices inch up on signs of tighter global supply | 18/04/2019 |
| Uber's self-driving unit valued at \$7.25 billion in new investment | 18/04/2019 |
| Earnings deluge could make or break sentiment | 18/04/2019 |
| U.S. wins WTO ruling against China grain import quotas | 18/04/2019 |
| Sears sues Lampert, claiming he looted assets and drove it into bankruptcy | 18/04/2019 |
| New North American trade deal modestly boosts U.S. economy, trade panel finds | 18/04/2019 |
| Air Canada pilots reviewing aircraft systems on Boeing's MAX jets | 18/04/2019 |
| Exclusive: Spain's Repsol suspended swap deal for Venezuelan oil under U.S. pressure | 18/04/2019 |
| Wall Street closes slightly higher, industrials lead | 18/04/2019 |
| Potential Fed nominee Cain says not withdrawing from consideration | 18/04/2019 |
| Pinterest, Zoom shares surge in market debuts after IPOs | 18/04/2019 |
| Risk of U.S. 'profit recession' eases as results beat forecasts | 18/04/2019 |
| Stocks mixed as strong U.S. retail sales offset weak European manufacturing data | 18/04/2019 |
| GM CEO Barra's pay dipped slightly to just under \$22 million in 2018 | 18/04/2019 |
| U.S. lawmakers to get long-awaited analysis of new NAFTA deal | 18/04/2019 |
| Automakers invest heavily in electric vehicles despite still-low demand | 18/04/2019 |
| ExorLuxottica shareholder body propose independent director to ease deadlock | 18/04/2019 |
| U.S. retail sales, labor market data paint upbeat economic picture | 18/04/2019 |
| U.S. trade agency sees 76,000 new auto jobs from North American trade deal | 18/04/2019 |
| Zoom starts trading at \$65 per share, 80 percent above IPO price | 18/04/2019 |
| German ministry wants to extend electric car subsidies: document | 18/04/2019 |
| Explainer: Betting on the past? Europe decides on connected car standards | 18/04/2019 |
| Exclusive: New U.S. consumer watchdog chief to continue review of complaints database, fair lending | 18/04/2019 |
| U.S. pilot program allows online grocery shopping with food stamps | 18/04/2019 |
| Google lets Android users in Europe choose rival browsers, search engines | 18/04/2019 |
| Hermes CEO steps down from L'Oréal board over competing make-up line | 18/04/2019 |
| Jet Airways shares plunge, rivals race to grab grounded carrier's slots | 18/04/2019 |
| India to temporarily allocate Jet Airways slots to rival carriers: official | 18/04/2019 |
| AmEx profit beats as rewards program boosts customer spending | 18/04/2019 |
| Who will succeed Carney to run Britain's central bank? | 18/04/2019 |
| Honeywell evaluating revenue potential from Boeing's next aircraft launch: CFO | 18/04/2019 |
| Honeywell expects Boeing 737 MAX deliveries to resume in the second half of 2019 | 18/04/2019 |
| McDonald's pulls Signature Crafted burgers, doubles down on Quarter Pounders | 18/04/2019 |
| Schlumberger posts profit drop, sees international spending rising | 18/04/2019 |
| Airbus sells longer-range A321, expects quick end to Boeing crisis | 18/04/2019 |
| France points way for UK shake up of audit market | 18/04/2019 |
| New Apple lab uses robots to rip apart devices for recycling materials | 18/04/2019 |
| Daimler to seek 6 billion euros in cost savings at Mercedes: Manager Magazin | 18/04/2019 |
| Abraaj founder's extradition case adjourned, another former executive arrested: court official | 18/04/2019 |
| U.S. retail sales post biggest gain in one-and-a-half years in March | 18/04/2019 |

Sentiment Scores

Consolidated table

Bitcoin OHLC prices +
sentiment scores for [Business News](#)

| Date | Open | High | Low | Close | Volume | Market Cap | Score |
|------------|---------|---------|---------|---------|----------------|-----------------|--------|
| 13/04/2019 | 5088.85 | 5127.12 | 5061.59 | 5096.59 | 10823289598.00 | 89925574875.00 | 0.062 |
| 14/04/2019 | 5095.76 | 5184.02 | 5053.57 | 5167.72 | 10391952498.00 | 91188595341.00 | -0.065 |
| 15/04/2019 | 5167.32 | 5196.61 | 5024.07 | 5067.11 | 12290155061.00 | 89422237603.00 | -0.056 |
| 16/04/2019 | 5066.58 | 5238.95 | 5055.19 | 5235.56 | 11618660197.00 | 92404613297.00 | 0.088 |
| 17/04/2019 | 5236.14 | 5274.28 | 5219.21 | 5251.94 | 12438480677.00 | 92702617458.00 | 0.077 |
| 18/04/2019 | 5251.48 | 5319.99 | 5250.51 | 5298.39 | 13256489918.00 | 93532402741.00 | 0.087 |
| 19/04/2019 | 5298.15 | 5336.68 | 5233.34 | 5303.81 | 13780238655.00 | 93638345002.00 | 0.079 |
| 20/04/2019 | 5304.16 | 5358.49 | 5295.88 | 5337.89 | 13169647522.00 | 94248717444.00 | 0.013 |
| 21/04/2019 | 5335.88 | 5359.93 | 5257.34 | 5314.53 | 13731844223.00 | 93847052256.00 | 0.209 |
| 22/04/2019 | 5312.49 | 5422.69 | 5280.28 | 5399.37 | 14601631648.00 | 95354207776.00 | 0.153 |
| 23/04/2019 | 5399.37 | 5633.80 | 5389.41 | 5572.36 | 15867308108.00 | 98417387004.00 | -0.028 |
| 24/04/2019 | 5571.51 | 5642.04 | 5418.26 | 5464.87 | 17048033399.00 | 96530038144.00 | 0.031 |
| 25/04/2019 | 5466.52 | 5542.24 | 5181.34 | 5210.52 | 15330283408.00 | 92046492864.00 | 0.095 |
| 26/04/2019 | 5210.30 | 5383.63 | 5177.37 | 5279.35 | 16812108040.00 | 93272287960.00 | -0.035 |
| 27/04/2019 | 5279.47 | 5310.75 | 5233.64 | 5268.29 | 13111274675.00 | 93086156556.00 | 0.043 |
| 28/04/2019 | 5271.75 | 5326.23 | 5255.68 | 5285.14 | 12819992056.00 | 93391244395.00 | -0.02 |
| 29/04/2019 | 5284.86 | 5311.27 | 5216.49 | 5247.35 | 13735490672.00 | 92737510865.00 | -0.022 |
| 30/04/2019 | 5247.73 | 5363.26 | 5224.19 | 5350.73 | 13878964574.00 | 94573826827.00 | 0.087 |
| 01/05/2019 | 5350.91 | 5418.00 | 5347.65 | 5402.70 | 13679528236.00 | 95501110091.00 | 0.102 |
| 02/05/2019 | 5402.42 | 5522.26 | 5394.22 | 5505.28 | 14644460907.00 | 97330112147.00 | 0.084 |
| 03/05/2019 | 5505.55 | 5865.88 | 5490.20 | 5768.29 | 18720780006.00 | 102000000000.00 | -0.067 |
| 04/05/2019 | 5769.20 | 5886.89 | 5645.47 | 5831.17 | 17567780766.00 | 103000000000.00 | 0.081 |
| 05/05/2019 | 5831.07 | 5833.86 | 5708.04 | 5795.71 | 14808830723.00 | 102000000000.00 | -0.036 |

Sentiment Scores

Consolidated table

Bitcoin OHLC prices +
sentiment scores for [Market News](#)

| Date | Open | High | Low | Close | Volume | Market Cap | Score |
|------------|---------|---------|---------|---------|----------------|-----------------|--------|
| 27/04/2019 | 5279.47 | 5310.75 | 5233.64 | 5268.29 | 13111274675.00 | 93086156556.00 | 0 |
| 28/04/2019 | 5271.75 | 5326.23 | 5255.68 | 5285.14 | 12819992056.00 | 93391244395.00 | 0.015 |
| 29/04/2019 | 5284.86 | 5311.27 | 5216.49 | 5247.35 | 13735490672.00 | 92737510865.00 | 0.296 |
| 30/04/2019 | 5247.73 | 5363.26 | 5224.19 | 5350.73 | 13878964574.00 | 94573826827.00 | 0.059 |
| 01/05/2019 | 5350.91 | 5418.00 | 5347.65 | 5402.70 | 13679528236.00 | 95501110091.00 | 0.033 |
| 02/05/2019 | 5402.42 | 5522.26 | 5394.22 | 5505.28 | 14644460907.00 | 97330112147.00 | 0.042 |
| 03/05/2019 | 5505.55 | 5865.88 | 5490.20 | 5768.29 | 18720780006.00 | 102000000000.00 | 0.044 |
| 04/05/2019 | 5769.20 | 5886.89 | 5645.47 | 5831.17 | 17567780766.00 | 103000000000.00 | 0.012 |
| 05/05/2019 | 5831.07 | 5833.86 | 5708.04 | 5795.71 | 14808830723.00 | 102000000000.00 | 0.031 |
| 06/05/2019 | 5791.69 | 5802.96 | 5653.69 | 5746.81 | 15737171804.00 | 102000000000.00 | -0.183 |
| 07/05/2019 | 5745.60 | 5988.18 | 5741.40 | 5829.50 | 18026409033.00 | 103000000000.00 | -0.093 |
| 08/05/2019 | 5849.48 | 5989.98 | 5794.72 | 5982.46 | 15320605300.00 | 106000000000.00 | -0.095 |
| 09/05/2019 | 5982.32 | 6183.04 | 5982.32 | 6174.53 | 16784645411.00 | 109000000000.00 | -0.082 |
| 10/05/2019 | 6175.82 | 6434.62 | 6161.52 | 6378.85 | 19419875368.00 | 113000000000.00 | -0.056 |
| 11/05/2019 | 6379.67 | 7333.00 | 6375.70 | 7204.77 | 28867562329.00 | 127000000000.00 | 0.005 |
| 12/05/2019 | 7203.51 | 7503.87 | 6815.77 | 6972.37 | 27773333680.00 | 123000000000.00 | 0.106 |
| 13/05/2019 | 6971.18 | 8047.41 | 6898.28 | 7814.92 | 28677672181.00 | 138000000000.00 | -0.254 |
| 14/05/2019 | 7807.88 | 8268.71 | 7696.39 | 7994.42 | 32031452227.00 | 142000000000.00 | -0.157 |
| 15/05/2019 | 7989.37 | 8216.42 | 7899.11 | 8205.17 | 28344112920.00 | 145000000000.00 | -0.062 |

Sentiment Scores

| | | | | | | | |
|------------|---------|---------|---------|---------|----------------|----------------|-------|
| 28/04/2019 | 5271.75 | 5326.23 | 5255.68 | 5285.14 | 12819992056.00 | 93391244395.00 | -0.02 |
| 28/04/2019 | 5271.75 | 5326.23 | 5255.68 | 5285.14 | 12819992056.00 | 93391244395.00 | 0.015 |

Correlation Coefficients

Correlation Coefficients for bitcoin OHLC prices vs Sentiment Score of Business News

| | Open | High | Low | Close | Volume | Market.Cap | Score |
|------------|------------|-------------|-------------|-------------|--------------|-------------|--------------|
| Open | 1.0000000 | 0.99012609 | 0.98550831 | 0.97511187 | 0.136135447 | 0.97491884 | -0.104372197 |
| High | 0.9901261 | 1.00000000 | 0.98109760 | 0.98742944 | 0.166244941 | 0.98568341 | -0.096445326 |
| Low | 0.9855083 | 0.98109760 | 1.00000000 | 0.98982875 | 0.092342554 | 0.99013704 | -0.100111449 |
| Close | 0.9751119 | 0.98742944 | 0.98982875 | 1.00000000 | 0.129223252 | 0.99865232 | -0.095551367 |
| Volume | 0.1361354 | 0.16624494 | 0.09234255 | 0.12922325 | 1.000000000 | 0.15757220 | -0.009739196 |
| Market.Cap | 0.9749188 | 0.98568341 | 0.99013704 | 0.99865232 | 0.157572197 | 1.00000000 | -0.096882327 |
| Score | -0.1043722 | -0.09644533 | -0.10011145 | -0.09555137 | -0.009739196 | -0.09688233 | 1.000000000 |



**No strong
correlation**

Correlation Coefficients

Correlation Coefficients for bitcoin OHLC prices vs Sentiment Score of Market News

| | Open | High | Low | Close | Volume | Market.Cap | Score |
|------------|-------------|------------|--------------|-------------|--------------|-------------|-------------|
| Open | 1.00000000 | 0.9856928 | 0.978779984 | 0.96631666 | 0.064222233 | 0.96611979 | -0.13172967 |
| High | 0.98569281 | 1.00000000 | 0.971928414 | 0.98252385 | 0.103943574 | 0.98007218 | -0.14408341 |
| Low | 0.97877998 | 0.9719284 | 1.000000000 | 0.98661380 | 0.009072967 | 0.98723232 | -0.13438306 |
| Close | 0.96631666 | 0.9825238 | 0.986613801 | 1.00000000 | 0.056404034 | 0.99837736 | -0.14289288 |
| Volume | 0.06422223 | 0.1039436 | 0.009072967 | 0.05640403 | 1.000000000 | 0.08607087 | -0.06912479 |
| Market.Cap | 0.96611979 | 0.9800722 | 0.987232315 | 0.99837736 | 0.086070867 | 1.00000000 | -0.14073232 |
| Score | -0.13172967 | -0.1440834 | -0.134383061 | -0.14289288 | -0.069124785 | -0.14073232 | 1.00000000 |



No strong correlation

Correlation Coefficients

13 March 2020

| | |
|---|------------|
| Factbox: Latest on the spread of coronavirus around the world | 13/03/2020 |
| North Korea had military forces on lockdown for 30 days over coronavirus - U.S. general | 13/03/2020 |
| Bulgaria bans travel to Iran, raises risk on travels to 11 countries | 13/03/2020 |
| Fed's economic forecasts to give window into extent of coronavirus fears | 13/03/2020 |
| Why Brazilian airline shares are hardest hit by the coronavirus panic | 13/03/2020 |
| Airline SAS to cut, suspend U.S. flights | 13/03/2020 |
| North Macedonia bars foreigners arriving from 'high-risk countries' over coronavirus | 13/03/2020 |
| UK's Johnson to talk to world leaders on coronavirus response: spokesman | 13/03/2020 |
| Iraq puts Germany and Qatar on coronavirus entry ban list | 13/03/2020 |
| Ethiopia confirms its first case of coronavirus | 13/03/2020 |
| What you need to know about coronavirus today | 13/03/2020 |
| Czech government bans most travel in and out of country to fight coronavirus | 13/03/2020 |
| South Korea reports more recoveries than coronavirus cases for the first time | 13/03/2020 |
| Zhang Yiming, founder of TikTok owner ByteDance, gears up for the global stage | 13/03/2020 |
| U.S. companies draw on credit lines, fearing they may lose them | 13/03/2020 |
| After miracle recovery, Fukushima brewers look to the Games to push sake globally | 13/03/2020 |
| Buffett-backed Chinese EV maker BYD says making 5 million masks daily to fight virus | 13/03/2020 |
| Canada's Trudeau to be in isolation after wife tests positive for coronavirus | 13/03/2020 |
| Starbucks to invest \$130 million for roasting plant in China's Kunshan | 13/03/2020 |
| Hong Kong records fourth coronavirus-related death - hospital spokeswoman | 13/03/2020 |
| Singapore to bar recent visitors to Italy, Spain, Germany, France | 13/03/2020 |
| Bob Dylan concerts in Japan canceled as coronavirus spreads | 13/03/2020 |

Business News
events happening
on 13 March 2020

USD 7913.62
(12 March) →
USD 5017.83
(13 March)

↓36%

Correlation Coefficients

12 March 2020

| | |
|--|------------|
| U.S. excludes some Chinese medical products from tariffs | 12/03/2020 |
| Juul co-founder James Monsees plans to leave | 12/03/2020 |
| Washington state repeals pro-Boeing tax break; U.S. hopes to avoid EU tariffs | 12/03/2020 |
| Airbus: End of Washington state tax break of Boeing just 'initial step' | 12/03/2020 |
| Global airlines call for government aid and United warns of cuts to U.S. routes | 12/03/2020 |
| U.S. airlines capping fares from Europe as Americans seek flights home | 12/03/2020 |
| Ford takes aim at Jeep with new Bronco SUVs | 12/03/2020 |
| Canada revising deal aimed at validating U.S.-certified planes | 12/03/2020 |
| Wall Street dazed and confused after worst day since 1987 | 12/03/2020 |
| Wall Street sell-off batters bitcoin, pounds palladium as investors go to cash | 12/03/2020 |
| Walgreens, Kroger limit purchase of some essential products amid virus outbreak | 12/03/2020 |
| Gap sees 2020 profit above estimates, flags \$100 mln virus hit to sales | 12/03/2020 |
| Business jet operators see demand surge on U.S. travel restrictions, coronavirus | 12/03/2020 |
| Broadcom withdraws 2020 revenue forecast on coronavirus worries | 12/03/2020 |
| Plunging Wall Street stocks end record bull run | 12/03/2020 |
| Wall Street's 'fear gauge' marks record surge after stock sell-off | 12/03/2020 |
| Oracle's cloud push powers quarterly profit, revenue beat | 12/03/2020 |
| Slack shares slump on soft outlook, slower growth | 12/03/2020 |
| Amazon tells staff globally to work from home if possible | 12/03/2020 |
| AT&T waives data overage fees for home subscribers; Comcast boosts speeds for some users | 12/03/2020 |
| Banks remind customers they can bank online amid coronavirus outbreak | 12/03/2020 |
| Wall Street empties out as New York City declares state of emergency | 12/03/2020 |
| Panic grips financial markets after U.S. travel curbs, ECB move | 12/03/2020 |
| As Trump's stock market gains shrink, he says it will 'work out fine' | 12/03/2020 |
| United to scale back flights to Europe after March 19 | 12/03/2020 |
| Boeing shares plummet as travel restrictions hit airlines | 12/03/2020 |
| JetBlue CEO latest airline executive to take salary cut amid coronavirus | 12/03/2020 |
| Trump signs law to prevent U.S. rural telecom carriers from using Huawei network equipment | 12/03/2020 |
| Airbnb bookings take hit amid global coronavirus outbreak | 12/03/2020 |
| Oil falls 7% after Trump surprises with travel curbs | 12/03/2020 |
| Rio Tinto to pay ex-CEO's deferred bonus with interest | 12/03/2020 |
| Explainer: Fed may go into its crisis tool kit soon. What's in it? | 12/03/2020 |
| Verizon raises 2020 capital expenditure in 5G push | 12/03/2020 |

Business News
events happening
on 12 March 2020

USD 7913.62
(12 March) →
USD 5017.83
(13 March)

↓36%

Correlation Coefficients

12 March 2020

| | |
|--|---------|
| Wall Street sell-off batters bitcoin, pounds palladium as investors go to cash | 12/3/20 |
| UPDATE 2-Bitcoin plummets as cryptocurrencies suffer in market turmoil | 12/3/20 |
| Bitcoin slumps as global market turmoil infects cryptocurrencies | 12/3/20 |



**Bitcoin-related
News events
happening on 12
March 2020**

Time Series Plots

Visualizations of BTC OHLC Price

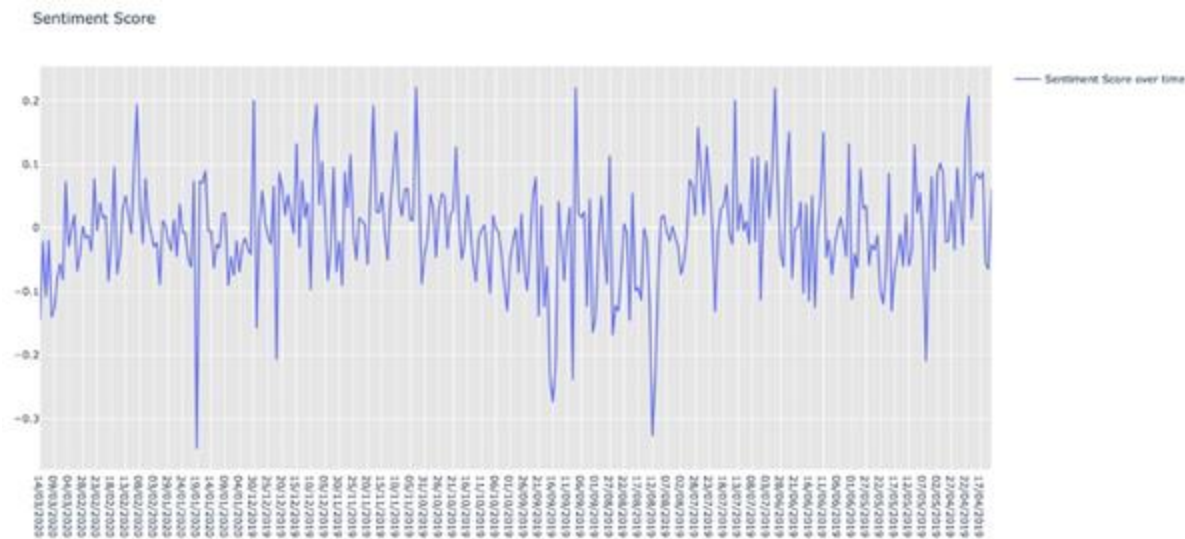


Candlestick Chart

Pricing trends

Time Series Plots

Visualizations of Sentiment Scores



Business News

Time Series Plots

Visualizations of Sentiment Scores



Market News

Time Series Plots

Visualizations of BTC OHLC Price vs Sentiment Scores



**BTC OHLC Price
vs Sentiment
Scores for
Business News**



**BTC OHLC Price
vs Sentiment
Scores for Market
News**

05

Conclusion



Problem Statement

- Correlation between news events and bitcoin prices
- Specific type of news event that directly influences bitcoin prices

Wrapping up

- General market situation
- General market outlook
- Optimistic / Pessimistic
- Different types of news events - different extents, varying contexts
- Extent of impact depends on:
 - Business, Market, Bitcoin-related news
 - Highly related to bitcoin
 - Indicated "uncertainty" in market situations
 - Specific news events (regulatory, concerning general market situation)
- Trickle down to impact bitcoin's price

Resources

PHOTOS

- ◀ <https://www.cryptonews.com/after-twiters-success-the-platforms/>
- ◀ <https://twitter.com/thetieio/status/1107671178423033858>
- ◀ <https://bitcoin.org/en/>
- ◀ <https://towardsdatascience.com/sentiment-analysis-for-text-with-deep-learning-2f0a0c6472b5>
- ◀ <https://www.wsj.com/articles/hong-kong-brokers-make-final-stand-against-trading-floors-demise-1503921255>
- ◀ <https://en.wikipedia.org/wiki/PyCharm>
- ◀ <https://rstudio.com/about/pbc-report/>
- ◀ https://en.wikipedia.org/wiki/Microsoft_Excel
- ◀ <https://coinmarketcap.com/>
- ◀ <https://seeklogo.net/reuters-logo-91222.html>
- ◀ <http://logok.org/reuters-logo/>
- ◀ <https://www.kdnuggets.com/2019/10/sentiment-emotion-analysis-beginners-types-challenges.html>
- ◀ <https://www.lucidchart.com/blog/5-why-analysis>

Thank you

