Multidimensional Visualization of the Development of Selected Indicators of Joint-Stock Companies

Jan Chodora[a]

[a]*Department of Computer Science and Engineering, Faculty of Applied Sciences, University of West Bohemia, Plzeň, Czech Republic*

Abstract

This article focuses on visualizing multidimensional financial data of joint-stock companies using technical analysis. It also discusses the fundamental analysis, which was the original objective but remained unachieved. The technical analysis involves the main multidimensional visualization, where price-depicting indicators are displayed alongside other indicators, such as RSI or volume. This article highlights the utilization of open-source tools, interactivity, and careful color selection. The resulting visualization tool is designed for effectively exploring trading history.

Keywords: colorblind-friendly, indicators of technical analysis, interactive, multidimensional, open-source, trading, visualization

1. Introduction

Visualizing financial data of joint-stock companies can be divided into several analytical approaches, this article focuses on two of them, fundamental analysis and technical analysis.

Fundamental analysis is based on on company or individual filings, which companies are obligated to send to the corresponding institute. In U.S., this institute is the U.S. Securities and Exchange Commission. This institute also makes these reports transparent by providing them for public browsing via an Electronic Data Gathering, Analysis, and Retrieval (EDGAR) system. Besides these data, fundamental analysis involves financial indicators such as P/E ratio, P/B, P/CF, ROE and others.

Another approach is technical analysis, which involves charts of stock volume and price development upon which technical indicators build up, such as SMA, EMA, RSI and so on. This gives space for pattern recognition and future price estimation.

2. Related Work

Authors from Investopedia [1] recommended some indicators of technical analysis such as OBV, A/D line, ADX, Aroon oscilator, MACD, RSI, and Stochastic oscilator. They also pointed out the use of metrics such as trading volume which according to them, provide clues as to whether a price move will continue.

Uncle Stock [2] is a commercial comprehensive stock screening tool which contains multidimensional visualization of indicators of technical analysis as well as visualizations of indicators of fundamental analysis and much more, like news overview for sentiment analysis.

Screener [3] is a commercial stock analysis and screening tool focused on companies located in India. It provides fundamental charts, along with price related charts, information of quarterly results and much more, presented in a form of tables and visualizations.

Screeni-py [4] is an open-source screener for data companies traded on National Stock Exchange of India. It consists of technical analysis-based visualizations, and it additionally includes AI-based predictions.

3. Methods

3.1. Review of Methods for Accessing EDGAR Database

The original goal of this project was to obtain data from the EDGAR database and create visualizations of financial indicators. Unfortunately, there were obstacles with automatic obtaining of data, so despite the effort, it was not achieved.

It might be relevant to document the approach attempted for the benefit of those who encounter try to solve this problem in the future.

Email address: chodoraj@students.zcu.cz (Jan Chodora)

First attempt was to use open-source solutions, such as the project OpenEDGAR [5], but this project seems to be no longer developed nor maintained, and thus it was assumed to be no longer functional.

Another promising approach was using the EDGAR Crawler project [6], even though this project is working and open-source, it does not provide structured information that could be easily processed automatically. It aims for creating a corpus that could be used in NLP, thus certainly usable but not visualization purposes.

There are also commercial solutions, such as wrappers like SEC API [7], that indeed retrieves relevant information, but is not open-source and limits the number of requests to insufficient number.

In this project, an attempt was made to access an API [8] which is directly a part of the EDGAR database, but without success in retrieving the information relevant for calculating financial indicators, this does not imply it can not be done.

3.2. Technical analysis

Technical analysis was part of the original goal, but rather as a supportive visualization. After failure with the original goal, it became the primary goal.

Data used was obtained from Yahoo Finance via an unofficial open-source tool, yfinance. Based on the data obtained, indicators of technical analysis were calculated.

All visualizations were made using Plotly Dash [9], which is an open source framework. The results were generated as JavaScript and saved into HTML files. The visualization consists of three interactive visualizations, which are interconnected via shared x-axis. It also allows user interactions, including zooming, turning on and off any of its components, and hovering over the visualization to display values for all of the components as tool tips. The visualization also allows saving as SVG. All color palettes are distinguishable by luminance, thus readable in gray scale. This might hopefully help readers whose color vision is impaired as well as for those who just want to view it in gray-scale.[1]

The first visualization contains price-related indicators such as the simple moving average, the exponential moving average, both represented by line charts, and the price itself represented by a candlestick graph. By default, the corresponding y-axes starts from zero.

The second visualization contains the relative strength index indicator, visualized by a line chart. This requires its own visualization since it projects price into a range from 0 to 100.

The third visualization depicts the volume of the stocks traded, visualized as a bar chart. Since the number of bars in the chart might make the orientation harder, it is enhanced by coloring[2] the bars based on their sizes.

4. Results

Figure 1 depicts the visualization of a period from November 25, 2019, to November 24, 2020. In January 2020, news about the SARS-CoV2 spread out.

From the visualization, it is noticeable that during March 2020, the price of the whole S&P 500 index suddenly dropped, hitting its lowest value March 25, 2020.

As the index started to fall, the RSI indicated that the market is oversold, with the lowest value on March 3, 2020, indicating that market might experience rise soon.

The volume[3] shows a period of high trading of trades starting around February 24, 2020, trough the whole March, 2020, and gradually calming over the next three months.

5. Discussion

It might be pleasant if the color spectrum for the volume visualization could be displayed as the corresponding y-axis marker. Instead it was not displayed at all, possibly making the whole visualization harder to interpret.

Another functionality which was not achieved was time wheel. While it could have been implemented, it was not possible to create a time wheel which would contain specific traces only, the default one contains all which is not only unreadable but also slows down the overall interactivity.

Similarly as in the previous case, it is not possible to zoom out from just a single subplot.

6. Future Work

As mentioned in the subsection 3.1, the original goal was not achieved and is thus left for future work, hinting that the optimal way might lay in direct access of the EDGAR API.

[1] Surprisingly, none of the solutions encountered displayed the color inherently distinguishable by luminance, especially the candlesticks graphs.

[2] The color spectrum was selected as light for low values to dark for high values.

[3] Unfortunately, the volume might not be much visible in this format due to the high number of bars and the fact that the picture was exported as vector graphics.

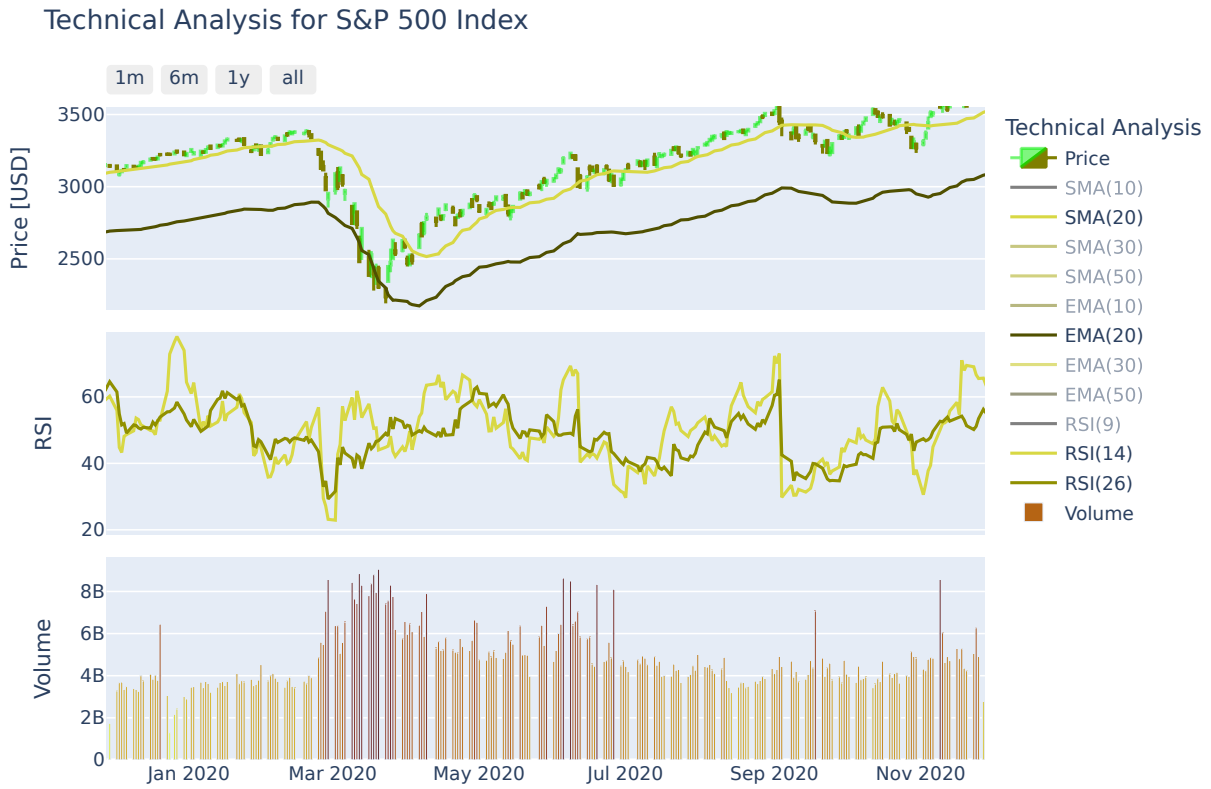

Figure 1: Visualization of the technical analysis for the S&P 500 index, it consists of three subplots, each of them with its own y-axis, price, RSI and volume, all with the shared time line displayed as x-axis.

Several indicators related to the candlestick graph, such those mentioned in section 1, might be implemented to improve the visualization.

Indicators that require their own y-axes might also be added, but it is arguable whether too many of them would not make the whole visualization harder to overwhelming.

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