Interactive Data Visualization Techniques – Online Stock Trading

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Interactive Data Visualization COMP8054

The alliance of stock trading and online software services is a relationship which first came to light in the mid 1980's. Companies preceding the dotcom bubble realized the potential of amalgamating the sale of stocks with the emerging technology that was the internet. With the first online trading platform 'E*Trade' going public in 1992 [1], the next 30 years saw newer and more sophisticated trading platforms began to appear online as public ownership of stocks began skyrocketing. These platforms have improved in conjunction with advancements in technology, in particular the data visualization techniques used with the platforms. While the alteration of the stock market into an online service is a modern phenomenon, the data visualization techniques used in the technical analysis of stock performance online are based on the same principles which have been used for hundreds of years. History is the one constant which can provide meaningful data on how a stock will progress in the future, and a traders' success within a market is reliant on the clear and concise visualization of this data. Therefore, technical analysis has always involved providing forecasts or trading advice based on largely visual inspection of past prices, without regard to any underlying economic or 'fundamental' analysis [2]. However, today's technologies have added another dimension to the technical analysis of stock trading, through the addition of interactive and live graphs.

Variants of the line chart have been used consistently in the domain of stock trading in order to provide such visualization, due to its ability to show data points and patterns over time in a manner which refrains from creating too much noise on the chart. As seen in figure 1 taken from the trading platform 'Trading 212', the line chart plots a point on the y-axis for the current market price, for each time interval on the x-axis. This is a representation of a stock market in its most basic form, showing the current trend of a given stock.

Figure 1

While line charts provide traders with a clutter-free representation of a stocks' performance over time, their simplicity has a direct correlation with the need for more substantial visualizations. However, their importance cannot be undermined. British mathematician Norman L. Biggs famously quoted "The origins of graph theory are humble, even frivolous" [3]. Aside from providing swift information on a stock markets current state, line charts provide the core design for the more data rich visualizations used in stock trading.

Bar charts are another commonly utilized visualization technique used by traders, based on the structure of the line chart but with additional information as seen in figure 2. Each time interval on the x-axis contains a bar, and each bar contains four pieces of information regarding the price of the market during that time. This includes the high, low, opening and closing price for a given time. If a bars' close is higher than its open, the bar is coloured in green and is known as a bearish bar. The opposite way around will result in a bar being coloured red, known as a bullish bar. This use of colour in the visualization entwines with human colour psychology where green is desirable, and red is the contrary [4].

Figure 2

These values are highly beneficial to traders when analysing the correlation between a stocks' fluctuation and the time period in which it occurs. For example, a trader may be able to conclude that a stock consistently closes on a higher price than it opens on a certain day of the week. In comparison to the line chart, the bar chart appears to be the superior visualization, as it showcases the said information as well as the current trend of the stock over time. Yet, it falls short on providing clear visualization of this extra data. Currently, trading platforms provide dynamic, interactive data on the x and y co-ordinates of users' mouse when it is hovered over a point on the graph. But there is no option for constant visualization of the exact figures for the high, low, opening and closing price for each bar, or even the current stock price each bar is representing.

The Japanese candlestick chart is regarded by most traders as the preferred method of visualization, as seen in figure 3. First coined in the 1800's by a Japanese rice farmer called Homma Munehisa [5], it is very similar to the previously mentioned bar chart. The difference lies in its use of 'candles' instead of bars. These candles use vertically placed rectangles, where the top of the rectangle is the closing price, and the bottom is the opening price. A line

out of each end represents the high and low prices of the time period that candle represents. The colour pattern followed is identical to that of the bar chart.

Figure 3

Japanese candlestick charts improve on the level of visualization bar charts provide due to the overall size of each data point. Despite representing the same information, Japanese candlesticks offer a clearer visualization, giving the viewer a more focused comparison between the opening and closing price within a given timeframe. The extra colour in each data point also gives the visualization more vibrancy allowing for easier interpretation of the chart. Despite this, the Japanese candlestick chart is lacking the same feature as the bar chart on current trading platforms, as there is no constant visualization of the exact figures for each candlestick.

Therefore, the addition of an interactive data visualization feature to display such information on a Japanese candlestick chart would be highly beneficial. The author of this paper proposes using pop-up tooltips containing the contextual information, as can be seen in figure 4. In terms of coding, this can be achieved using a mixture of the mouseover function and click listener event on the candlestick div. If the visualization technique is toggled on, a mouseover function is called when each candlestick is hovered over by the cursor, causing it to highlight and expand size. When the candlestick is clicked, the click listener is invoked, and a custom tooltip will appear. The data is passed into the tooltip from the candlestick and displayed inside the tooltip. This tooltip displays the data symbolised by each candlestick in a static, text format. In order to terminate the visualization of the tooltip, the highlighted candlestick can be clicked again, and the visualization will disappear.

The caveat with the addition of this visualization techniques is that there will be a large quantity of noise added to an already busy chart. The highlighting of candlesticks as a mouse cursor hovers over them also may result in the view of neighbouring candlesticks being obstructed. It is recommended that the use of this visualization technique can be toggled on and off, to prevent disturbance of a trader's analysis of the chart when that view is improvident to their current needs.

Figure 4

It is comprehensible from the analysis of the different charts used in stock trading that an equilibrium between being informational and coherent is sought after. The use of multiple variants of 2-D charts allows the trader to view the current state of the market from a variety of angles, depleting the chance of misinterpretation due to information overload. This is of utmost importance in a field such as stock trading, where a trivial mistake can result in the loss of substantial amounts of capital [6]. It can be concluded that the goal of charts such as Japanese candlesticks is to provide an interface as clutter free as possible, resorting to providing data using symbolic visualization as opposed to just in a numerical and textual format. It is true that the proposed visualization technique in theory adds a necessary perspective to the chart, despite its caveat. However, in practice it may result in a loss of the equilibrium which makes Japanese candlestick charts the common traders' preferred choice to begin with.

Google Drive Link - https://drive.google.com/file/d/1qBucir2nWrAeL9Db_D_3bNTL4wzGpQc8/view?usp=sharing

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