

Financial Technical Indicators Interactive Learning Tool

Final Report – Group 6 – DataVengers2020

1. Introduction – Motivation

Stock market analysis involves the use of charts and statistics to predict price movements and patterns for the financial markets ^[1]. Most commercial stock charting software (E.g. [TradeStation](#)®) are geared towards the professional technical analyst and are too complex and expensive for a novice investor. These tools assume the user understands the various technical indicators and can apply them in devising a trading strategy ^[2].

2. Problem definition

The project seeks to create an interactive tool that will display real time visualizations based on technical indicators, enabling the users to learn and simulate investment strategies. It will allow the users to indicate trading rules based on triggers for each one of the 5 financial technical indicators in scope: SMA, EMA, BB, RSI and CCI (See [Appendix A](#) for descriptions). Using these rules, users can run a simulation, which will show performance and predict trading strategies for a financial portfolio based on a machine learning based simulation engine.

3. Proposed method

3.1 Intuition/Innovation

The goal is to develop an interactive and intuitive learning tool incorporating best data visualization and machine learning techniques that will provide a delightful user experience. The approach is based on the following principles:

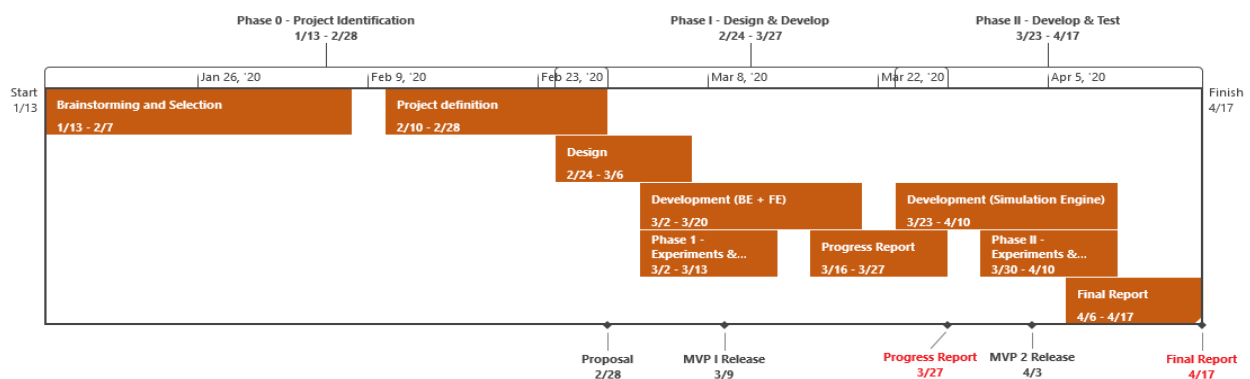
Simplicity and Relevance: We are building a visual tool with simple and streamlined parameters for quick understanding. These parameters are applied to a set of the most commonly used financial technical indicators ^[3].

Immediate feedback^[4]: A user will be able to see in real time the result of its parameters choices and its impact on a simulated stock market transaction.

Expandable: The tool is being developed taking into consideration its potential to add more financial technical indicators.

3.2 Approach

3.2.1. Plan of activities (see [Appendix C](#) for full schedule)



3.2.2. User interface

Designing an optimal experience for the users of the tool required taking into consideration a myriad of best practices and principles that have guided our development effort from the start. Below is a summary of the main ones:

Mapping Design Flow ^[5]: Before we got down to the details of user interface (UI) design, we created a high-level flow of the navigation and established a skeleton of how we expected the data to be presented and the main functional aspects of the User Interface experience.

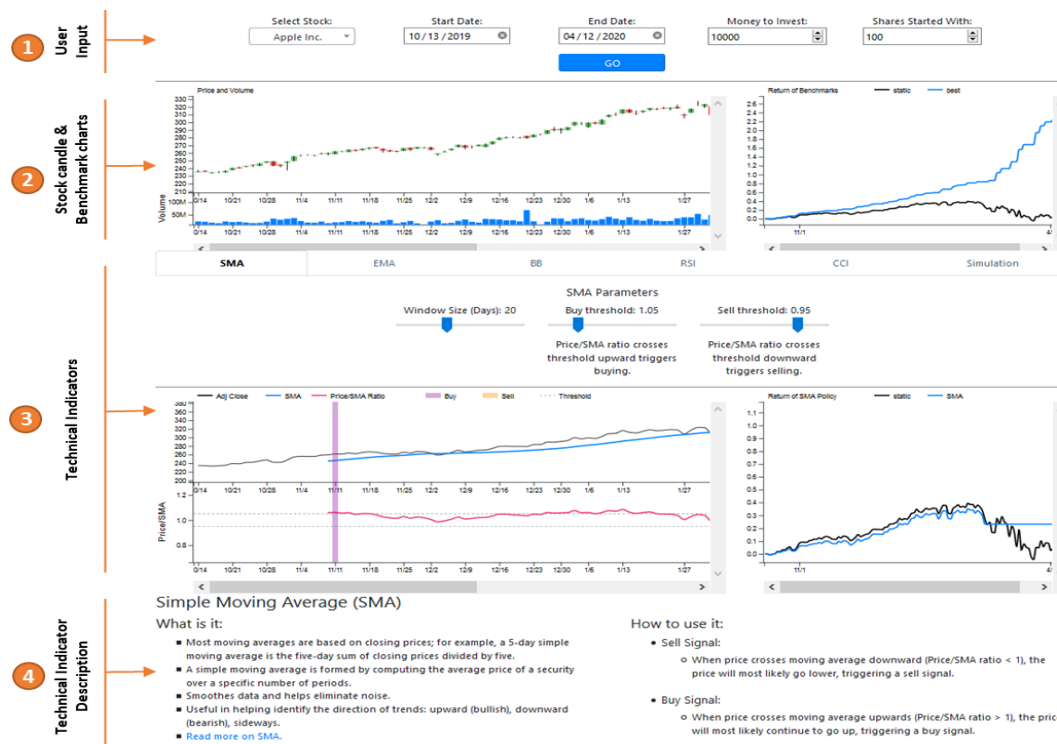
User Stories: User stories are a useful way of establishing a high-level view of different users' 'jobs to be done.' ^[6]. We created them from the perspective of typical users, to help us to establish the different goals our users might have.

Interactivity: Our tool is designed as a web application. We will be using D3 and Java Script for interactive data visualizations and the display of the dynamic data inherent to the nature of the stock market.

Decision Making Oriented: An important aspect of the user experience we are creating is supported by the Hick's Law ^[7] which stresses the need to minimize choices to ease cognitive burden and help drive decision making, which is a goal for our target audience.

Visually Appealing: We strived toward achieving a UI experience that is highly functional and visually appealing, taking into considerations aspects learned in class such as picking the correct color scale for colorblind users.

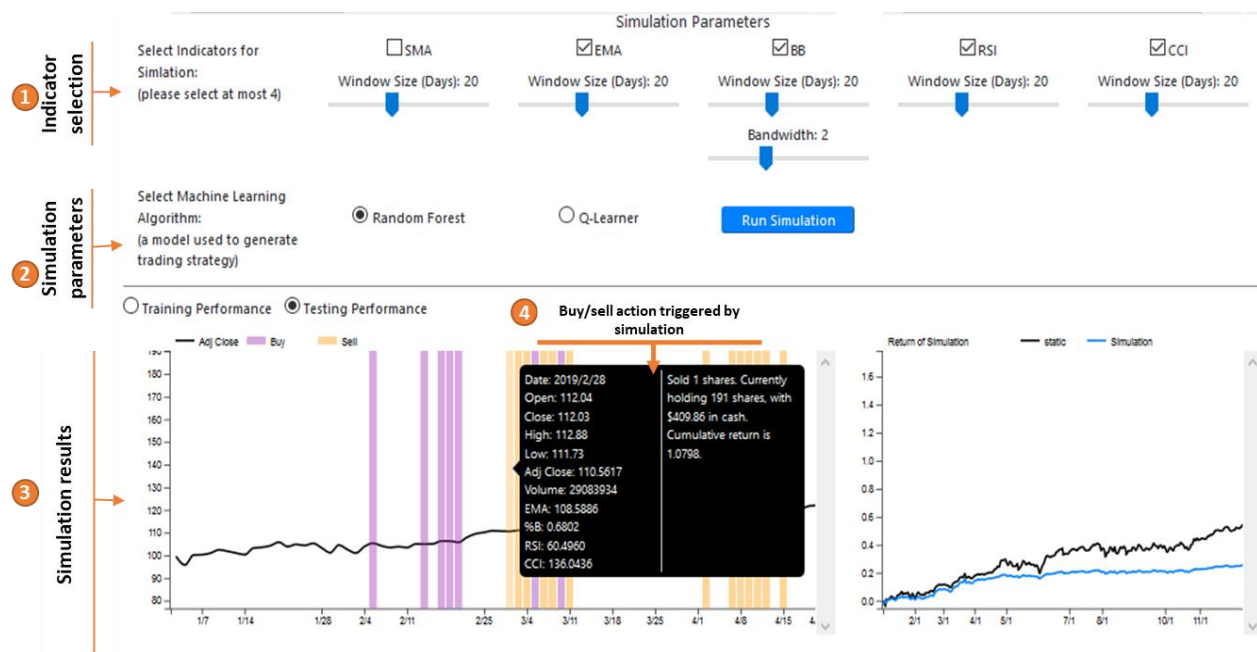
3.2.3. Technical Indicators - User interface



1. **User input** – User selects the stock, start and end date, amount to invest and number of shares.

2. **Stock charts** – The candle chart and benchmark chart for the selected stock and date range is displayed.
3. **Technical indicators** - Users select the appropriate indicator and adjust the parameters. Buy and Sell actions are triggered in real time so the user receives immediate feedback on the outcome of the parameters' selection. The returns chart displays the result that the parameters selection will have on investment strategy and how it compares to a static strategy (hold the stock and never sell).
4. **Technical indicator description** - A brief description of the selected indicator is provided, with links to more detailed descriptions.

3.2.4. Simulation – User interface



1. **Indicator Selection** – Users can select a maximum of 4 indicators to run the simulation due to constraints from our data provider Alpha Vantage API.
2. **Simulation Parameters** – The simulation start and end dates are populated by default and the Random Forest simulation algorithm is selected. *NOTE: When running the application locally, user can vary the length of training duration from 6 to 36 months; when using the application on [Heroku](#), training duration is fixed to 9-months of data for computation efficiency.* User can select to either train or test data to run the simulation against
3. **Simulation Results** – The tool then shows the buy and sell actions simulated for the selected stock as well as the simulated rate of return
4. **Buy/Sell/Hold results** – Users can hover over each buy/sell/hold bar to view details pertaining to that order

3.2.5. Simulation Engine (Algorithm)

The simulation engine leverages best data visualization practices and machine learning techniques to allow users to gain a better understanding of financial indicators and market trade. The simulation engine consists of the following modules: Data Collection, Generating Labels (Classes), Training & Testing and Generating Simulation Results.

Data collection consists of accessing stock price data using the [Alphavantage API](#). The **Stock Time Series** suite of API provides real-time and historical global equity data in four different temporal resolutions: (1) daily, (2) weekly, (3) monthly, and (4) intraday. Daily, weekly, and monthly time series contain 20+ years of historical data. The dataset will be generated using the indicators as the features along with stock market data (high, low, adj. close, and volume) and multi-class labels consisting of BUY, SELL, and HOLD

Generating class labels will be done by analyzing the adjusted closing price value at day $t+1$ and compared to the high and low values at day t . The three class labels will be generated using the following rules [8]:

$$\begin{aligned} \text{BUY}_t &= \text{if } C_{t+1} > H_t \text{ and } L_{t+1} > L_t \\ \text{SELL}_t &= \text{if } C_{t+1} < L_t \text{ and } H_{t+1} < H_t \\ \text{HOLD}_t &= \text{otherwise} \end{aligned}$$

The Training and Testing phase will perform the actual simulation and generate buy, sell, hold orders for the stock for training and test periods. These orders will then be applied to the stock in a market simulation to generate a portfolio value and statistics. The portfolio value and statistics along with the orders will be shown to the user allowing them to see how the strategy performed. Two distinct learning algorithms are provided to generate the buy sell orders and compare their performance.

- **Random Forest Classifier:** Supervised Learning Algorithm that will use the dataset described above to generate the market orders [9].
- **Q-learner:** Reinforcement algorithm that will be implemented using these [guidelines](#) [10]. The Q-learner's Q-table will consist of $Q(s, a)$ where states (s) are rows and actions (a) (buy, sell, hold) are the columns. Each state is based on all the financial technical indicator values discretized into a concrete state. The Q-learning agent will take actions landing in new states and receiving a reward. The goal is to maximize long-term reward. Reward is calculated based on current stock holdings and the stock price ratio from prior trading day and current trading day. See [Appendix B](#) for a flow chart.

4. Experiments/ Evaluation

4.1 Testing strategy

The primary goals for this tool were – (1) provide a simple, intuitive tool to learn about technical indicators (2) provide a simulation tool for these indicators. Our testing efforts were focused on ensuring these goals were met.

4.1.1. Simulation algorithm evaluation

Both simulations algorithms were run against different portfolios, performance data collected was then used to compare the two simulation algorithms. The comparison performance data collected answered the following questions

- How long does each algorithm take to complete and display results?
- How well does each algorithm generate buy, sell and hold orders and the impact those orders have on the final portfolio/statistics?
- How does each algorithm perform on stocks from different sectors?

4.1.2. User interface evaluation

Novice and experienced investors were recruited to use the tool and provide feedback via a Google [survey](#). Users were also asked to compare this tool with two other tools

([StockCharts.com](#) and [TradingView.com](#)). NOTE: all questions were ranked from 1 (excellent) through 5 (poor). Survey questions were as follows.

- Participant profile (Age, gender, occupation, familiarity with technical indicators)
- How well were you able to understand and use each financial indicator?
- How does the tool compare with TradingView and Stock Chart?
- How intuitive and easy to use was the tool?
- Was the user able to understand and use the simulation feature?

- **Testing phases.**

- **Phase I:** MVP Release and Evaluation of the tool's main features, including how to work with the parameters associated to the financial technical indicators, by a sample of target users (see [Appendix D](#) for participant profiles).
- **Phase II:** Re-evaluation of the full tool by the same set of users. The focus of the evaluation was the improvements to the tool and the simulation engine.

4.2 Test results

4.2.1. Simulation algorithm evaluation

Assuming an initial investment of \$10,000/stock, an automated script executed both simulation algorithms for several portfolios. Training data comprised of stock information from Jan 1, 2015 through Dec 31, 2018, and test data consisted of stock information from Jan 1, 2019 through Dec 31, 2019. The below tables show the results for one such portfolio.

After removing the two outliers (ALT, RLMD), it appears that the Random Forest algorithm performed better than Q-learner on the test data (higher return). When compared with static returns, both algorithms did not perform well, which indicates over-fitting of our learning models to training data. Run time performance testing showed that Random Forest was much faster than Q-Learner (RF average time = 12.5 secs, Q-Learner average time = 58 secs). (See [Appendix D](#) for full test results).

Q-LEARNER						
Ticker	TRAINING			TEST		
	Simulated Return	Static Return	Difference	Simulated Return	Static Return	Difference
ADBE	220%	213%	7%	17%	47%	-29%
ALT	1138%	-85%	1223%	0%	-27%	27%
BABA	44%	32%	11%	35%	55%	-20%
DELL	10%	16%	-6%	-7%	9%	-16%
FB	68%	67%	1%	37%	51%	-15%
GILD	-29%	-28%	-1%	3%	6%	-3%
HZNPN	39%	53%	-14%	7%	82%	-74%
IAC	207%	210%	-2%	7%	38%	-31%
INO	34%	-57%	91%	-1%	-22%	21%
MNTA	0%	-9%	8%	4%	75%	-70%
MSFT	155%	138%	17%	14%	58%	-44%
RLMD	209%	-63%	273%	9%	748%	-739%
RUBI	1%	-77%	77%	1%	116%	-115%
STM	122%	104%	18%	3%	98%	-95%
SUPN	167%	304%	-137%	-7%	-28%	20%
T	6%	4%	2%	3%	41%	-38%
WUBA	32%	29%	2%	-6%	18%	-24%
ZTS	103%	103%	0%	23%	58%	-34%
TOTALS	1178%	1104%	74%	136%	703%	-567%

RANDOM FOREST						
Ticker	TRAINING			TEST		
	Simulated Return	Static Return	Difference	Simulated Return	Static Return	Difference
ADBE	212%	213%	-1%	22%	47%	-25%
ALT	346%	-85%	430%	-1%	-27%	27%
BABA	87%	32%	54%	55%	55%	0%
DELL	9%	16%	-7%	11%	9%	2%
FB	71%	67%	4%	32%	51%	-20%
GILD	-29%	-28%	-2%	1%	6%	-6%
HZNPN	15%	53%	-38%	39%	82%	-43%
IAC	205%	210%	-5%	20%	38%	-19%
INO	8%	-57%	66%	-2%	-22%	20%
MNTA	-22%	-9%	-14%	25%	75%	-50%
MSFT	161%	138%	22%	16%	58%	-43%
RLMD	46%	-63%	110%	18%	748%	-730%
RUBI	-45%	-77%	31%	2%	116%	-115%
STM	92%	104%	-12%	62%	98%	-36%
SUPN	142%	304%	-162%	-31%	-28%	-4%
T	2%	4%	-2%	24%	41%	-17%
WUBA	22%	29%	-8%	2%	18%	-16%
ZTS	98%	103%	-5%	16%	58%	-42%
TOTALS	1027%	1104%	-77%	306%	703%	-413%

4.2.2. User interface evaluation

	Technical Indicator Ease of Use					Comparative Study		Overall ease of use
	SMA	EMA	BBP	RSI	CCI	TradingView	StockCharts	
Excellent	27%	18%	18%	27%	18%	36%	36%	22%
Above Avg	18%	18%	0%	18%	27%	18%	45%	16%
Avg	18%	36%	45%	27%	27%	36%	18%	31%
Below Avg	18%	18%	36%	9%	18%	9%	0%	20%
Poor	18%	9%	0%	18%	9%	0%	0%	11%

Users were asked to provide feedback on each section of the UI using a standard five-point scale (1: Excellent – 2: Above Average – 3: Average – 4: Below Average – 5: Very Poor). The table below shows the results of the feedback. (See [Appendix D](#) for full survey results)

5. Conclusions and discussions

User Interface – The tool we developed provides a simple and intuitive way for a user to learn about technical indicators as well as use them in simulating investment strategies. User testing feedback supports this conclusion. **69%** of the testers indicated that overall, the tool was easy to use. **69%** of the testers indicated our tool did a good job of explaining each indicator. Comparative results show that over **91%** of the testers felt that our tool was better when compared to the TradingView or the StockChart tool.

Simulation Evaluation – Our evaluations have revealed that the Random Forest ML algorithm was much faster and generated a better strategy. However, in order to generate a profitable strategy (beats static portfolio performance), additional testing and analysis, as well as additional algorithm tuning is required. Some things to consider are, addition of more indicators (*note: taking on too many indicators was identified as a risk in the project proposal and the scope was limited to five indicators*), including a market index (to account for market movements) etc.

Technical considerations – The Alpha Vantage API allows 5 calls per minute, so a maximum for 4 indicators can be selected per simulation (the last call being reserved for getting stock data). This limitation of five calls per minute may sometimes cause the tool to fail, displaying an error message when multiple users are using the tool. Moving the calculation of technical indicators locally instead of retrieving them from Alpha Vantage is one option to consider. The chosen deployment platform (HEROKU app) enforces a timeout of 30 seconds on HTTP calls. The Q-Learning algorithm could take up to 1 minute to complete depending on the duration of training data, so the training period had to be limited to 9 months when deployed on HEROKU to avoid timeout. Finally, test results show that adding volatility as a factor and the addition of more indicators could improve simulation performance.

Platform Visual improvements – Enrichment of the tool with text and visual elements, zoom in/out capability, overlay of multiple indicators in one plot, short cuts for the time ranges were some of the suggested enhancements for future phases of this project.

6. Team collaboration and distribution of work

All team members have contributed a similar amount of effort. See [Appendix C](#): Project Schedule. Weekly team meetings were well attended and very productive.

7. References

- [1] J. J. Murphy, Technical Analysis of the Financial Markets, New York: New York Institute of Finance, 1999.
- [2] Paul V. Azzopardi, "Behavioral Technical Analysis: An introduction to behavioral finance and its role in technical analysis." Harriman House. 2010
- [3] Adam Barone, The top technical indicators for Rookie Traders. Investopedia, June,2019.
- [4] Diallo Sessoms, Interactive Instruction: Creating Interactive Learning Environments Through Tomorrow's Teachers, Journal of Technology in Teaching and Learning, 2008
- [5] Raman Sapra, Customer Journey Mapping, Knowledge@Wharton, Wharton School of the University of Pennsylvania, 2015
- [6] Christopher Murphy, A comprehensive guide to user experience design, Penguin, June 2018
- [7] Rosati Luca, How to design interfaces for choice: Hick-Hyman law and classification for information architecture. 2013
- [8] T. Manoj and K. Deepak, "A hybrid financial trading support system using multi-category classifiers and random forest," *Applied Soft Computing*, vol. 67, pp. 337-349, 2018.
- [9] L. Khaidem, S. Saha and D. R. Sudeepa, "Predicting the direction of stock market prices," *Applied Mathematical Finance*, 2016.
- [10] Q. R. Group, "Deep Q-Learning," [Online]. Available: https://quantsoftware.gatech.edu/Deep_Q-Learning.
- [11] Sarah Mae Sincero, Survey Response Scales, Explorable, 2019
- [12] Sneha Nadig, How to effectively prepare "Test Bed" and Minimize the Test Environment Defects, Software Testing, Dec 2019

8. Appendix

8.1 Appendix A: Financial Technical Indicators Definitions

Simple Moving Average (SMA): Most moving averages are based on closing prices; for example, a 5-day simple moving average is the five-day sum of closing prices divided by five. A simple moving average is formed by computing the average price of a security over a specific number of periods.

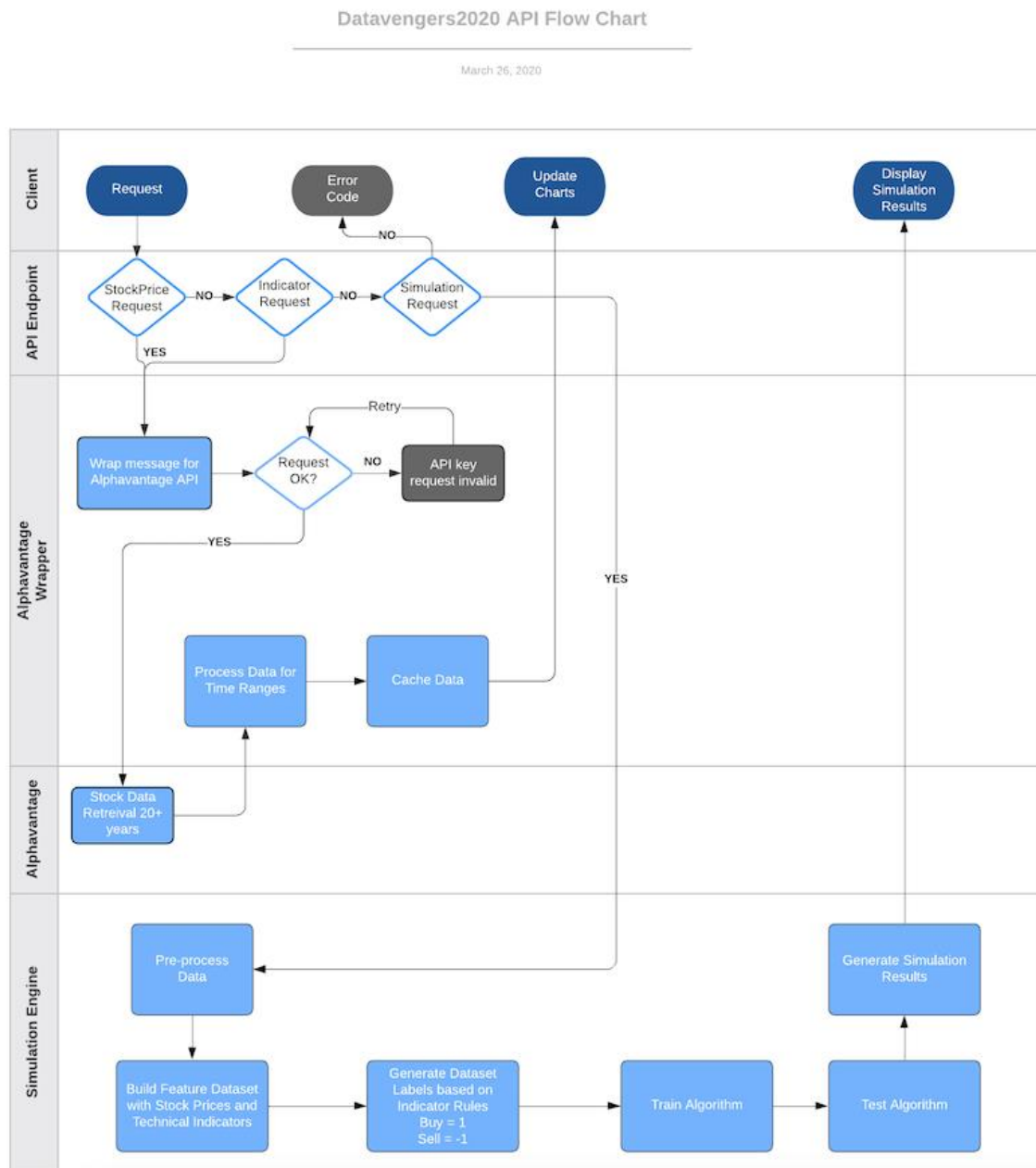
Exponential Moving Average (EMA) reduces the lag by applying more weight to recent prices. The weighting applied to the most recent price depends on the number of periods in the moving average.

Bollinger Bands (BB): Created in the 1980's by John Bollinger as a method for traders to identify extreme short-term prices in a security. The indicator is created by plotting the average of a predetermined number of prices along with two trading bands above and below. The outer bands are created by simply adding and subtracting one standard deviation from the moving average (standard deviation is used because it is a common measure of volatility).

Relative Strength Index (RSI): RSI is an extremely popular momentum oscillator. It's an oscillator because it oscillates between to ranges of high and low value and a momentum indicator because it measures how much interest currently exists in the price by measuring the speed and change (magnitude) of price movement. RSI helps analyze stocks that are overbought or oversold.

Commodity Channel Index (CCI): The CCI compares the current stock price to an average price over a period of time. The indicator fluctuates above or below zero, moving into positive or negative territory. While most values, approximately 75%, fall between -100 and +100, about 25% of the values fall outside this range, indicating a lot of weakness or strength in the price movement.

8.2 Appendix B: Financial Technical Indicators Interactive Learning Tool's API Flow Chart

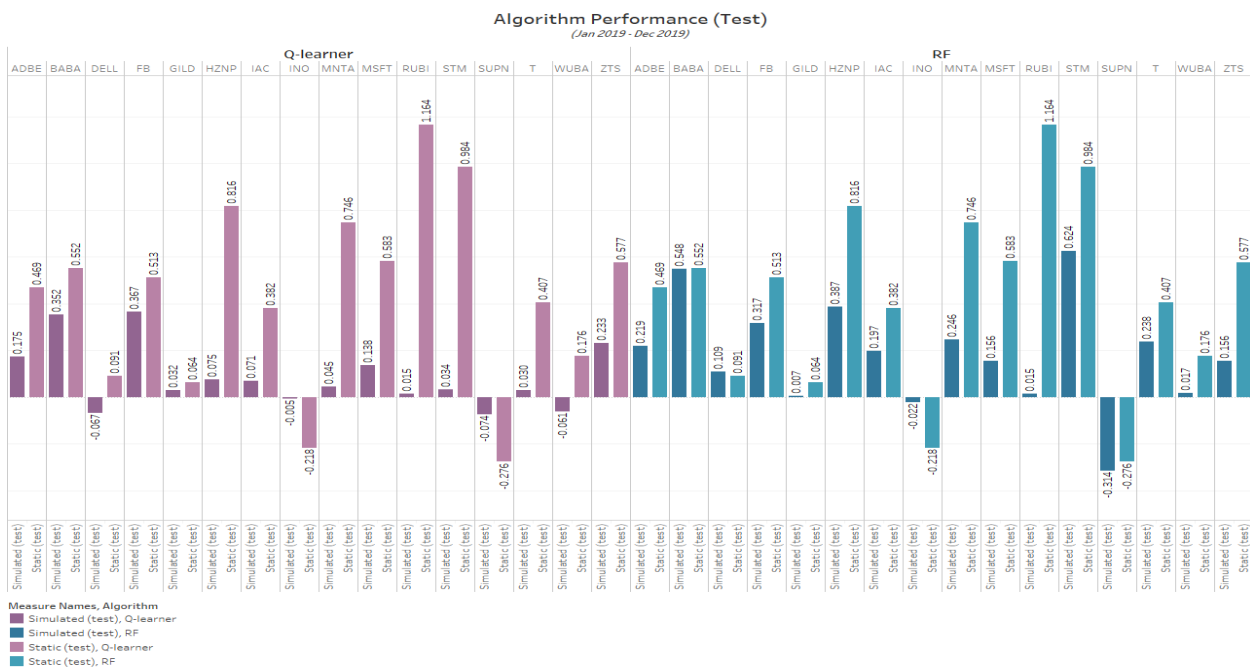
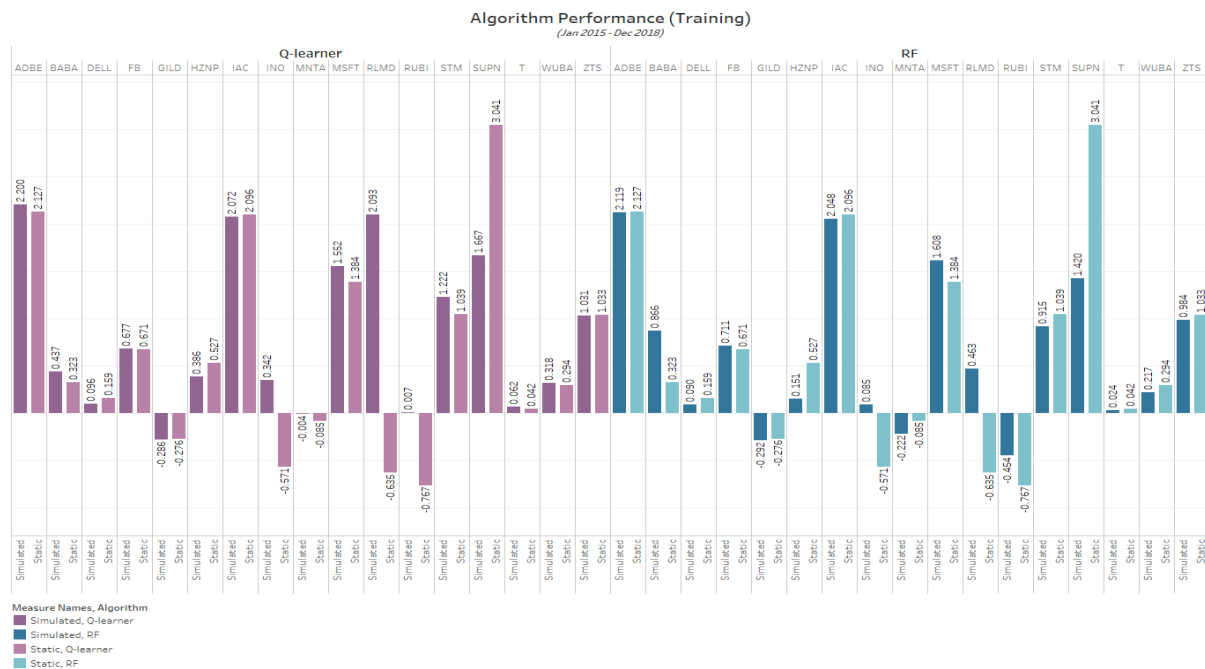


8.3 Appendix C: Project Schedule

ID	Task Name	Start	Finish	Duration	Resource Names
1	Phase 0 - Project Identification	Mon 1/13/20	Fri 2/28/20	7 wks	
2	Brainstorming and Selection	Mon 1/13/20	Fri 2/7/20	4 wks	
3	Brainstorming	Mon 1/13/20	Fri 1/31/20	3 wks	Team
4	Project Selection	Mon 2/3/20	Fri 2/7/20	1 wk	Team
5	Project definition	Mon 2/10/20	Fri 2/28/20	3 wks	
6	Collect baseline data from API	Mon 2/10/20	Fri 2/14/20	1 wk	Danny
7	Data Preparation (Clean/Format)	Mon 2/17/20	Fri 2/21/20	1 wk	JC
8	Proposal Creation (Document / Deck)	Mon 2/24/20	Fri 2/28/20	1 wk	Team
9	Presentation Creation	Mon 2/24/20	Fri 2/28/20	1 wk	Team
10	Proposal	Fri 2/28/20	Fri 2/28/20	0 wks	Xing
11	Phase I - Design & Develop	Mon 2/24/20	Fri 3/27/20	5 wks	
12	Design	Mon 2/24/20	Fri 3/6/20	2 wks	
13	Analytic Tools Identification	Mon 2/24/20	Fri 3/6/20	2 wks	Danny
14	Development (BE + FE)	Mon 3/2/20	Fri 3/20/20	3 wks	
15	Back End Development	Mon 3/2/20	Fri 3/13/20	2 wks	Danny
16	Front End Development	Mon 3/2/20	Fri 3/13/20	2 wks	Xing
17	BE & FE Integration	Mon 3/9/20	Fri 3/20/20	2 wks	Danny
18	Testing	Mon 3/9/20	Fri 3/13/20	1 wk	Team
19	MVP I Release	Mon 3/9/20	Mon 3/9/20	0 wks	
20	Phase 1 - Experiments & Evaluation	Mon 3/2/20	Fri 3/13/20	2 wks	
21	Survey Creation	Mon 3/2/20	Fri 3/6/20	1 wk	Juan Carlos, Latha Airodi
22	Usability Testing/Survey submitted	Mon 3/9/20	Fri 3/13/20	1 wk	Users
23	Analyze Survey Results	Mon 3/9/20	Fri 3/13/20	1 wk	Team
24	Progress Report	Mon 3/16/20	Fri 3/27/20	2 wks	
25	Progress Report Creation	Mon 3/16/20	Fri 3/27/20	2 wks	Team
26	Progress Report	Fri 3/27/20	Fri 3/27/20	0 wks	Xing
27	Phase II - Develop & Test	Mon 3/23/20	Fri 4/17/20	4 wks	
28	Development (Simulation Engine)	Mon 3/23/20	Fri 4/10/20	3 wks	
29	Simulation Engine Development	Mon 3/23/20	Fri 4/3/20	2 wks	Danny, Xing
30	Implement feedback messaging for tool	Mon 3/23/20	Fri 4/3/20	2 wks	Juan Carlos, Latha Airodi
31	Test Simulation Engine	Mon 4/6/20	Fri 4/10/20	1 wk	Team/Users
32	MVP 2 Release	Fri 4/3/20	Fri 4/3/20	0 wks	
33	Deployment	Mon 4/6/20	Fri 4/10/20	1 wk	
34	Set up hosting environment (HEROKU)	Mon 4/6/20	Fri 4/10/20	1 wk	Danny
35	Phase II - Experiments & Evaluation	Mon 3/30/20	Fri 4/10/20	2 wks	
36	Analyze and prioritize feedback	Mon 3/30/20	Fri 4/3/20	1 wk	Team
37	Implement prioritized enhancements	Mon 4/6/20	Fri 4/10/20	1 wk	Team
39	Create documentation	Mon 3/30/20	Fri 4/3/20	1 wk	Team
40	Final Report	Mon 4/6/20	Fri 4/17/20	2 wks	Xing
41	Final report creation	Mon 4/6/20	Fri 4/17/20	2 wks	Team
42	Final Report	Fri 4/17/20	Fri 4/17/20	0 wks	

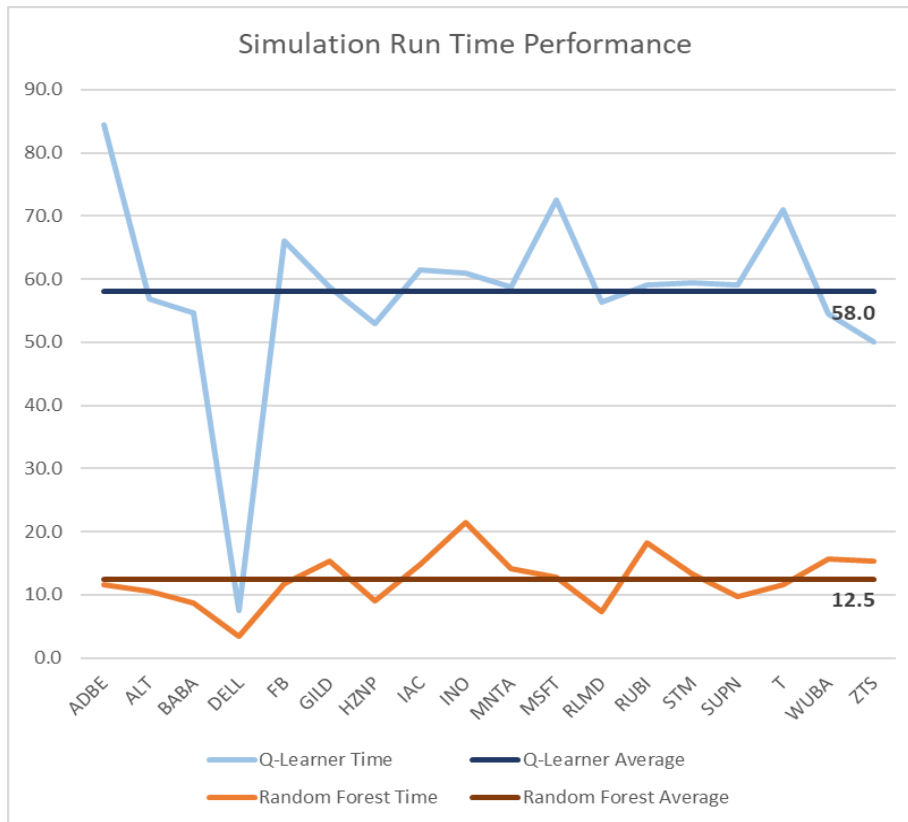
8.4 Appendix D: Test results

8.4.1. Simulation Performance Test Results



CSE-6242 – Project final report

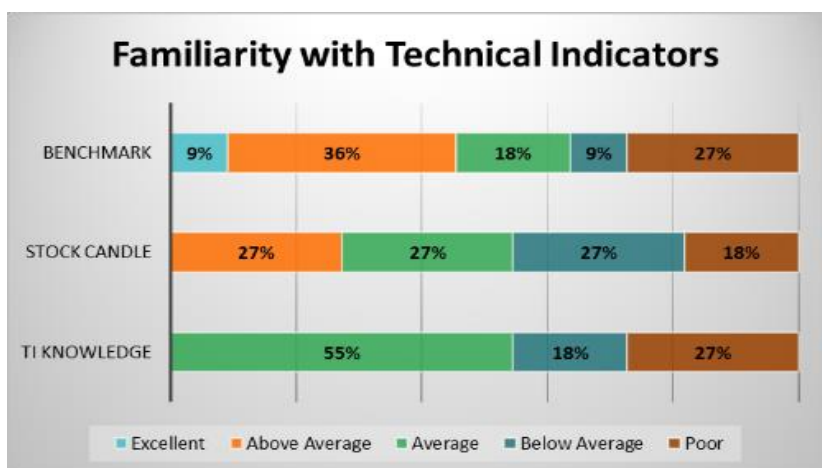
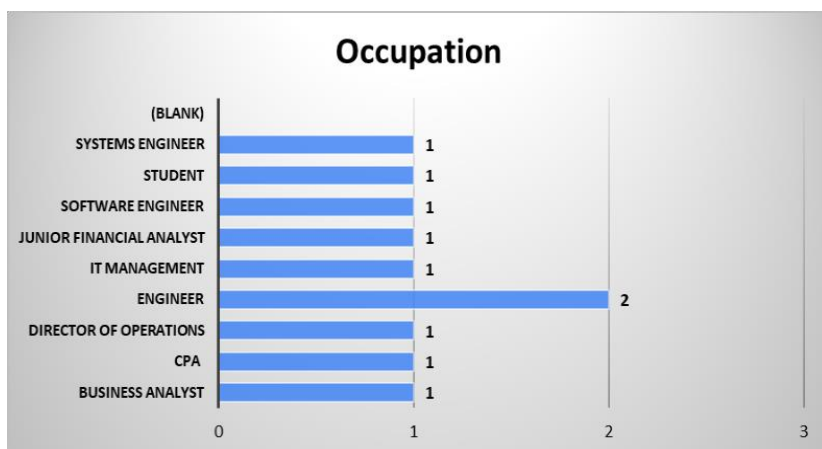
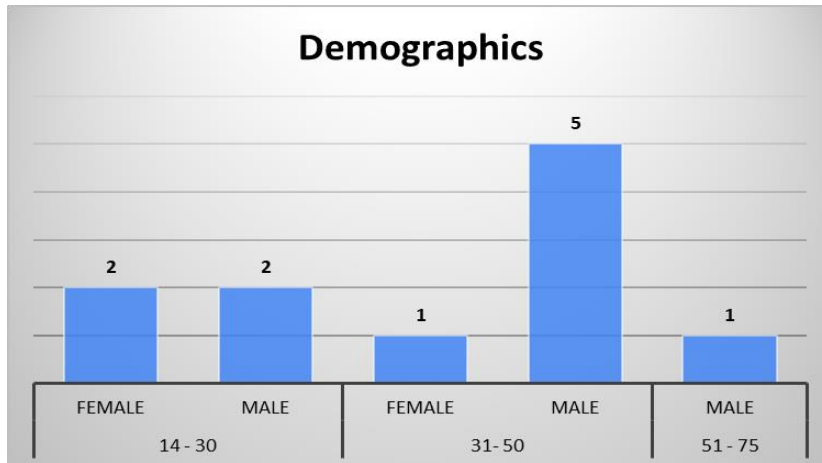
[Daniel Velez](#) | [Juan Carlos Arias](#) | [Xing Gao](#) | [Latha S Airodi](#)



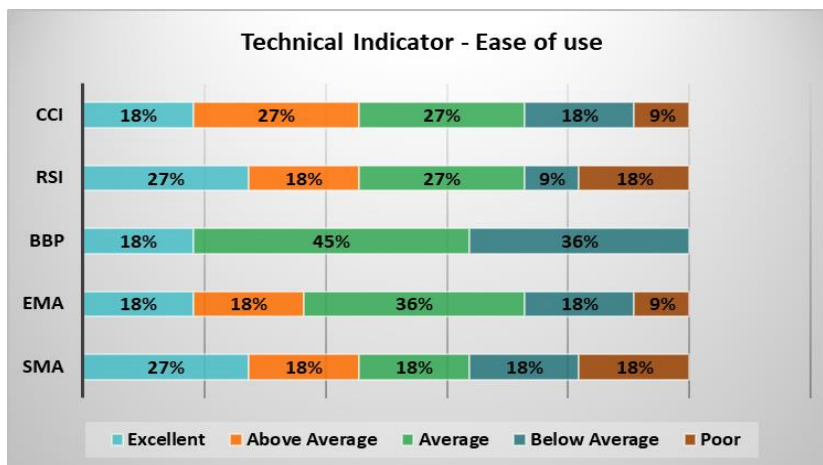
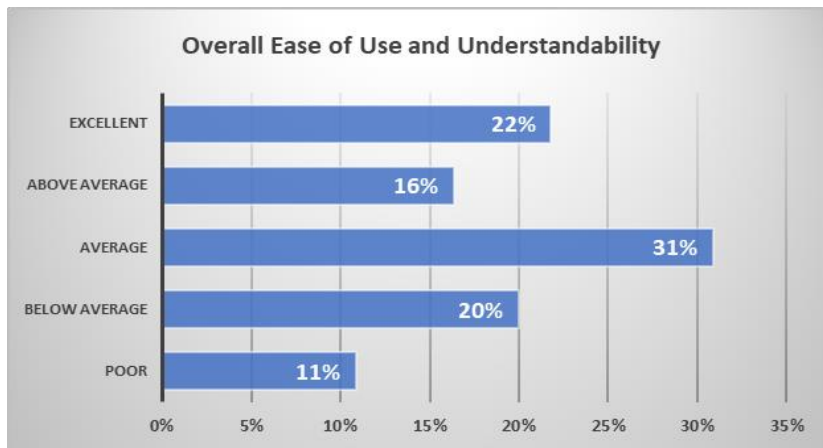
8.4.2. User survey feedback

Survey link -

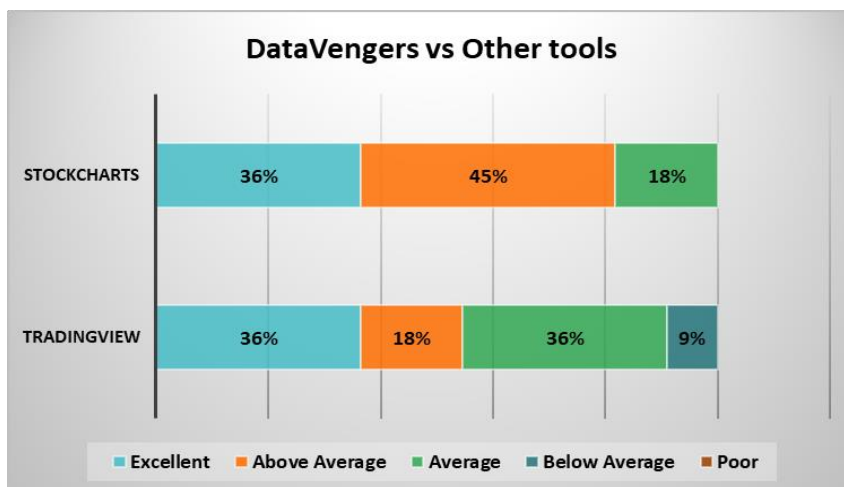
Participant Profile



User interface feedback



Comparison with other tools



User comments

1. *Are you familiar with a stock candle chart (1 being very familiar and 5 being not at all familiar). If not, provide feedback on what can be done to improve the UI*
 - Looks good - For folks who are not familiar - A legend would be helpful - +ve for day or not
 - zoom in capability, designate numbers as prices,
 - Maybe update numerical system and use ,
 - I didn't know where to start so maybe some text explaining how to get started?
 - Looks good
2. *Are you familiar with a Benchmark chart (1 being very familiar and 5 being not at all familiar). If not, provide feedback on what can be done to improve the UI*
 - Have a hover box explaining it
 - Need an explanation section at top rather than scrolling all the way to the bottom across all the other sections
 - put description of items in the hover over box, include "benchmarks"
 - I can guess the meaning of 'static' but its meaning might not be obvious to people who are not familiar with algorithmic trading. A short description for 'static' would help.
 - Static vs Best? That's confusing. Which benchmark are you using?
 - Short explanation of what static and best mean could help
 - Couldn't understand what the benchmark chart was indicating.
3. *Based on the description provided for the SMA indicator, are you able to understand what the SMA technical indicator is? (1 being fully understand, 5 do not understand).If not, provide feedback on what can be done to improve the UI*
 - Again, have a box that appears to explain it
 - Indication of price label, dates on the right do not show full date range - this is on all the right charts, label on Return of SMA Policy axis
 - There is no text based ""description"" of the SMA indicator, just charts. The x and y could be labeled with units. The picture/charts are small and hard to read in this survey.
 - I am also not familiar with SMA at all.
 - It wasn't that obvious where to get started and what the effect on the chart was
 - Not sure what I am supposed to do until it was explained to me. Need some type of help
4. *Based on the description provided for the EMA indicator, are you able to understand what the EMA technical indicator is? (1 being fully understand, 5 do not understand).If not, provide feedback on what can be done to improve the UI*
 - I don't understand what the sliders do
 - label on the Return of EMA Policy axis
 - There is no text based ""description"" of the EMA indicator, just charts. The x and y could be labeled with units. The picture/charts are small and hard to read in this survey.
 - I am also not familiar with EMA at all.
 - Similar comment than SMA
 - IS it possible to describe what is happening when selecting parameters and what next actions should be?

5. *Based on the description provided for the BBP indicator, are you able to understand what the BBP technical indicator is? (1 being fully understand, 5 do not understand). If not, provide feedback on what can be done to improve the UIBB ease of use*
 - %B?
 - Describe what its tracking. Volatility?
 - There is no text based ""description"" of the BBP indicator, just charts. The x and y could be labeled with units. The picture/charts are small and hard to read in this survey.
 - I am also not familiar with BBP at all.
 - It says BB not BBP
 - I tried to use Save as Rule..didn't do anything. The descriptions don't offer much in terms of guidance
 - I like the sliders and the fact that you see results immediately ..but not guidance on the parameter values
6. *Based on the description provided for the RSI indicator, are you able to understand what the RSI technical indicator is? (1 being fully understand, 5 do not understand). If not, provide feedback on what can be done to improve the UI*
 - The sliders confused me, it would help a lot to have a help button
 - what are the numbers on the left of both charts?
 - "There is no text based ""description"" of the RSI indicator, just charts. The x and y could be labeled with units. The picture/charts are small and hard to read in this survey.
 - I am also not familiar with RSI at all.
 - Similar opinion than previous comments
 - Similar to previous one
7. *Based on the description provided for the CCI indicator, are you able to understand what the CCI technical indicator is? (1 being fully understand, 5 do not understand). If not, provide feedback on what can be done to improve the UI*
 - I didn't even find it
 - There is no text based ""description"" of the CCI indicator, just charts. The x and y could be labeled with units. The picture/charts are small and hard to read in this survey.
 - I am also not familiar with CCI at all.
 - Ditto
 - After it was explained to me I was able to move forward
8. *How easy or hard was the Datavengers tool compared to Trading View (1 being very easy, 5 being very hard). Provide feedback*
 - It looks nice, the mobile site is nice, the icons are intuitive
 - Professional site with a lot of good features to download etc.
 - big charts
 - More modern interface
 - The auto tracking x and y coordinate. Its a little cleaner and simplified compared to the Stock Charts one. In general its just more polished, for example the text looks less like its from the 80s. The quick change options from the time frame are nice (6mo, 1 yr, etc)
 - It can zoom in and out
 - User interface is easy to use and very intuitive.

- Very interactive: can easily zoom in/out with gesture and add trend lines
- Not much..A lot of information and not clear way on how to get started
- The title of the stock and the full name of the company are displayed

9. *How easy or hard was the Datavengers tool compared to StockChart tool (1 being very easy, 5 being very hard). Provide feedback*

- Nothing
- Vry basic
- I hate that I can't zoom in. Chart is way too small.
- the settings are not as hidden as Trading View
- drop downs for customization
- It allows me to overlay multiple indicators in one simple plot (so one can compare multiple indicators at the same time)
- Didn't try
- too busy..not much

10. *Other feedback to improve Datavengers tool?*

- Help buttons, real time visual update on the graph when you change the slider
- Visualization/Presentation can be improved and made more savvy
- make charts bigger and give information in hover-tools, especially over the axis
- provide short cuts for the time ranges. Not just the start / end dates so its easy to jump between time windows.
- Labels and units were the main one. I prefer to have a few "hover" indicators when it makes sense. Some of the items I mentioned on the Trading View would be good.
- Maybe change the layout to make each section look more consistent?
- "Needs some type of introduction on the top. Explaining how to use the range of dates. Data range availability.
- SMA: What is the meaning of the title "%SMA"? It is related to the Buy and Sell parameters. Make the relationship more clear
- It seems like a good tool to learn about indicators. Good job! Might need more instructions on how to use it to make it more easy to understand/use
- Very clean and simply laid out. Intuitive. Easy to learn.