Summer Internship Report

Understanding of Financial Markets using Machine Learning

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ACKNOWLEDGEMENT

It is with earnest gratitude that I manifest my heartiest indebtedness to the professors of THE NORTHCAP UNIVERSITY without their invaluable assistance and the guidance it would not have been achievable for this training to occur and taken a tangible shape.

I owe my sincere thanks to The Career Launcher who gave this internship opportunity .

I am also greatly privileged to my parents for all their hard work and my friends for their continuous belief in me in my endeavour. Lastly, I would like to thank everyone who has been a part of this training and contributed to the successful completion of the training.

ABSTRACT

A financial market is a word that describes a marketplace where bonds, equity, securities, currencies are traded. Financial markets play a vital role in facilitating the smooth operation of capitalist economies by allocating resources and creating liquidity for businesses and entrepreneurs. The markets make it easy for buyers and sellers to trade their financial holdings. Financial markets create securities products that provide a return for those who have excess funds (Investors/lenders) and make these funds available to those who need additional money (borrowers).

The stock market is just one type of financial market. Financial markets are made by buying and selling numerous types of financial instruments including equities, bonds, currencies, and derivatives. Financial markets rely heavily on informational transparency to ensure that the markets set prices that are efficient and appropriate. The market prices of securities may not be indicative of their intrinsic value because of macroeconomic forces like taxes.

Some financial markets are small with little activity, and others, like the New York Stock Exchange (NYSE), trade trillions of dollars of securities daily. The equities (stock) market is a financial market that enables investors to buy and sell shares of publicly traded companies. The primary stock market is where new issues of stocks, called initial public offerings (IPOs), are sold. Any subsequent trading of stocks occurs in the secondary market, where investors buy and sell securities that they already own.

In this Internship work, we focused on understanding the financial markets and making analysis using Machine Learning libraries and algorithms.

INTRODUCTION

My summer internship was a training program in **Understanding of Financial markets using Machine Learning** carried out by **The Career Launcher,** certified and endorsed by **AICTE.**

Career Launcher India Limited (CL) is Asia's leading education service provider with presence in over 130 locations across India, Middle East and United States. CL provides test-prep education to enable school and college students gain admission to professional courses. It is also actively involved in the field of mainstream education, mainly through its growing network of play schools and secondary school.

Today over 400+ academicians and professionals around the world work with CL to counsel and groom over 50,000 students across the globe. It is a leading education corporate providing world class education services in South Asia with annual turnover touching Rs 150 crores.

With over 15 years of experience in the education sector, the organisation has moved from being a purely test prep based company, to three distinct areas of education services- test prep, mainstream education and employability training. The education industry is estimated to be currently in excess of 150,000 crores and is growing at a steady 16%+ every year. It continues to be highest non-food expense pan South Asia. As part of their growth and expansion plans, they are looking for partners in Middle East and North Africa regions.

ABOUT APPLE INC

Apple Inc. is an American multinational technology company headquartered in Cupertino, California, that designs, develops, and sells consumer electronics, computer software, and online services. It is considered one of the Big Tech technology companies, alongside Amazon, Google, Microsoft, and Facebook.

Apple is well known for its size and revenues. Its worldwide annual revenue totalled $265 billion for the 2018 fiscal year. Apple is the world's largest technology company by revenue and one of the world's most valuable companies. It is also the world's third-largest mobile phone manufacturer after Samsung and Huawei.

CEO: Tim Cook

Founded: 1 April 1976, Cupertino, California, United States

Headquarters: Cupertino, California, United States

Founders: Steve Jobs, Steve Wozniak, Ronald Wayne

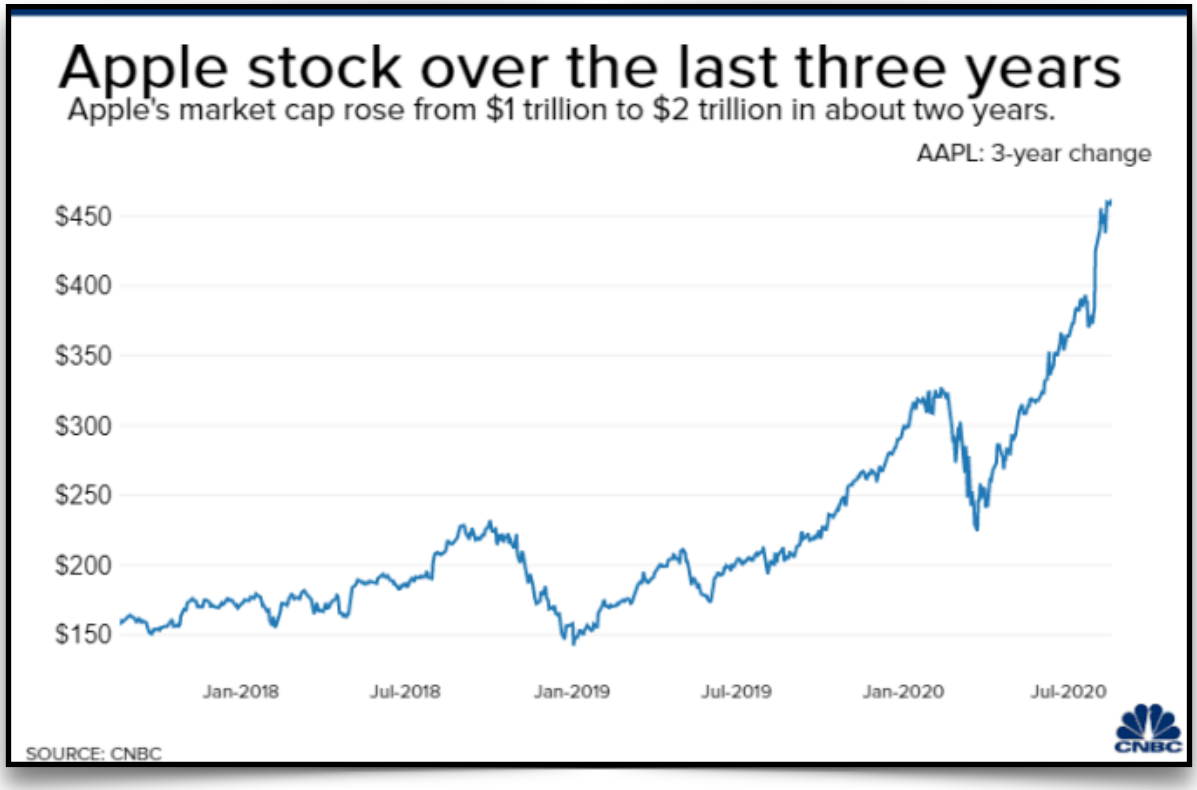


Figure 1 Apple stock changes

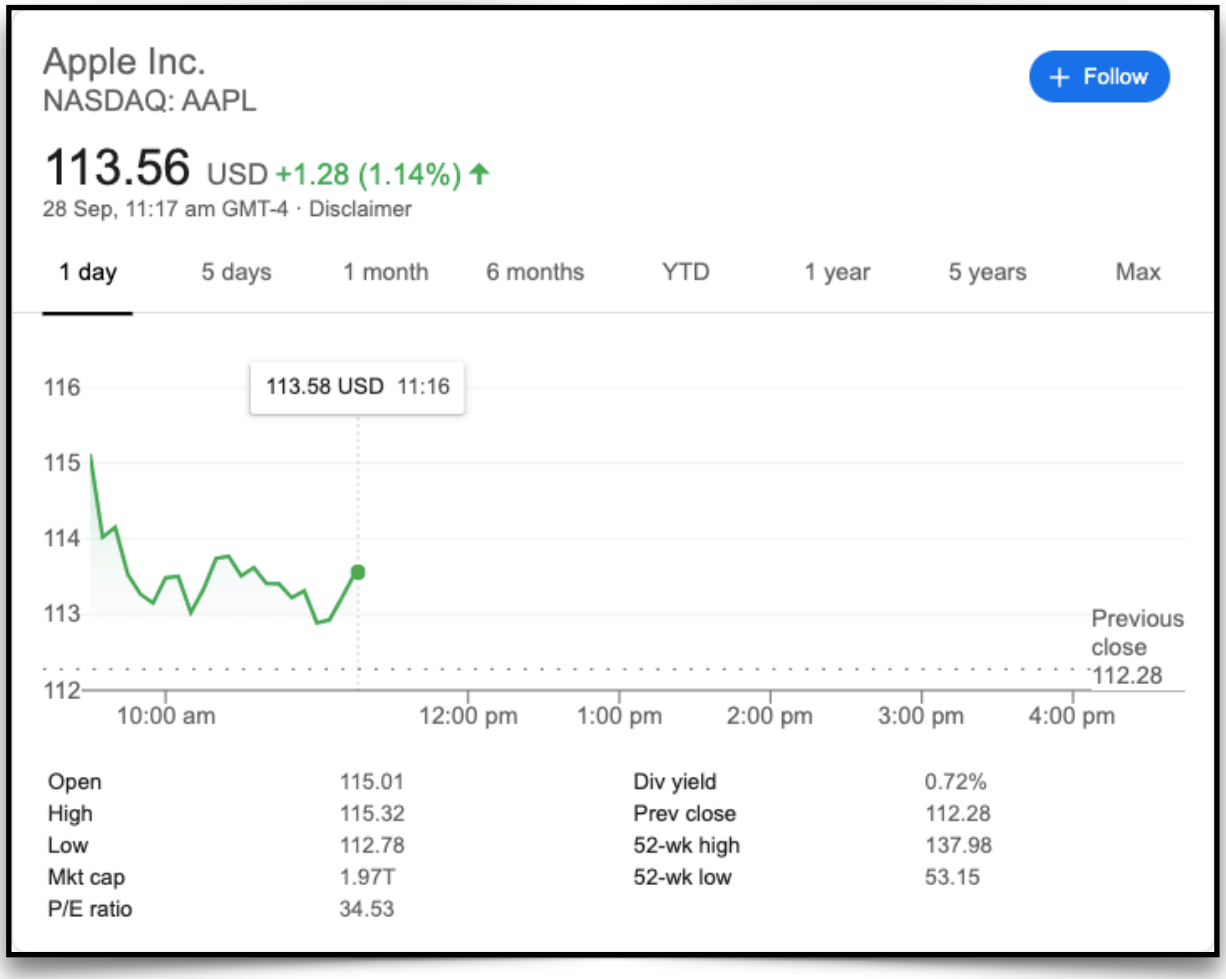


Figure 2 Apple stock market (AAPL)

TRAINING DESCRIPTION

The Internship training program was on the Understanding of Financial Market. The training was split into 8 weeks. The first week was all about the study of Basics of Financial market, choosing of a company and its profile study. The coming weeks comprised of the problem solving Modules that were allotted each week and we could only move onto the next module once the assigned module was evaluated by the experts.

OBJECTIVE: -

The objective of the summer program was to learn and understand the concepts of ML and how can they be interlinked with Financial market. The main focus of the training was to visualise, analyse and draw inferences using python and ML that can be used in Stock and commodity market for profit generation.

GOAL: -

The Goals of the project were, get to know know financial market works specifically Stock market and commodity market. How profit is surplussed by investing at the right time? How predictions are made based on the past experiences? How inferences are generated from the data values by visualising them?

ACTIVITIES: -

WEEK 1

During the first week of the training, we learnt a lot about the Financial Market, how it works on virtual platform, how profits are surplussed, how is the trading done. We were given document to read all that was necessary.

In addition to it, we were allotted the company of our choice and some basic research was done on that company. My chosen company was APPLE, maybe because apple is one of the top leading companies of the world.

WEEK 2

From the second week, implementation started with the unlocking of the Module I i.e (DATA EXPLORATION). It comprised of problem statements that involved

Processing and analysing the data of the Apple company to find out the trends of the stock price. Data is a potent tool that we came on terms from this week. We started with the basic technical indicators and used libraries like pandas and numpy.

We even studied VWAP (Volume Weighted Average Price) that are commonly applied by traders on 1 minute and 5 minute charts. These time frames are used when day trading because price action moves quickly. The VWAP indicator starts at the open price and moves up or down based on volume and price action throughout the day.

WEEK 3

In the third week, Module II i.e (DATA VISUALISATION AND TECHNICAL ANALYSIS) was unlocked. It comprised of problem statements that involved Visualisation. 'A picture speaks a thousand words' has never been truer in financial markets. Plotting, basic technical indicators and our own customisation, and making our own trade calls were done throughout the week.

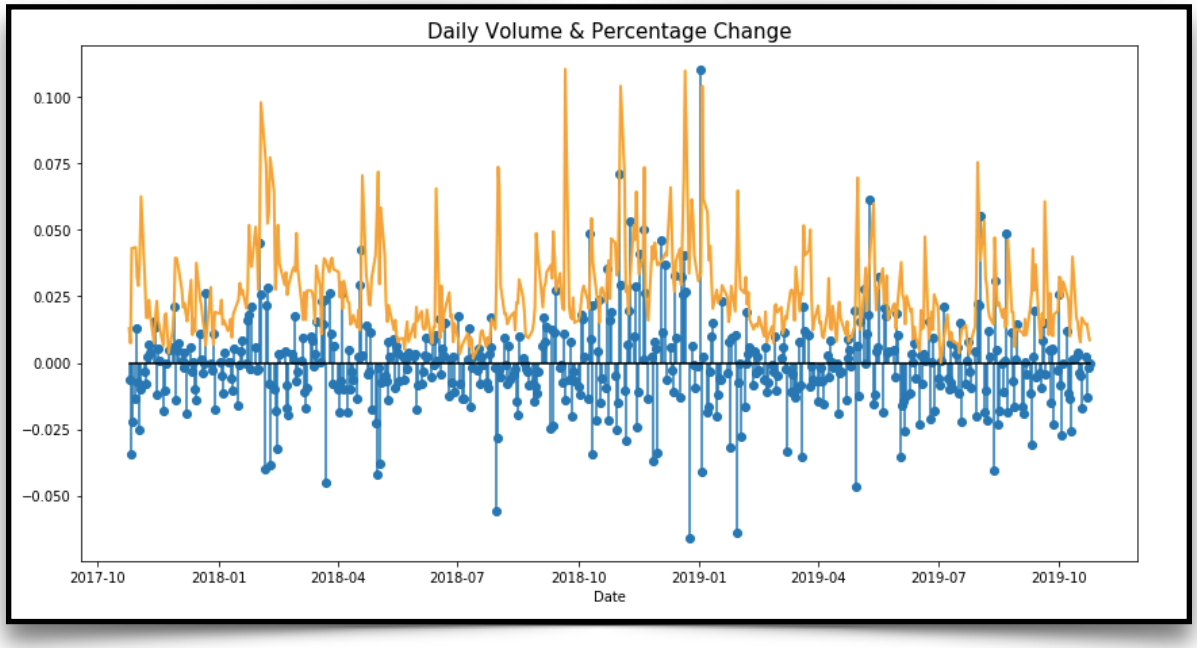


Figure 3 Relationship between Daily Volume and Percentage change

We even saw that volume traded and daily percentage change are directly proportional. Whenever the volume traded peeks there is most change between prices of stocks.

WEEK 4

In the forth week, Module III i.e (FUNDAMENTAL ANALYSIS USING REGRESSION) was unlocked. It comprised of problem statements that involved the regression concepts. Predicting the outcomes of an event based on OHLC were done using regression to come up with an ideal inferences.

OHLC chart shows the open, high, low, and close price for a given period.It can be applied to any timeframe.The vertical line represents the high and low for the period, while the line to the left marks the open price and the line to the right marks the closing price. This entire structure is called a bar. When the close is above the open, the bar is often coloured black. When the close is below the open the bar is often coloured red.

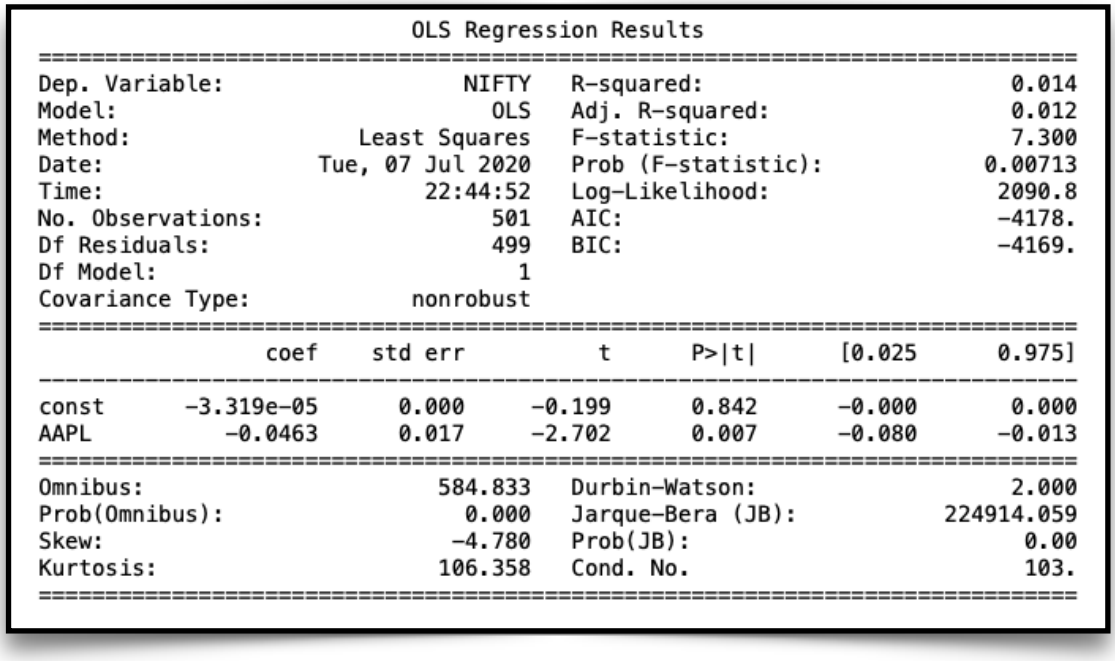
OLS Regression Results

Dep. Variable:	NIFTY	R-squared:	0.003
Model:	OLS	Adj. R-squared:	0.001
Method:	Least Squares	F-statistic:	1.419
Date:	Tue, 07 Jul 2020	Prob (F-statistic):	0.234
Time:	22:44:52	Log-Likelihood:	1769.7
No. Observations:	502	AIC:	-3535.
Df Residuals:	500	BIC:	-3527.
Df Model:	1		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	0.0004	0.000	1.165	0.245	-0.000	0.001
AAPL	0.0216	0.018	1.191	0.234	-0.014	0.057

Omnibus:	11.685	Durbin-Watson:	1.843
Prob(Omnibus):	0.003	Jarque-Bera (JB):	14.782
Skew:	-0.243	Prob(JB):	0.000617
Kurtosis:	3.685	Cond. No.	57.0

Figure 4 Displaying the OLS Regression Results for daily return



OLS Regression Results

Dep. Variable:	NIFTY	R-squared:	0.014
Model:	OLS	Adj. R-squared:	0.012
Method:	Least Squares	F-statistic:	7.300
Date:	Tue, 07 Jul 2020	Prob (F-statistic):	0.00713
Time:	22:44:52	Log-Likelihood:	2090.8
No. Observations:	501	AIC:	-4178.
Df Residuals:	499	BIC:	-4169.
Df Model:	1		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	-3.319e-05	0.000	-0.199	0.842	-0.000	0.000
AAPL	-0.0463	0.017	-2.702	0.007	-0.080	-0.013

Omnibus:	584.833	Durbin-Watson:	2.000
Prob(Omnibus):	0.000	Jarque-Bera (JB):	224914.059
Skew:	-4.780	Prob(JB):	0.00
Kurtosis:	106.358	Cond. No.	103.

Figure 5 Displaying the OLS Regression Results for monthly return

We learned about Beta, a measurement of market risk or volatility. That is, it indicates how much the price of a stock tends to fluctuate up and down compared to other stocks.

A beta less than 0, which would indicate an inverse relation to the market, is possible but highly unlikely. Companies with volatilities lower than the market have a beta of less than 1 but more than 0.

β value is +ve for Daily return and β value is -ve for Monthly return of AAPL.

WEEK 5

In the fifth week, Module IV i.e (TRADE CALL PREDICTION USING CLASSIFICATION) was unlocked. It comprised of problem statements that involve the concepts of Classification. Training the model and making prediction calls were done.

A moving average (MA) is a widely used technical indicator that smooths out price trends by filtering out the “noise” from random short-term price fluctuations. Moving averages can be constructed in several different ways, and employ different numbers of days for the averaging interval.

The most common applications of moving averages are to identify trend direction and to determine support and resistance levels.

We made trade calls using sum of moving averages here. The strategy was to apply two moving averages to a chart: one longer and one shorter. When the shorter-term MA crosses above the longer-term MA, it's a buy signal, as it indicates that the trend is shifting up. This is known as a "golden cross." Meanwhile, when the shorter-term MA crosses below the longer-term MA, it's a sell signal, as it indicates that the trend is shifting down. This is known as a "dead/death cross."

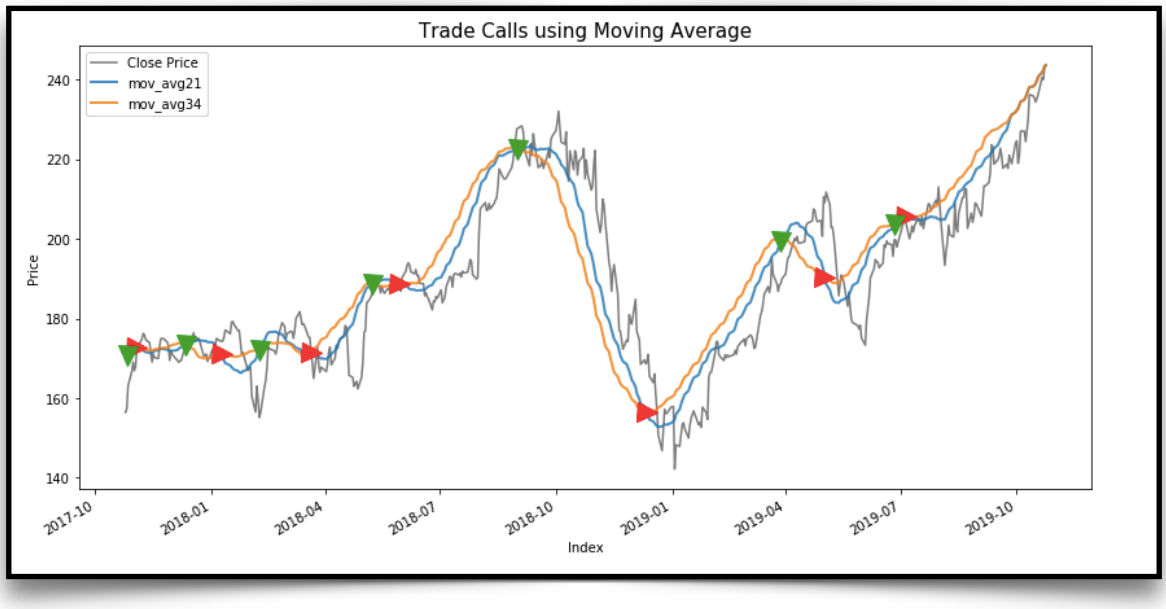


Figure 6 Trade Calls using Moving Average

Bollinger Bands are a trading tool used to determine entry and exit points for a trade.

The bands are often used to determine overbought and oversold conditions.

Using only the bands to trade is a risky strategy since the indicator focuses on price and volatility, while ignoring a lot of other relevant information.

Bollinger Bands are a rather simple trading tool, and are incredibly popular with both professional and at-home traders.

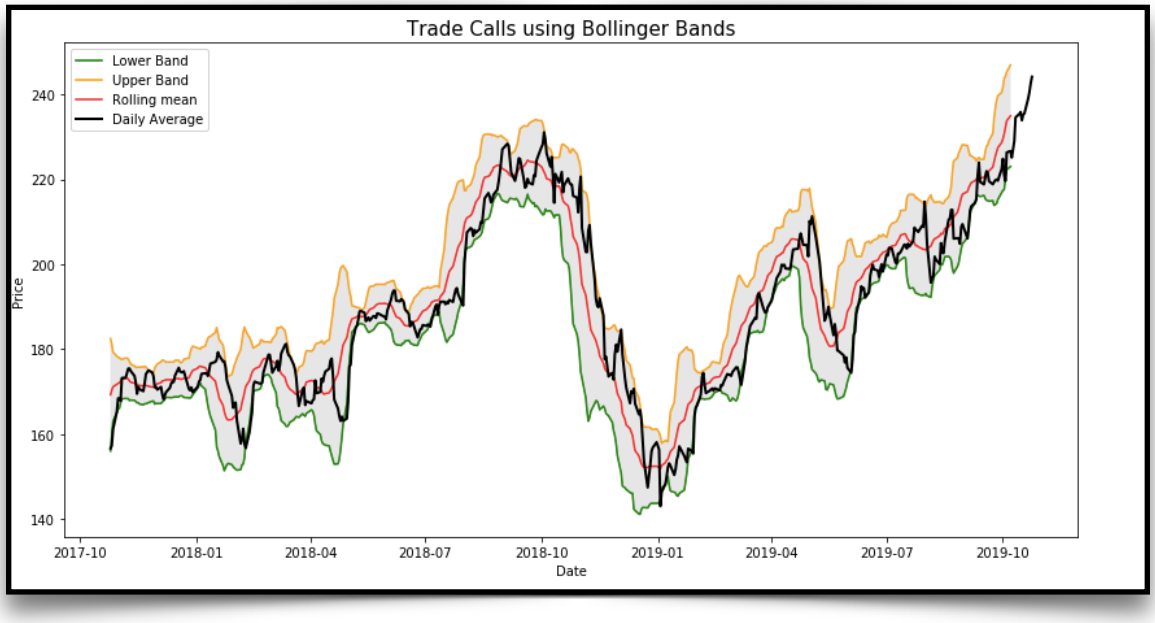


Figure 7 Trade Calls using Bollinger Bands

WEEK 6

In the sixth week, Module V i.e (MODERN PORTFOLIO THEORY) was unlocked. It comprised of problem statements involving investing portfolio optimisation with python. The fundamental concept of diversification and the creation of an efficient frontier that can be used by investors to choose specific mixes of assets based on investment goals: that is, the trade off between their desired level of portfolio return vs their desired level of portfolio risk.

Sharpie Ratio is used to help investors understand the return of investment compared to its risk.The ratio is the average return earned in excess of the risk-free rate per unit of volatility or total risk. Volatility is a measure of the price fluctuations of an asset or portfolio. Generally, the greater the value of the Sharpe ratio, the more attractive the risk-adjusted return

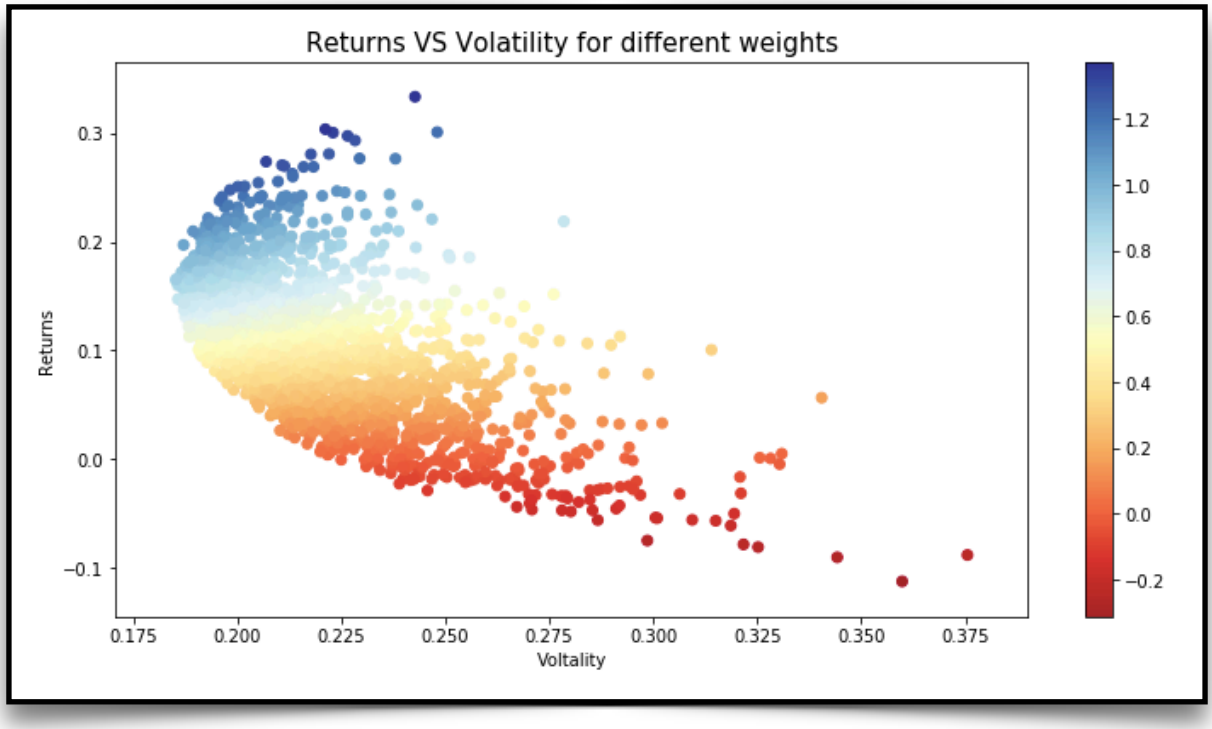


Figure 8 Returns VS Volatility for different weights

WEEK 7

In the seventh week, Module VI i.e (CLUSTERING FOR DIVERSE PORTFOLIO ANALYSIS) was unlocked. It comprised of problem statements involving the Clustering concept. Clustering is used to group sets of objects that share similar characteristics. This technique was used to build a diversified portfolio. Stocks that exhibit high correlations in returns fall into one basket, those slightly less correlated in another, and so on, until each stock was placed into a category. The clusters made in market are based on volatility and returns of different portfolios.

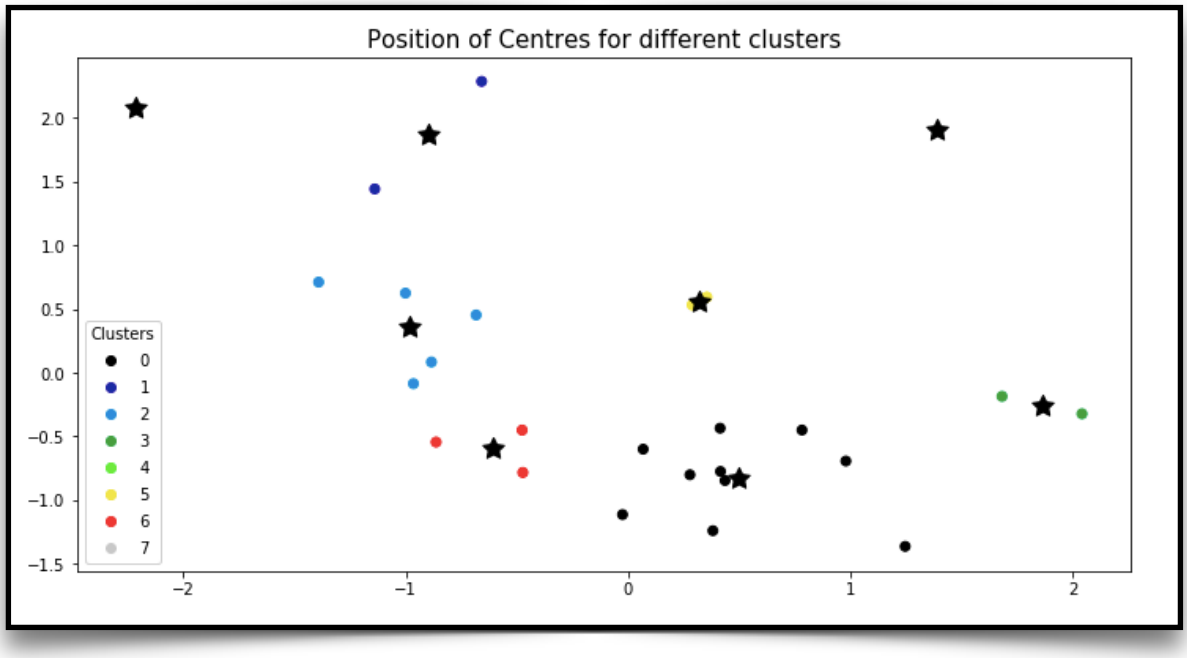


Figure 9 Clustering for diversification analysis

ANALYSIS

This project made me see the real world application of what I studied till now in python and Machine Learning. Made me explore new things in the field of Data analysis and gave me exposure to a completely unknown field of FINANCIAL MARKET and literally now I'm familiar with maximum terms related to it. I now know how trading is done.

I learned how to finish the work on deadlines and exploring yourself before seeking for any help. All the evaluations were done on time and no delays were encountered by the team. I explored enough during the training period but there are still many aspects left out that I'll surely work upon in future.

My primary strength is Data analysis using visualisations like I can draw out inferences easily by making beautiful and informative visualisations. I personally felt that being aware of what all visualisations are there and knowing about the algorithms used for predictions helped a lot during the project.

CONCLUSION

As a whole, this internship/training journey was a very useful and productive experience. I have learned and attained skills to work on any challenging topic.
Related to my study I learned more of what I already knew and hence could enhance my knowledge to the next level.
In review this internship/training program has been an excellent and rewarding experience.
This program helped me do my swot analysis. This helped me to foster and hone on the necessary skills.
This internship/training program provided the insight of what are scopes where I can improve my skills and make it my strength for the future.

This internship was done as a part of a summer training at the end of 4 semesters of BTech Computer Science. Various goals were in mind to be achieved through this internship. Most of them could be achieved were achieved which included :
To improve my skills and inculcate further knowledge
To brush up my skills and put them to use.
To get the exposure to real world applications of Data Science.
To explore areas of improvement and experience the processes.

This internship/training program was helpful in realizing my potential and helping me with future prospects and goals. Some of the key elements learnt are discipline, enthusiasm, punctuality, teamwork and how work is carried out in a professional way. Overall this internship was fun-filled and also educational in many ways. Lastly, this training/internship opportunity gave me insights and the motivation to pursue my career in this scientific field.

GLOSSARY

Stock Market is an electronic market place. Buyers and sellers meet and trade their point of view

Public v/s Private Company - A Public company is one which can its shares to the general public on the stock exchange (share market) Eg- Reliance, ICICI Bank , Yes Bank whereas A private company is one which holds its shares to a few, big money investors. Eg- Paytm, Dell

Shares - As the name suggests, a share is a ‘part’ of a company which you can buy or sell, IF the company is publicly listed i.e. on a stock exchange.

Stocks v/s Shares - The 2 words are used interchangeably, though there is a slight difference between the two. A stock can refer to any arbitrary company, but the word ‘share’ is used when we are referring to a specific company.

NSE (National Stock Exchange) and **BSE (Bombay Stock Exchange**) are basically the ‘markets’ where one can buy and sell shares of a company. Unlike the conventional markets, these markets are electronic and not physical. All transactions take place electronically.

Portfolio - If I have invested in more stocks than 1, let’s say 10 different stocks, then this collection of investment is known as a Portfolio.

Equities (Stocks and Shares) - Shares and its derivatives collectively are known as equity. Investment in stocks involves buying shares of publicly listed companies. The shares are traded both on the Bombay Stock Exchange (BSE), and the National Stock Exchange (NSE).

Commodities –

- Investments in gold and silver are considered one of the most popular investment avenues. Gold and silver over a long-term period has appreciated in value. Investments in these metals have yielded an annual return of approximately 8% over the last 20 years!
- Crude Oil is another commodity which keeps on varying with time and if one is able to analyse the trend correctly, one can make a fortune in this product.

Bull Market (Bullish) – If you believe that the stock prices are likely to go up then you are said to be bullish on the stock price. From a broader perspective, if the stock market index is going up during a particular time period, then it is referred to as the bull market.

Bear Market (Bearish) – If you believe that the stock prices are likely to go down then you are said to be bearish on the stock price. From a broader perspective, if the stock market index is going down during a particular time period, then it is referred to as the bear market.

Trend – A term 'trend' usually refers to the general market direction, and its associated strength. For example, if the market is declining fast, the trend is said to be bearish. If the market is trading flat with no movement then the trend is said to be sideways.

52 week high/low – 52 week high is the highest point at which a stock has traded during the last 52 weeks (which also marks a year) and likewise 52 week low marks the lowest point at which the stock has traded during the last 52 weeks. The 52 week high and low gives a sense of the range within which the stock has traded during the year. Many people believe that if a stock reaches 52-week high, then it indicates a bullish trend for the foreseeable future. Similarly if a stock hits 52 week low, some traders believe that it indicates a bearish trend for the foreseeable future.

All time high/low – This is similar to the 52-week high and low, with the only difference being the all time high price is the highest price the stock has ever traded from the time it has been listed. Similarly, the all time low price is the lowest price at which the stock has ever traded from the time it has been listed.

Long Position – Long position or going long is simply a reference to the direction of your trade. For example, if you have bought or intend to buy Biocon shares then you are said to be long on Biocon or planning to go long on Biocon respectively. If you have bought the Nifty Index with an expectation that the index will trade higher then essentially you have a long position on Nifty. If you are long on a stock or an index, you are said to be bullish.

Short Position – Going short or simply 'shorting' is a term used to describe a transaction carried out in a particular order. This is a slightly tricky concept. If you have sold (shorted) the Nifty Index with an expectation that the index will trade lower then essentially you have a short position on Nifty. If you are short on a stock or an index, you are said to be bearish.

Square off – Square off is a term used to indicate that you intend to close an existing position. If you are long on a stock squaring off the position means to sell the stock.
Intraday position – Is a trading position you initiate with an expectation to square off the position within the same day.

OHLC – OHLC stands for open, high, low and close. We will understand more about this in the technical analysis module. For now, open is the price at which the stock opens for the day, high is the highest price at which the stock trade during the day, low is the lowest price at which the stock trades during the day, and the close is the closing price of the stock.

Volume (Total Traded Quantity) – Volumes and its impact on the stock prices is an important concept . Volumes represent the total transactions (both buy and sell put together) for a particular stock on a particular day.

Deliverable Quantity – All the shares which were not squared off on an intraday basis.

Turnover – Product of total volume traded to the average price of a stock for the day.

BIBLIOGRAPHY

Our main website to go to was https://www.investopedia.com/.

PROJECT DAILY TASKS

DATE	Day	Task	WEEKS
6/1/20	Monday	Introduction to financial markets	
6/2/20	Tuesday	Allotment of stock of particular companies(i.e Apple, Microsoft etc)	
6/3/20	Wednesday	Company Profile Study	
6/4/20	Thursday	Study on Commodities and Stocks Indices	
6/5/20	Friday	Study on Nifty Index	
6/6/20	Saturday	BREAK	WEEK 1
6/7/20	Sunday	BREAK	
6/8/20	Monday	EDA	
6/9/20	Tuesday	Analysis of last 90 days of stock data	
6/10/20	Wednesday	VWAP analysis	
6/11/20	Thursday	Predicting trends after analyzing stocks	
6/12/20	Friday	Submission of Week 1	
6/13/20	Saturday	BREAK	WEEK 2
6/14/20	Sunday	BREAK	
6/15/20	Monday	Analysis of every drastic change in stock and	
6/16/20	Tuesday	Understanding volatility and using it for analysis	
6/17/20	Wednesday	Study of bollinger band strategy	
6/18/20	Thursday	Trade calls using Moving Averages	
6/19/20	Friday	Submission of Week 2	
6/20/20	Saturday	BREAK	WEEK 3
6/21/20	Sunday	BREAK	
6/22/20	Monday	Prediction using OHLC , Regression -Beta Calculation	
6/23/20	Tuesday	CAPM analysis	
6/24/20	Wednesday	Creation of OLS regression model	
6/25/20	Thursday	Comparing and analysing Nifty and Apple(allocated stock) Prices	
6/26/20	Friday	Submission of Week 3	
6/27/20	Saturday	BREAK	WEEK 4
6/28/20	Sunday	BREAK	

6/29/20	Monday	Trade calls using Bollinger Band	
6/30/20	Tuesday	Trained a classification model and predicted calls	
7/1/20	Wednesday	Algorithm Trading using Classification	
7/2/20	Thursday	Creation and Testing of the trading algorithm	
7/3/20	Friday	Submission of week 4	
7/4/20	Saturday	BREAK	WEEK 5
7/5/20	Sunday	BREAK	
7/6/20	Monday	Study of Modern Portfolio Theory	
7/7/20	Tuesday	Study of Sharpie Ratio	
7/8/20	Wednesday	Worked on Mordern Portfolio theory	
7/9/20	Thursday	Worked on Mordern Portfolio theory	
7/10/20	Friday	Submission of Week 5	
7/11/20	Saturday	BREAK	WEEK 6
7/12/20	Sunday	BREAK	
7/13/20	Monday	Study of Diverse Portfolio Analysis	
7/14/20	Tuesday	Creation of Diverse Portfolios	
7/15/20	Wednesday	Data Exploration of Diverse Portfolio	
7/16/20	Thursday	Clustering for Diverse Portfolio Analysis	
7/17/20	Friday	Submission of Week 6	
7/18/20	Saturday	BREAK	WEEK 7
7/19/20	Sunday	BREAK	
7/20/20	Monday	Internship Report Finalization	
7/21/20	Tuesday	Internship Report Finalization	
7/22/20	Wednesday	Intership Completion Interveiw	
7/23/20	Thursday	Internship Completion Interveiw	
7/24/20	Friday	ALL DONE!!!	WEEK 8

CERTIFICATE