Introduction to Technical Analysis & Algorithmic Trading

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Annuity: Finance Club of IIT Gandhinagar

Yes, we exist! And intend to become more active :)

Some expectations for the session

- We do not expect any background in finance. We will teach the basics here :)
- However, interest/passion/curiosity in/for finance is a must!
- This is not a get-rich-quick scheme. We are merely teaching a way to analyse financial securities
- Some basic coding is advantageous. Hope you have Jupyter Notebook installed in your laptops

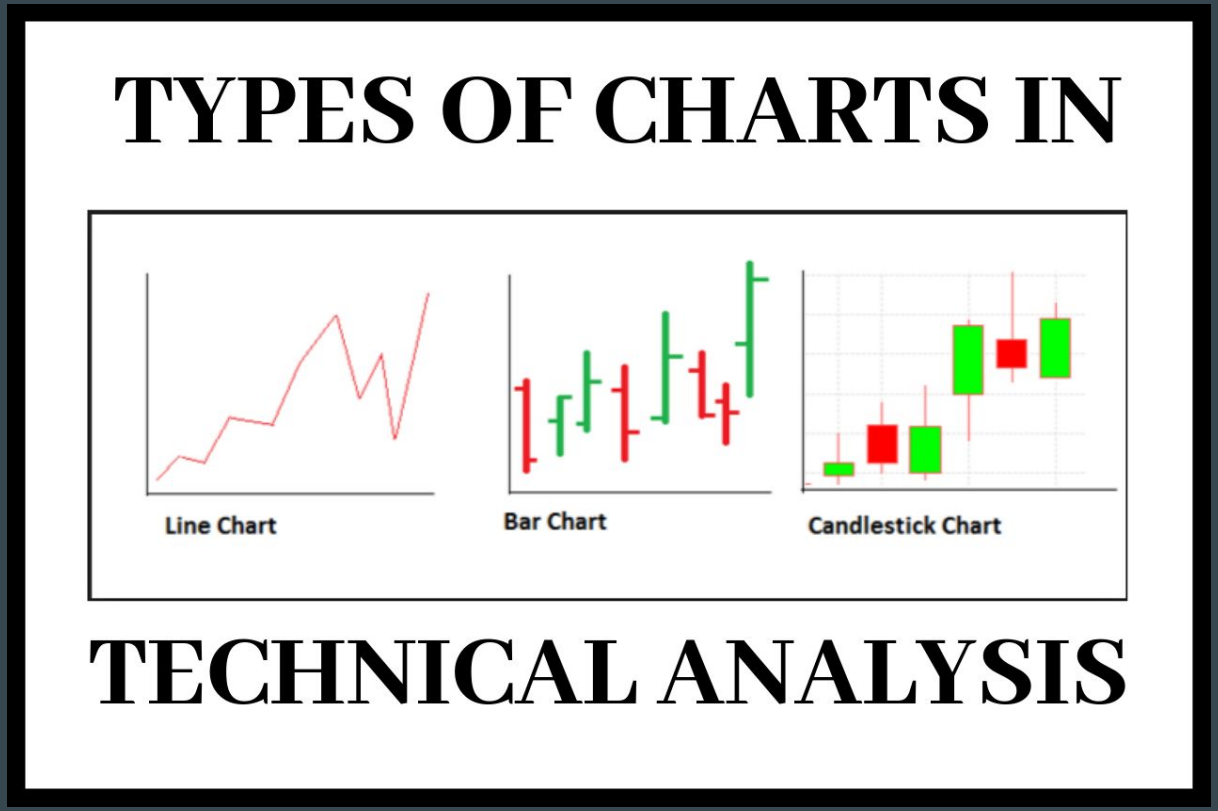
What is Technical Analysis?

- Technical analysis is a means of examining and predicting price movements in the financial markets, by using historical price charts and market statistics.

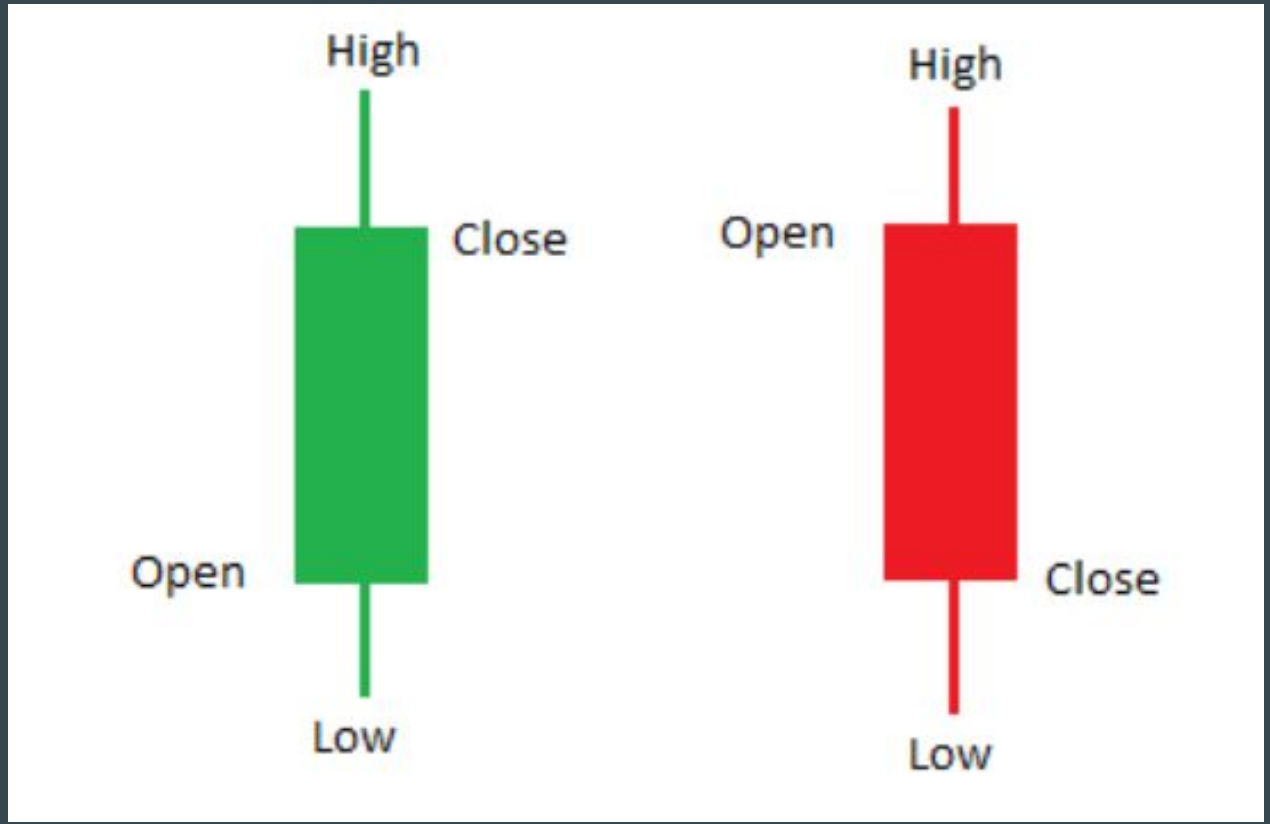
- Behavioral finance? Relies on the assumption that market prices tend to follow certain patterns on basis of the irrationality of human behavior (markets strongly influenced by trader's emotion)

- Efficient market hypothesis and its parts

Too much jargon? Let's start with basics...



Candlestick charts are the most useful!



More on Candlesticks

Candlesticks represent 5 main pieces of information - O C H L V

On a particular chart, a candlestick will represent the price movement in a particular duration - 5 min, 30 min, 1 day, etc.

O-Opening Price

C- Closing Price

H- Highest Price in the interval

L- Lowest Price in the interval

V- Volume of trades in the interval (number of buy+sell orders, metric for activity)

Now what? Why do I care about these candlesticks?

- Simple, it's all about money! (And of course finding patterns in financial data; More patterns → More money)

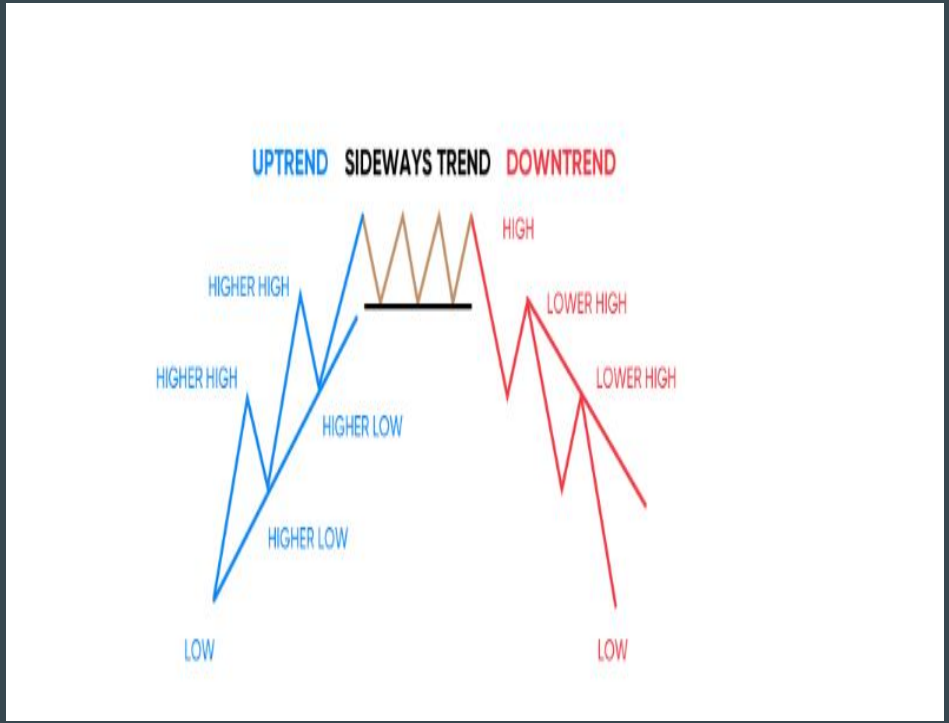
- But what in the world are patterns? And how do I find them? Based on the time-tested principle of "History tends to repeat itself"

- Also, they are of two types: Single and Multi candlestick patterns

- "Charts really are the 'footprint of money."

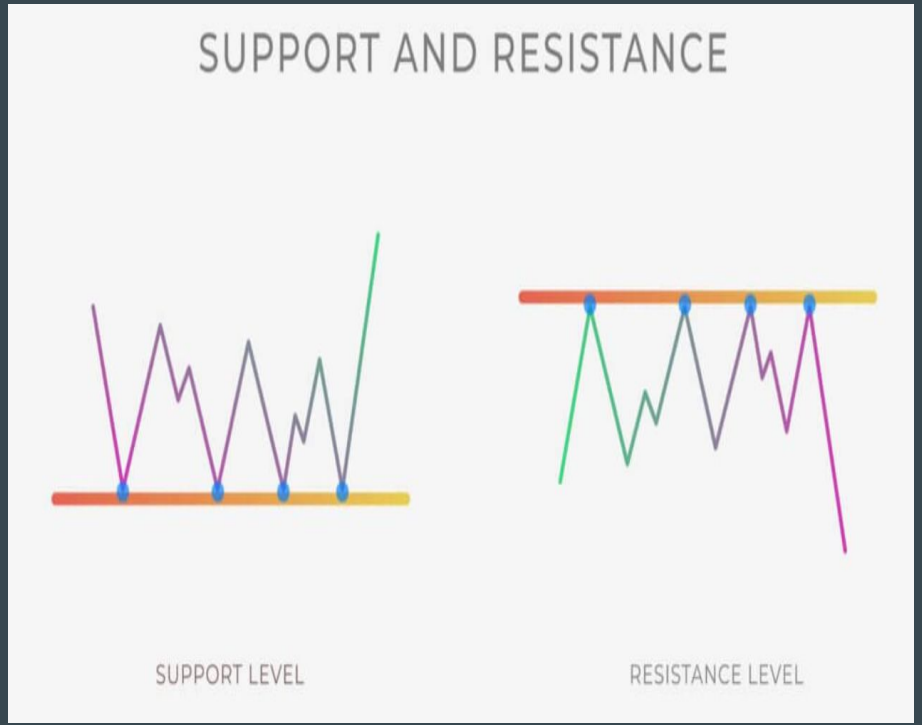
Trending Markets- Uptrend and Downtrend

- The market for a security is said to be trending if the prices for it continually close either higher or lower for a number of trading periods. The market could be in an uptrend or a downtrend.
- An uptrend is identified by a succession of higher highs and higher lows in asset prices.
- A downtrend will be the opposite - lower highs and lower lows.



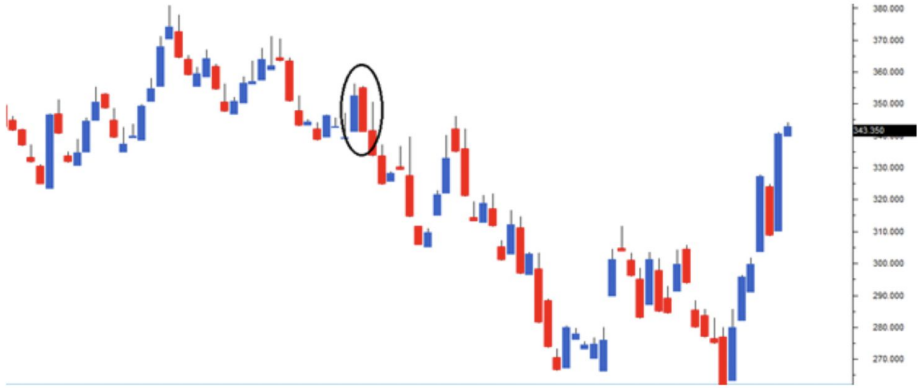
Support and Resistance

- Support and resistance ar price points on a chart that favour reversal in trends.
- After a continuous downtrend, the demand to acquire assets at bargain prices keeps rising till the demand eventually exceeds the selling pressure. This causes a reversal in the downtrend of an asset. The point is called Support.
- When an asset price rises in an uptrend, soon the asset becomes overbought and the demand to purchase it at higher prices diminishes. The supply via selling pressure will soon exceed the demand resulting in a resistance level. This is a Resistance point/region.



Some single chart patterns

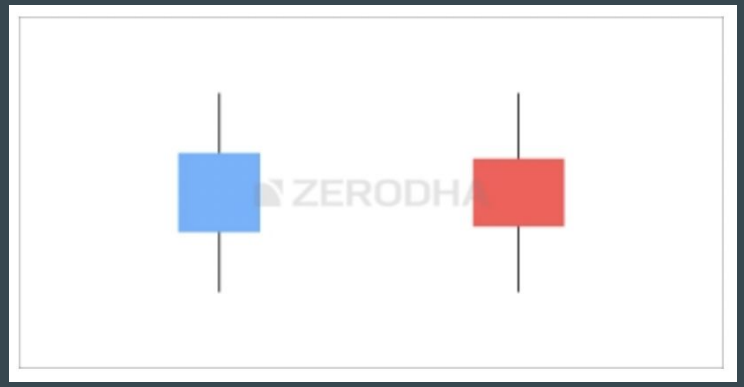
In the chart above (ACC Limited), the encircled candle is a bullish marubozu. Notice the bullish marubozu candle does not have a visible upper and a lower shadow. The OHLC data for the candle is: Open = 971.8, High = 1030.2, Low = 970.1, Close = 1028.4



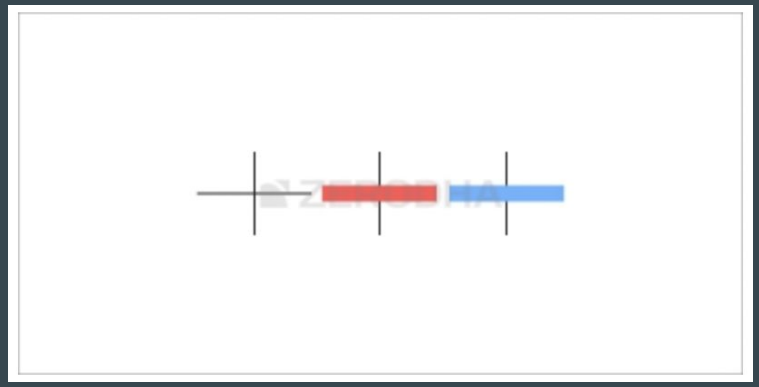
In the chart above (BPCL Limited), the encircled candle indicates the presence of a bearish marubozu. Notice the candle does not have an upper and a lower shadow. The OHLC data for the candle is as follows:

Bullish/Bearish Marubozu

Some single-candle patterns



Spinning tops: Show confusion in market

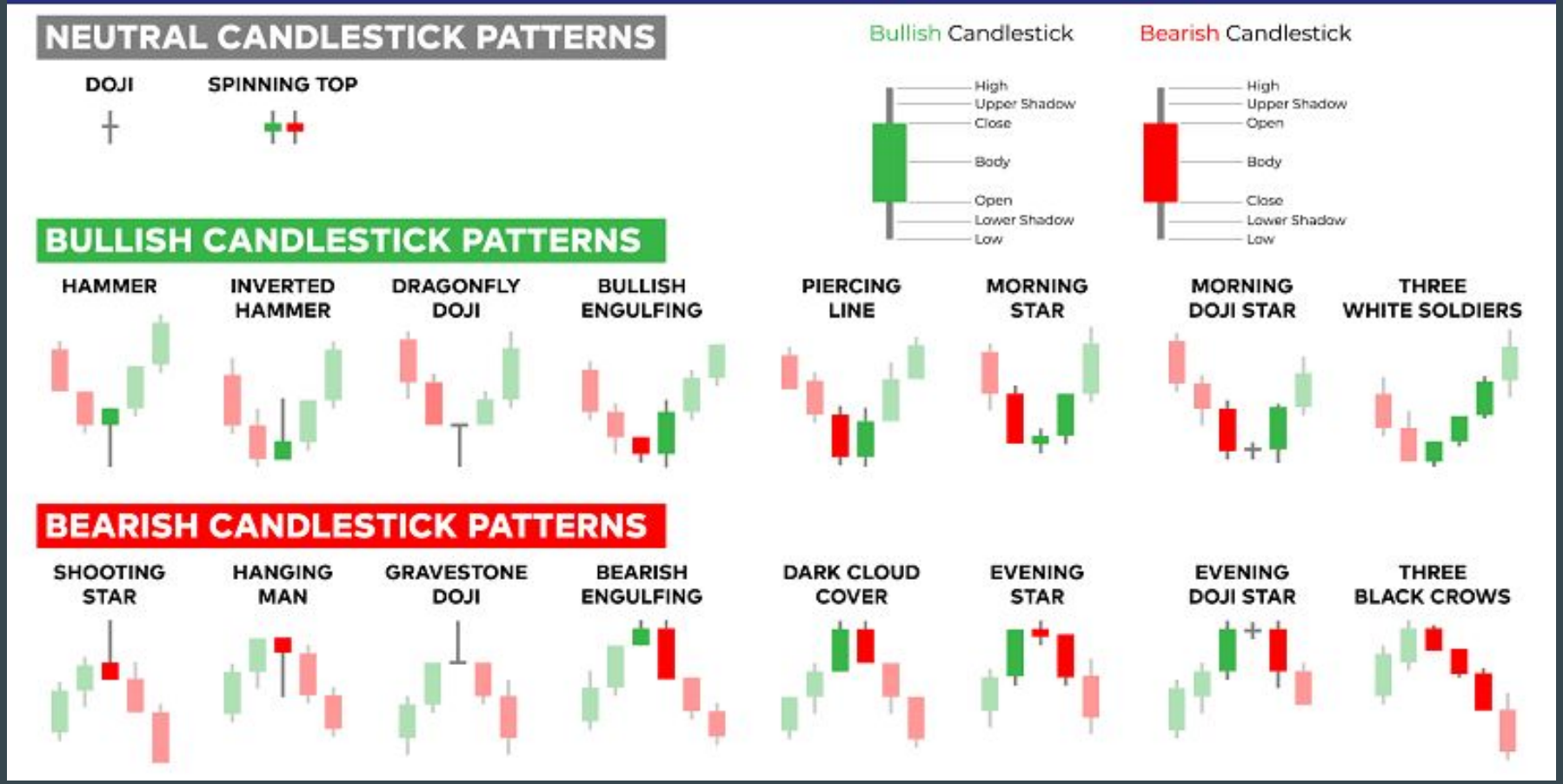


Dojis: Also show confusion in market

Some more single-candle patterns

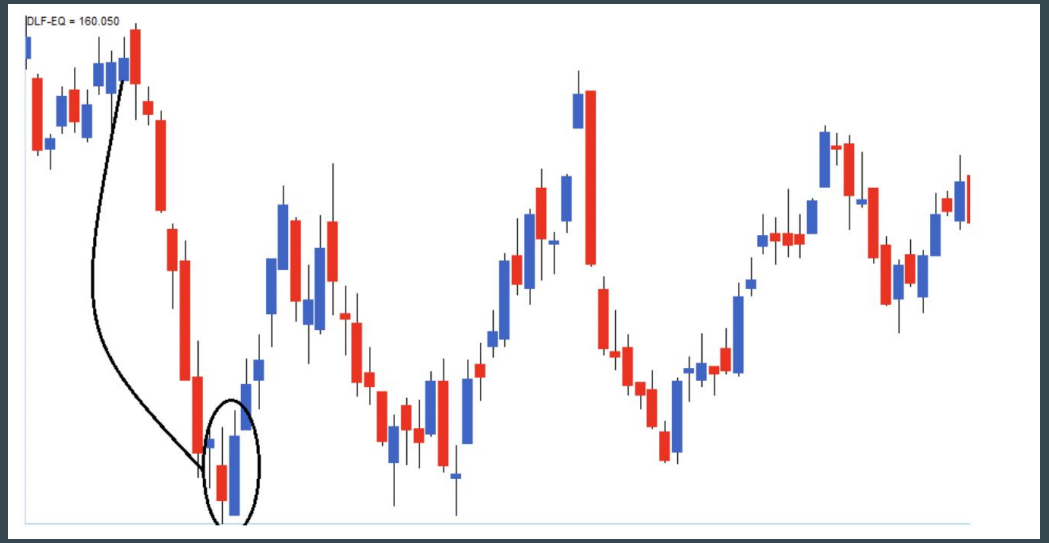
Hanging man,
hammer, shooting star

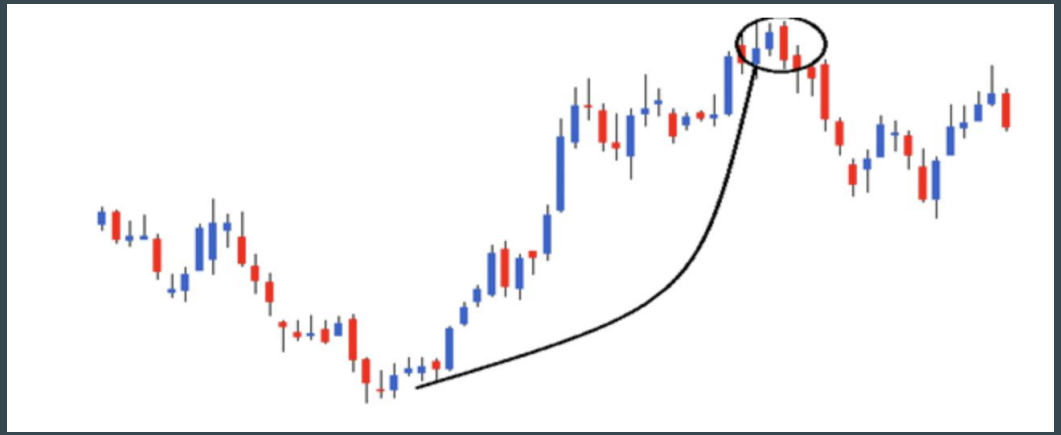
A more extensive list



Some multi-candle patterns

Bullish/Bearish engulfing patterns





Some more multi-candle patterns

Morning star and Evening star

What about volume of stocks?

- Volume can give important information about trends

- A general guideline:

Sl No	Price	Volume	What is the expectation?
01	Increases	Increases	Bullish
02	Increases	Decreases	Caution – weak hands buying
03	Decreases	Increases	Bearish
04	Decreases	Decreases	Caution – weak hands selling

Now comes the crux: Technical Indicators

- What are **technical indicators**?: Technical indicators are heuristic or pattern-based signals produced by the price, volume, and/or open interest of a security or contract.

- Removing the jargon: A mathematical pattern derived from historical data to predict future prices

- Mathematically quantifies the previous patterns.

- This makes it easier to incorporate them in any algorithmic trading strategies.

Types of Technical Indicators

- **Trend indicators:** These indicators can help point out the direction of the trend and can tell us if a trend actually exists. Eg: Moving averages, Ichimoku, ADX, etc.

- **Oscillator indicators:** Oscillators give traders an idea of how momentum is developing on a specific currency pair. When price treks higher, oscillators will move higher. When price drops lower, oscillators will move lower. Eg: RSI, CCI, Stochastics, MACD, etc.

- **Volatility indicators:** Measures how large the upswings and downswings. Eg: Bollinger bands, ATR, etc.

- **Support/Resistance indicators:** Based on support/resistance levels. Eg: Pivot points, etc

- **Volume based indicators:** Based on volume of stock traded. Eg: OBV, Chaikin oscillations, etc.

Some Popular Technical Indicators

1) Moving Averages - Simple and Exponential
- SMA- It can have a variable period length, usually 10, 20, 50, 200 day MA.
- An n-day Moving Average is an average of closing prices in the previous n trading days. It provides a constantly updated average price and helps identify trends.
- An increasing value of SMA indicates an uptrend and vice versa

- EMA- It is also an average value of closing prices in the previous n trading days but this is a Weighted Mean. The recent prices are given an exponentially larger weight and so and EMA “lags” lesser than an SMA. It is more responsive to current trends.
- Eg. Price>MA ---> Uptrend ---->buying signal

Mathematical Formulation

$$\text{Simple Moving Average} = \frac{(A_1 + A_2 + \ldots\ldots + A_n)}{n}$$

$$\text{Weightage Moving Average} = (A_1 \times W_1 + A_2 \times W_2 + \ldots\ldots + A_n \times W_n)$$

$$EMA_{Today} = (Value_{Today} \times (\frac{Smoothing}{1 + Days})) + EMA_{Yesterday} \times (1 - (\frac{Smoothing}{1 + Days}))$$

2) RSI- Relative Strength Index

- Indicator for reading the momentum of a market for an asset. Takes values from 0 to 100.
- Conventionally, RSI>70 is an indication of an overbought market and is a selling signal when combined with a resistance point.
- RSI<30 indicates an oversold market and is a buying signal when combined with a support point.

3) MACD- Moving Average Convergence Divergence

- MACD = 12 period EMA - 26 period EMA
- 9 day EMA of MACD is the signal line.
- Whenever MACD crosses above the signal line, it is a bullish signal and when it crosses below, it is a bearish signal.

Some examples of classic trading strategies using indicators

- Golden crossovers Short-term MA crossing long-term MA from below is a bullish signal and vice versa
- RSI & ADX
- RSI & OBV

- In general, try to pick complementary indicators (In this way, your conviction in your strategy would be greater and you won't trade on any random noise which might have crept into data)

Now let’s actually code these strategies, backtest them and measure their performance

Fire up your laptops!

Installations & Dependencies

Download Anaconda from it's website

Open CMD and git clone https://github.com/revantshah24/Annuity_IntroToTAWorkshop

Open Anaconda Powershell and conda install -c conda-forge yfinance/TA-Lib/pandas-datareader

Open new Anaconda Powershell and run Jupyter Notebook command and navigate to the directory called Annuity_IntroToTAWorkshop or Upload the .ipynb files to the Jupyter Server

We also have a competition!

Pick stocks from the following list -

Create a custom strategy for one or more of these stocks in a Jupyter Notebook file.

Backtest the strategy over the past 5 years' data and report returns using initial capital of 1,00,000 strictly.

Upload all the Jupyter Notebooks for the strategies to a Github repository and submit the link to the same by 16th September, 11:59 PM.

Strategies will be judged on two criteria- returns and uniqueness+documentation.

The top two participants will receive "WorldQuant" goodies as prizes!

Few Thumb Rules while making any strategy

1) Try to use a combination of multiple technical indicators (RSI,EMA,MACD,ADX) in parallel with identified support/resistance levels to correctly zero in on opportunities. Use candlestick patterns to identify entry/exit points.
2) Avoid relying too heavily on a particular indicator/pattern.
3) Employ good trading discipline by correctly setting both TARGETS and STOP LOSSES.
4) Try using trailing stop losses like Moving Averages to make the most out of any trade.
5) Sometimes, the best strategies are opposite to conventional wisdom. Moving against the majority of traders can sometimes lead to massive gains.

Some resources

- https://zerodha.com/varsity/module/technical-analysis/ (The best introductory resource out there. Refer in case of an theoretical doubt)
- https://blog.quantinsti.com/
- https://github.com/mr-karan/awesome-investing?fbclid=IwAR2Xglim2xlJ4dcgR4XHwlnTCyIEXELgfHf8yOUMRkVtMJ1HtyA79hY8ccM
- On building and backtesting trading strategies: https://www.youtube.com/watch?v=qLIgx0S8D0w
- Numpy: https://numpy.org/devdocs/
- Pandas: https://pandas.pydata.org/docs/user_guide/index.html#user-guide
- Matplotlib: https://matplotlib.org/stable/users/index.html
- GitHub Repo for workshop: https://github.com/revantshah24/Annuity_IntroToTAWorkshop

Some More Resources and tools for Deploying Your Strategies

1) Extensive backtesting is recommended before deploying any strategy in the live markets.
2) https://kite.trade/ is one way to deploy strategies using Zerodha's Kite Connect API.
3) https://github.com/RomelTorres/alpha_vantage offers APIs to build and test strategies.
4) https://github.com/bhat-aditya/ATFinMarkets-QSTP