Algorithmic Trading in Financial Markets
Intro to Technical Indicators

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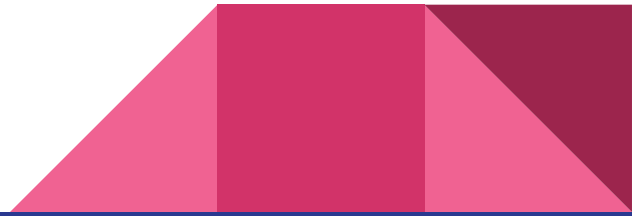
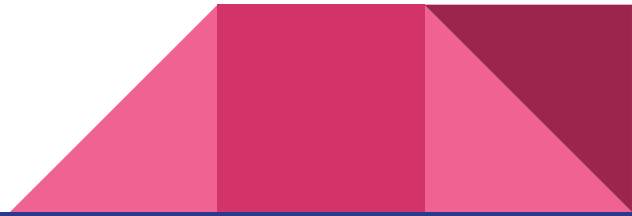


What are technical indicators?

- Mathematical patterns used by traders to predict future price.
- Based on historical price movements.
- Indicator generally have a ‘lag’.
- Technical indicators can be used to create trading strategies.



Moving Average Convergence Divergence (MACD)

- One of the most popular technical indicators.
- Based on exponential moving average (EMA).
- Contains Signal line plotted on top of base line.
- MACD is ‘lagging’ signal.


APPLE INC., 1D, NASDAQ
EMA
EMA
160.00
156.90
152.00
148.00
144.00
140.00
MACD
2.0000
0.0000
Signal Line
Base Line
MACD
May
Jun
Jul
Aug
Created with TradingView

Mathematically

MACD = (12 period EMA) - (26 period EMA)

MACD > 0 => buy

MACD < 0 => sell

Problems:

1. Can give false-positive.
2. Gives wrong signal during rapid rise / fall

Relative Strength Indicator (RSI)

- Evaluates ‘over brought’ or ‘oversold’ conditions.
- Oscillator can move between 0 to 100.

RSI value	**Indication**
0-30	Over sold
30-70	Neutral
70-100	Over brought


VISA INC., 1D, NYSE O142.34 H144.90 L142.32 C144.78 +2.44 (+1.71%)
Post Market
150.00
145.00
140.00
135.00
130.00
125.00
120.00
115.00
RSI 56.6646
Overbought > 70%
Oversold < 30%
80.0000
60.0000
40.0000
20.0000
May
Jun
Jul
Aug
Sep
Oct
Nov

Mathematically

$$RSI\ (step\ one) = 100 - \left[\frac{100}{1 + \frac{Ave\ Gain}{Ave\ Loss}}\right]$$

Ave Gain = Average positive return in last 14 period

Ave Loss = Average negative return in last 14 period

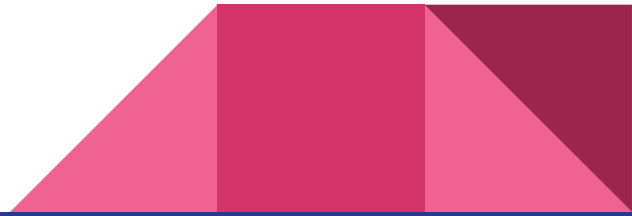
Strategy:

Below 30 -> BUY

Above 70 -> SELL

Bollinger Bands

- Another indicator to generate over-brought / over-sold signal
- Consists of Simple Moving Average (SMA) line along with 2 bands
- If price is trading near upper band, it is over-brought
- If price is trading near lower band, it is oversold




Bollinger Bands
387.69
380.00
370.00
360.00
350.00
344.43
340.00
332.80
330.00
320.00
310.00
301.16
290.00
280.00
270.00
260.00
250.00
240.00
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

Mathematically

- SMA line is 20-day simple moving average line
- The upper Band is +2 standard deviation from SMA
- The lower band is -2 standard deviation from SMA

$$\mathrm{BOLU} = \mathrm{MA}(\mathrm{TP}, n) + m * \sigma[\mathrm{TP}, n]$$
$$\mathrm{BOLD} = \mathrm{MA}(\mathrm{TP}, n) - m * \sigma[\mathrm{TP}, n]$$

where:

$\mathrm{BOLU} = \text{Upper Bollinger Band}$

$\mathrm{BOLD} = \text{Lower Bollinger Band}$

$\mathrm{MA} = \text{Moving average}$

$\mathrm{TP\ (typical\ price)} = (\mathrm{High} + \mathrm{Low} + \mathrm{Close}) \div 3$

$n = \text{Number of days in smoothing period (typically 20)}$

$m = \text{Number of standard deviations (typically 2)}$

$\sigma[\mathrm{TP}, n] = \text{Standard Deviation over last } n \text{ periods of TP}$

Average Directional Movement(ADX)

- Indicator which is used to calculate Trend Strength without regard to the trend direction.
- There are two components of this Indicator which gives us the trend Direction. They are - :
    - Plus Directional Indicator(+DI)
    - Minus Directional Indicator(-DI)

ADX Value	Trend Strength
0-25	Absent or Weak Trend
25-50	Strong Trend
50-75	Very Strong Trend
75-100	Extremely Strong Trend

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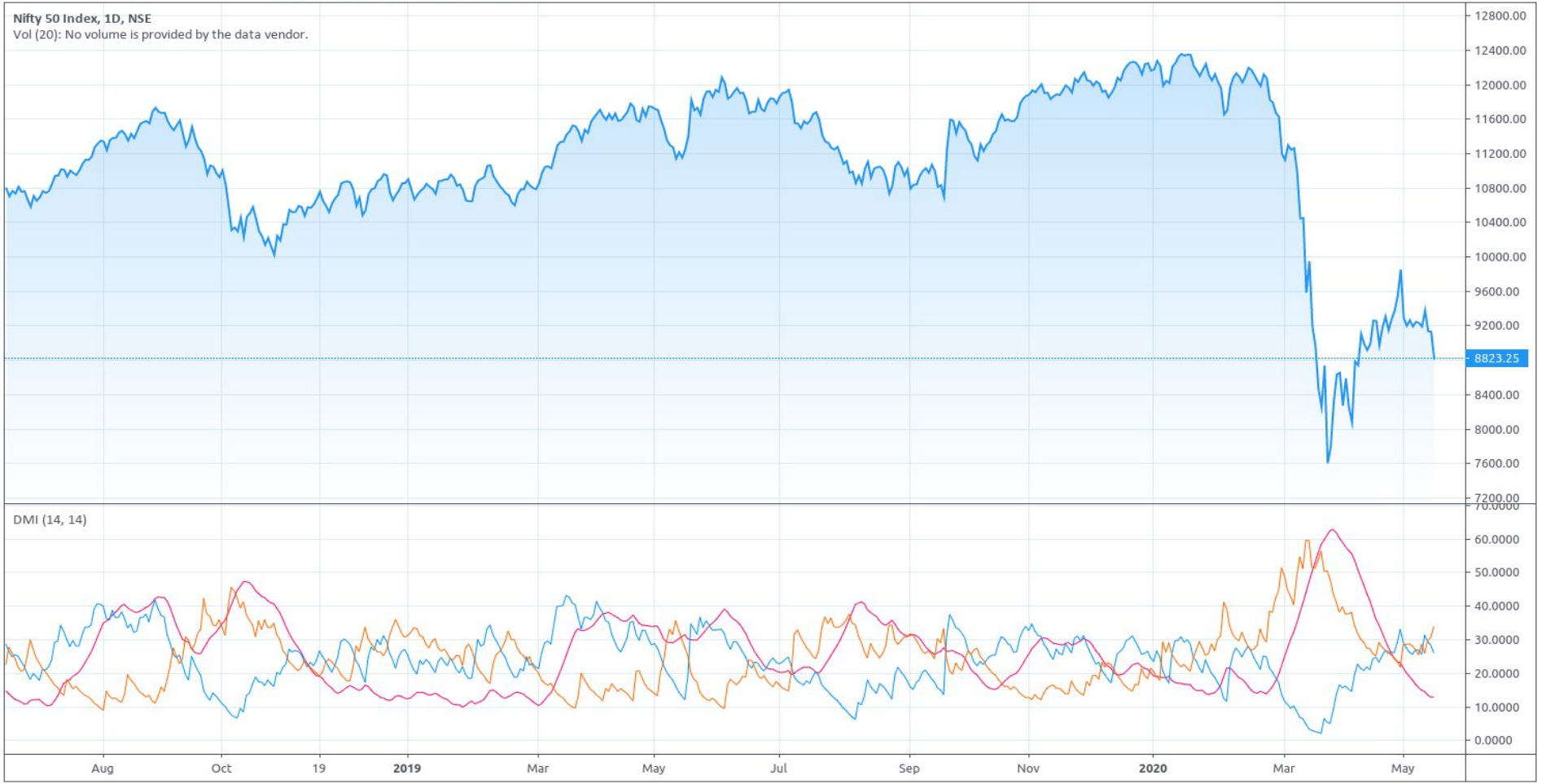
NSE:NIFTY, D 8823.25 ▼ −313.60 (−3.43%) **O:**9158.30 **H:**9158.30 **L:**8806.75 **C:**8823.25



TradingView

Strategy of ADX

- ADX system has three components – ADX, +DI, and -DI
- ADX is used to measure the strength/weakness of the trend and not the actual direction
- ADX above 25 indicates that the present trend is strong, ADX below 20 suggest that the trend lacks strength. ADX between 20 and 25 is a grey area
- A buy signal is generated when ADX is 25 and the +DI crosses over –DI
- A sell signal is generated when ADX is 25 and the –DI crosses over +DI
- Once the buy or sell signal is generated, take the trade by defining the stop loss
- The stop loss is usually the low of the signal candle (for buy signals) and the high of the signal candles (for short signals)
- The trade stays valid till the stoploss is breached (even if the +DI and –DI reverses the crossover)
- The default look back period for ADX is 14 days

Average True Range(ATR)

- It is an Indicator which measures volatility of the market.
- It does not give any idea about the market direction.
- It is typically derived from the 14-day moving average of a series of true range indicators.
- It was initially used in commodities market.

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NSE:BHARTIARTL, D 584.85 ▲ +46.80 (+8.7%) **O:**558.50 **H:**591.85 **L:**557.00 **C:**584.85

TradingView

Mathematically,

$$TR = \text{Max}[(H - L), \text{Abs}(H - C_P), \text{Abs}(L -$$

$$ATR = \left(\frac{1}{n}\right) \sum_{(i=1)}^{(n)} TR_i$$

where:

TR_i = A particular true range

n = The time period employed