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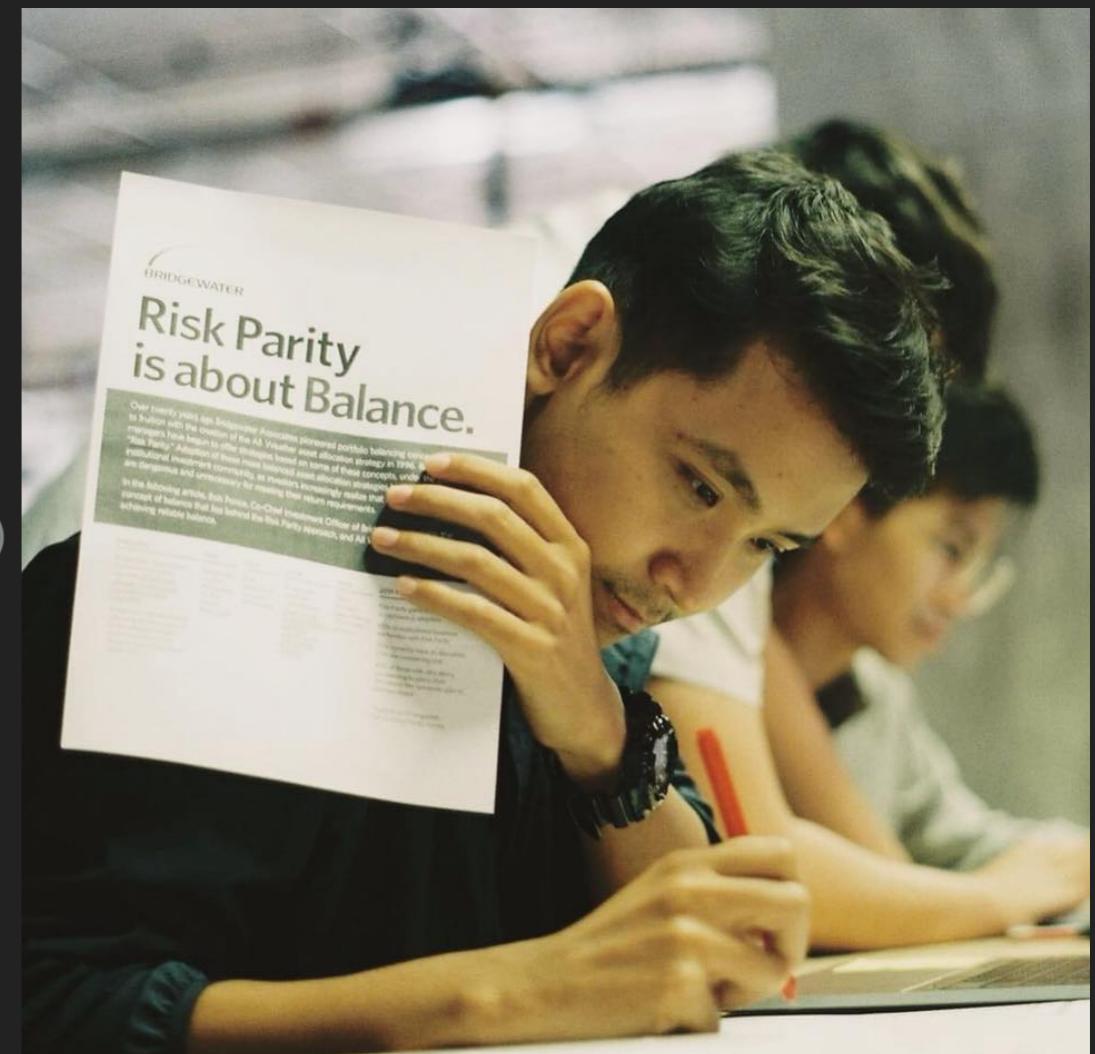
FINDING ALPHA

PYTHON & TALIB

TANAPAT KAMSAIIN Data Scientist @AVA Alpha

PROFILE

- ▶ Big data engineering @DPU
- ▶ Investment consultant @FNSYRUS
- ▶ Proprietary trader 2 years
- ▶ Data Scientist @AVA Alpha Team (present)
- ▶ Founder @PopQuants



PROFILE [LINKEDIN.COM](#)



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More...



Tanapat Kamsaiin

Data Scientist at MarketAnyware, Former : Quantitative Consultant at WorldQuant Bangkok.

Bangkok Metropolitan Area, Thailand · [471 connections](#) ·

[Contact info](#)



MarketAnyware



Dhurakij Pundit University

WHY ALGORITHMIC TRADING

- ▶ Expert Advisors (EA)
- ▶ AI Trading
- ▶ Robot trading
- ▶ High frequency Trading (HFT)
- ▶ Copy Trading

WHY ALGORITHMIC TRADING

- ▶ **Pros:**
- ▶ Minimize emotional trading
- ▶ Allows for backtesting
- ▶ Preserves the trader's discipline
- ▶ Improve your order speed
- ▶ Allows multiple accounts
- ▶ 24/7 Trading hour
- ▶ **Cons:**
- ▶ Mechanical failures can happen
- ▶ Requires the monitoring of functionality
- ▶ Requires more data
- ▶ Can perform poorly
- ▶ Overfitting

ALGORITHMIC TRADING STRATEGIES

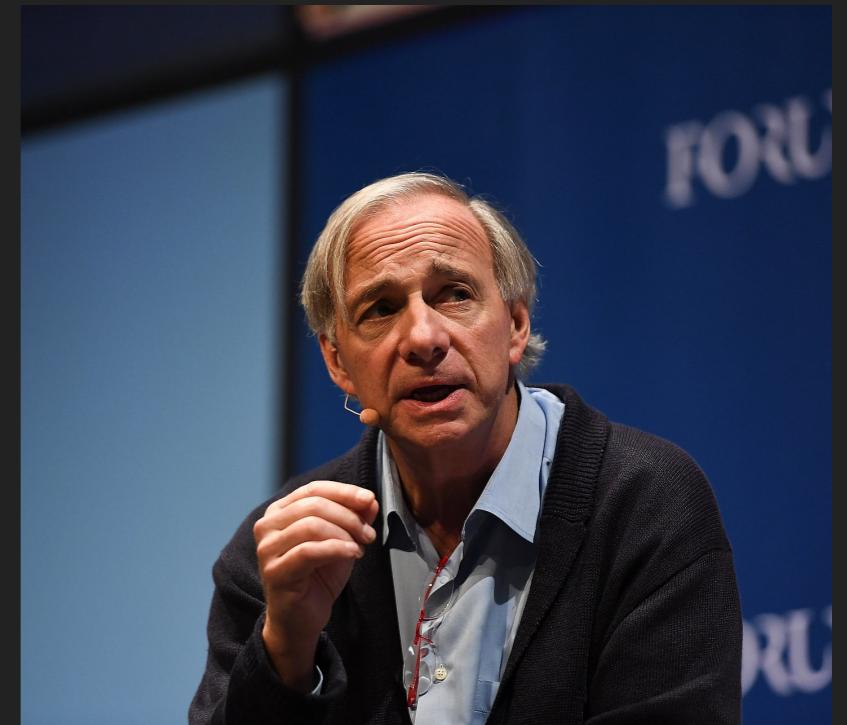
- ▶ Trend-following Strategies
- ▶ Arbitrage Opportunities
- ▶ Index Fund Rebalancing
- ▶ Mathematical Model-Based Strategies
- ▶ Trading Range (Mean Reversion)
- ▶ Volume-weighted Average Price (VWAP)
- ▶ Percentage of Volume
- ▶ High Frequency Trading (HFT)
- ▶ Etc.

ALGORITHMIC TRADING STRATEGIES : EXAMPLES

- ▶ Trend-following Strategies
- ▶ Trading Range (Mean Reversion)
- ▶ Mathematical Model-Based Strategies
- ▶ Technical Analysis [Exercise]

RAY DALIO: BRIDGE WATER MOST SUCCESSFUL HEDGE FUND

- ▶ *Portfolio Return = Cash + Beta + Alpha*
- ▶ Risk parity & All weather Strategy



Ray Dalio : Bridge Water
Association, Principle Author.

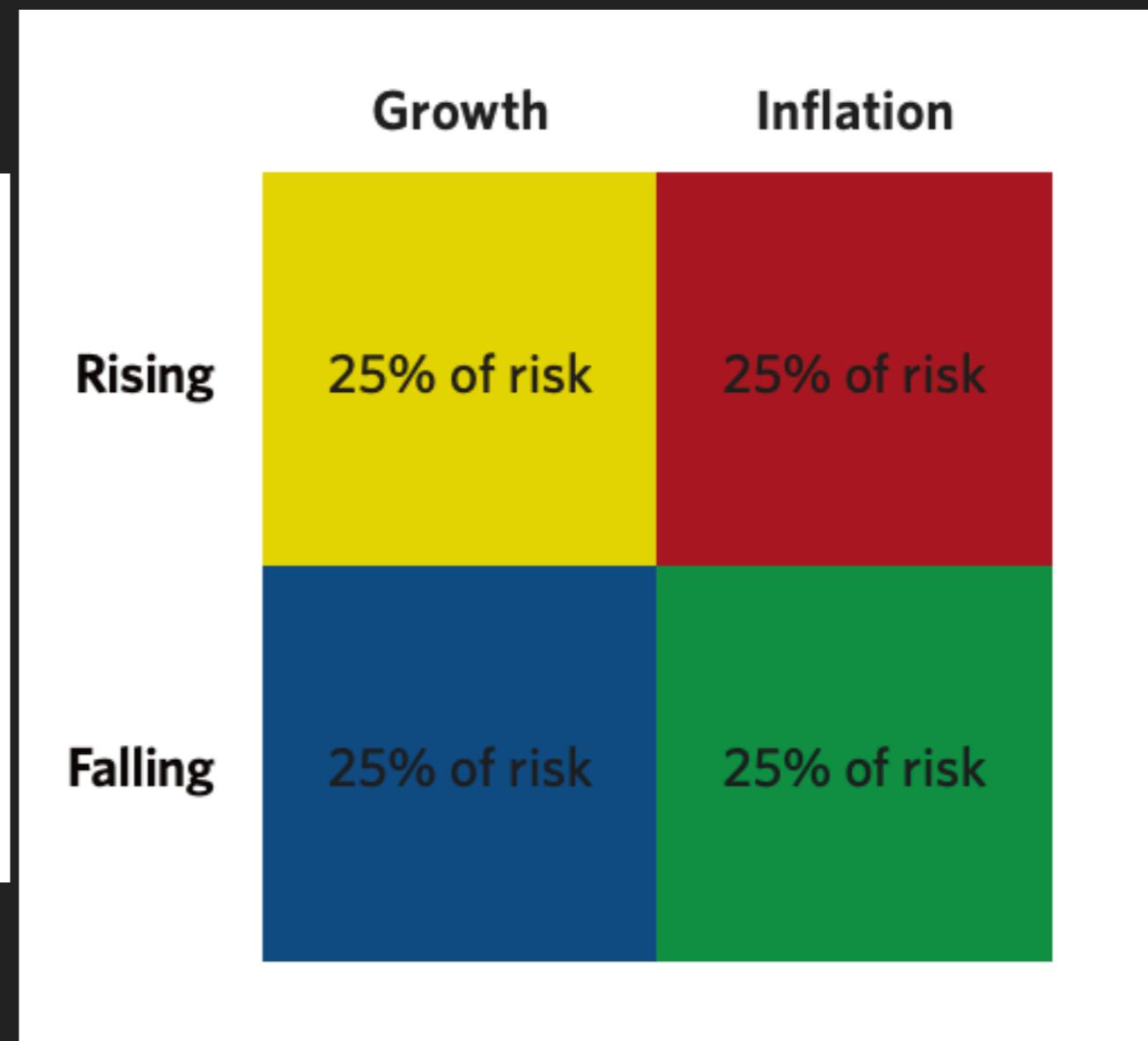
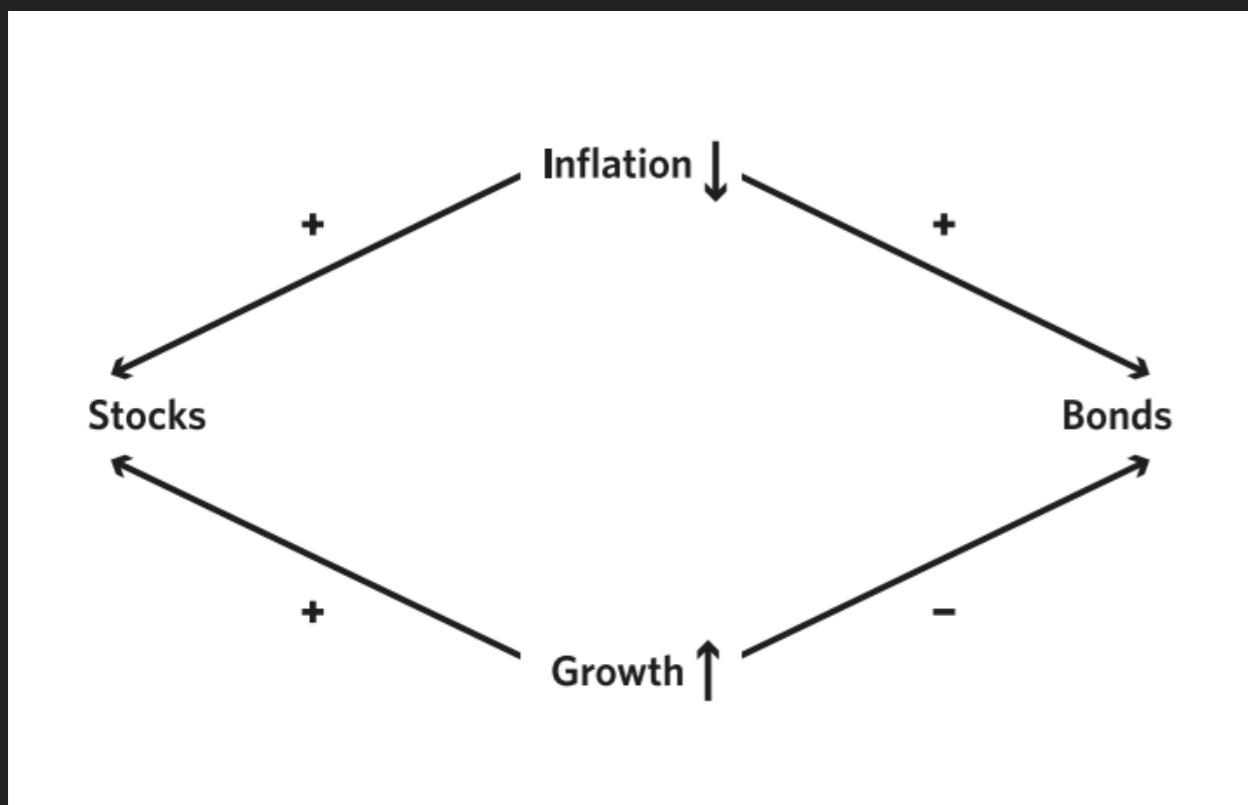
RISK PARITY

BRIDGEWATER

Risk Parity is about Balance.

Over twenty years ago Bridgewater Associates pioneered portfolio balancing concepts that came to fruition with the creation of the All Weather asset allocation strategy in 1996. Recently, several managers have begun to offer strategies based on some of these concepts, under the banner of “Risk Parity.” Adoption of these more balanced asset allocation strategies has surged in the institutional investment community, as investors increasingly realize that concentrated portfolios are dangerous and unnecessary for meeting their return requirements.

RISK PARITY



WHAT IS BETA

- ▶ A stock that swings more than the market over time has a beta greater than 1.0 = **High Beta**
- ▶ A stock beta is less than 1.0 = **Low Beta**
- ▶ High-Beta tend to be Riskier but provide the potential for higher returns; Low-Beta stocks pose less risk but typically yield lower returns.
- ▶ A stock beta 1.0 = Mr. Market

BETA CALCULATE

```
: # Import statsmodels library
import statsmodels.api as sm

# Create a regression model
reg = sm.OLS(data.daily_amazon_returns,
              data.daily_spy_returns)

# Fit the model
results = reg.fit()

# Print the beta of Amazon
print('Beta of Amazon: %.2f' % results.params[0])
```

Beta of Amazon: 1.87

Regression Method : Ordinary least square (OLS)

Syntax:

`OLS(y,x)`

In our case,

`y = daily_amazon_returns`

`x = daily_spy_returns`

$$\beta_i = \frac{\text{Covariance}(R_i, R_m)}{\text{Variance}(R_m)}$$

where,

β_i = Beta of the asset

R_i = Returns of the asset

R_m = Returns of the market

www.investopedia.com

```
In [26]: # Import the numpy library
import numpy as np

# Calculate the covariance of Amazon and S&P500.
Covariance = np.cov(data.daily_amazon_returns,
                     data.daily_spy_returns)[0][1]

# Calculate the variance of S&P500
Variance = np.var(data.daily_spy_returns)

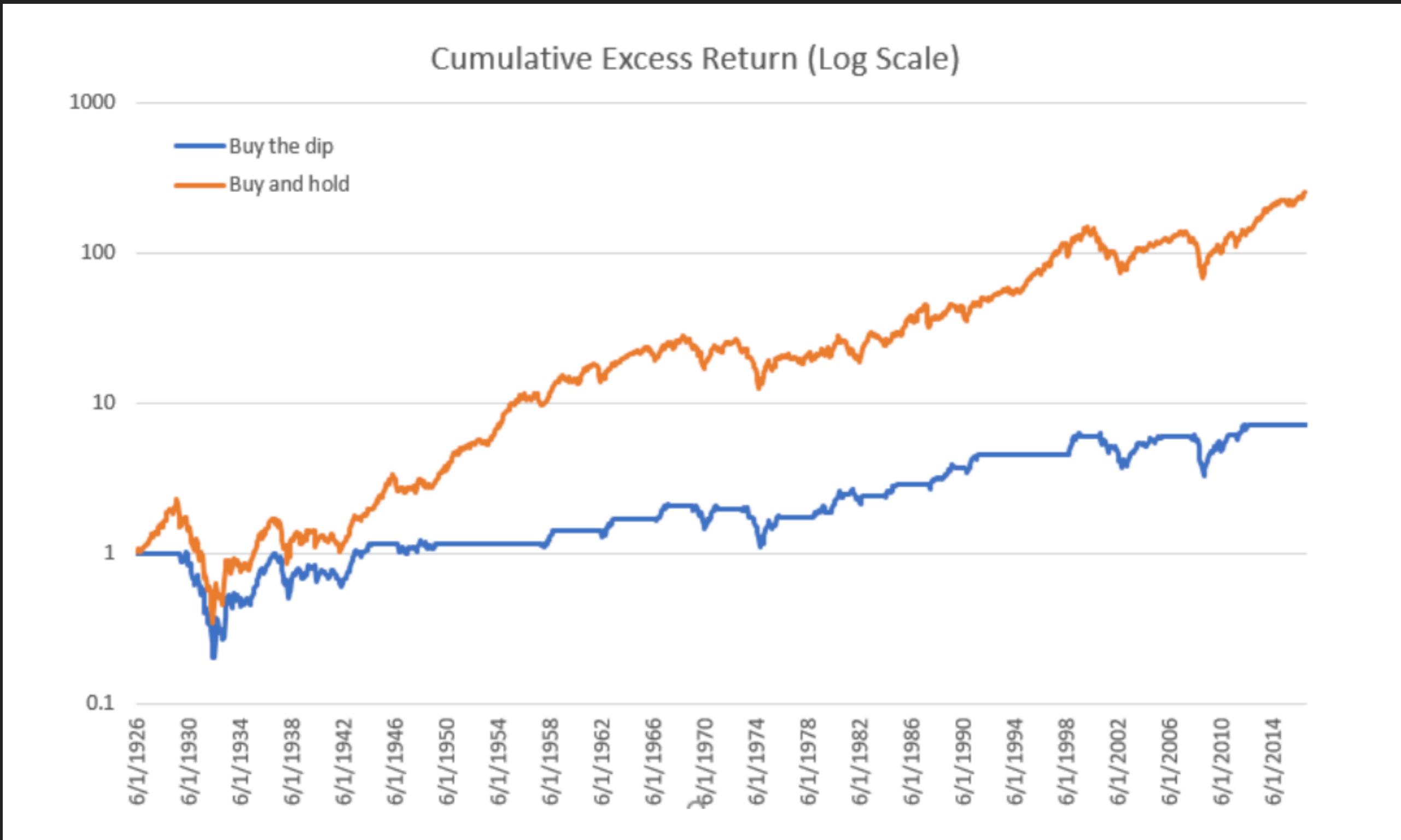
# Print the beta of Amazon
print('Beta of Amazon: %.2f' % (Covariance / Variance))
```

Beta of Amazon: 1.87

Variance-covariance Method

BUY AND HOLD STRATEGY

- ▶ Buy & Hold is a passive investment strategy in which an investor buys stocks and holds them for a long period.



Buy and Hold strategy return

HOW TO CALCULATE BETA FOR A PORTFOLIO

- ▶ Ex. Portfolio has 3 stocks A, B and C with portfolio weights as 10%, 30%, and 60% respectively. The beta of these three stocks is 1.1, 1.3 and 0.8
- ▶ The portfolio beta will be:
- ▶ ***Portfolio beta = 1.1*10%+1.3*30%+0.8*60% = 0.98***

ALPHA

- ▶ Alpha, also known as “Excess return” or “Abnormal rate of return”
- ▶ Is one of the most widely used measures of risk-adjusted performance. The number shows how much better or worse a fund performed relative to a benchmark.

Alpha is a measure of how well an investment performed compared to its benchmark.

ALPHA: HOW IT WORKS?

- ▶ Let's assume you are a Portfolio manager who expects portfolio return 15% next year. And the portfolio actually returns 16%
- ▶ The Alpha of the Portfolio : actual - expect = Alpha
- ▶ Alpha : $16\% - 15\% = 1\%$

ALPHA + CAPITAL ASSET PRICING MODEL (CAPM)

- ▶ $r = R_f + \text{beta} * (R_m - R_f) + \text{Alpha}$
- ▶ Where:
- ▶ r = security's portfolio's return
- ▶ R_f = Risk free rate of return (10 year Bond)
- ▶ beta = Security's or portfolio's price volatility relative to the overall market
- ▶ R_m = The market return

PERFORMANCE METRICS

- ▶ Sharpe ratio
- ▶ Maximum Drawdown

SHARPE RATIO

Formula and Calculation for Sharpe Ratio

$$\text{Sharpe Ratio} = \frac{R_p - R_f}{\sigma_p}$$

where:

R_p = return of portfolio

R_f = risk-free rate

σ_p = standard deviation of the portfolio's excess return

SHARPE RATIO

- ▶ Sharpe ratio adjusts a portfolio's past performance or expected future performance for the excess risk that was taken by the investor.
- ▶ A high Sharpe ratio is good when compared to similar portfolios or funds with lower returns.
- ▶ The Sharpe ratio has several weakness including an assumption that investment returns are normally distributed.

MAXIMUM DRAWDOWN

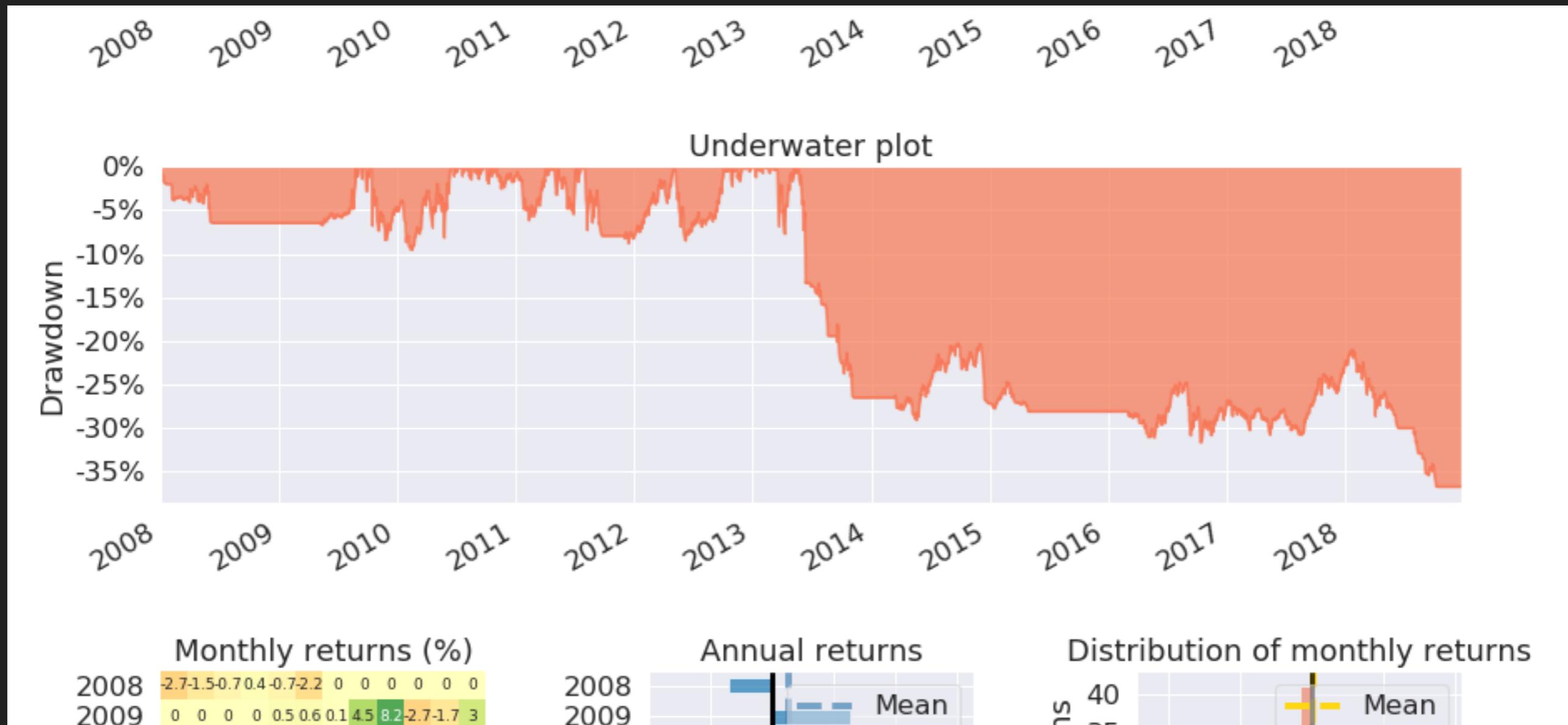
$$MDD = \frac{\text{Trough Value} - \text{Peak Value}}{\text{Peak Value}}$$

Maximum Drawdown Formula. Investopedia

MAXIMUM DRAWDOWN

- ▶ A maximum drawdown is the maximum observed loss from a peak to a trough of a portfolio, before a new peak is attained.
- ▶ Maximum drawdown is an indicator of downside risk over a specified time period.

MAXIMUM DRAWDOWN



TRADING STRATEGIES OVERVIEW

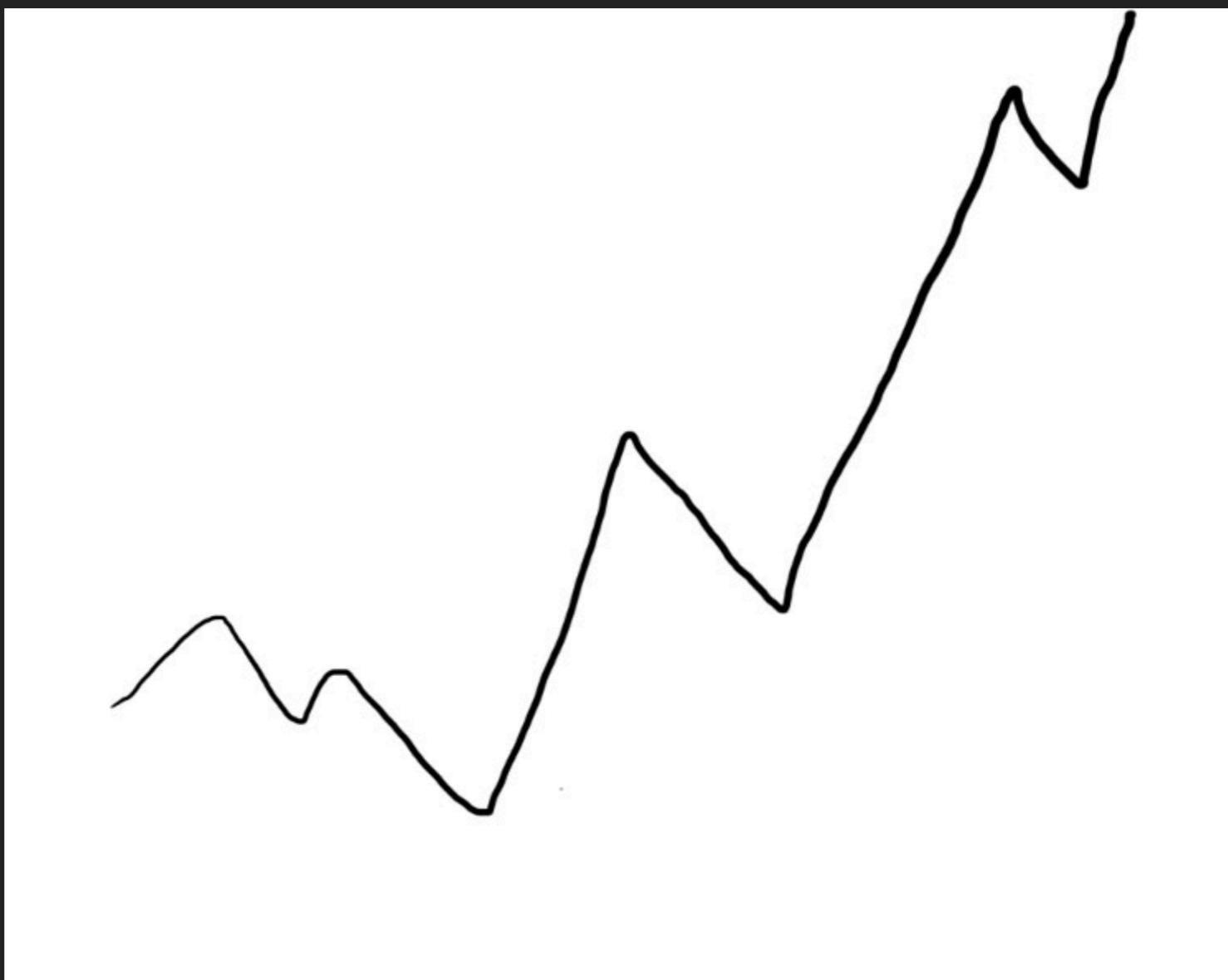
- ▶ Trend-following Strategies
- ▶ Trading Range (Mean Reversion)

TRADING STRATEGIES OVERVIEW

- ▶ Index Fund Rebalancing

TRADING STRATEGIES OVERVIEW

- ▶ Mathematical Model-Based Strategies

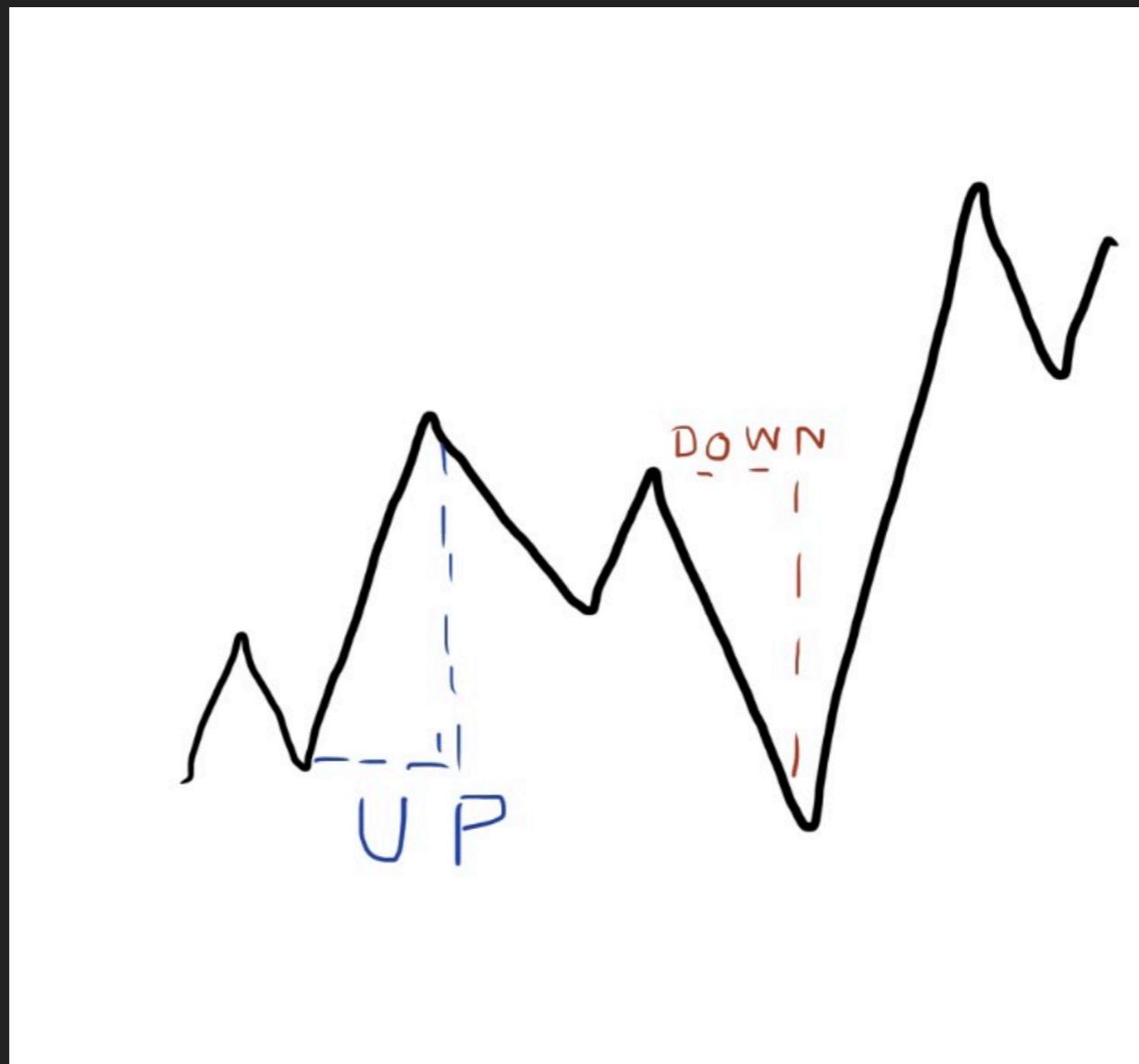


Differential

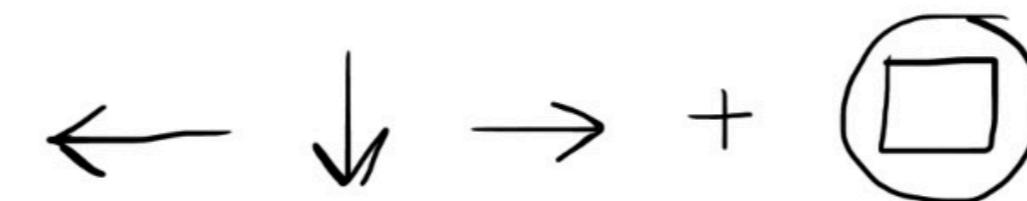
TRADING STRATEGIES OVERVIEW



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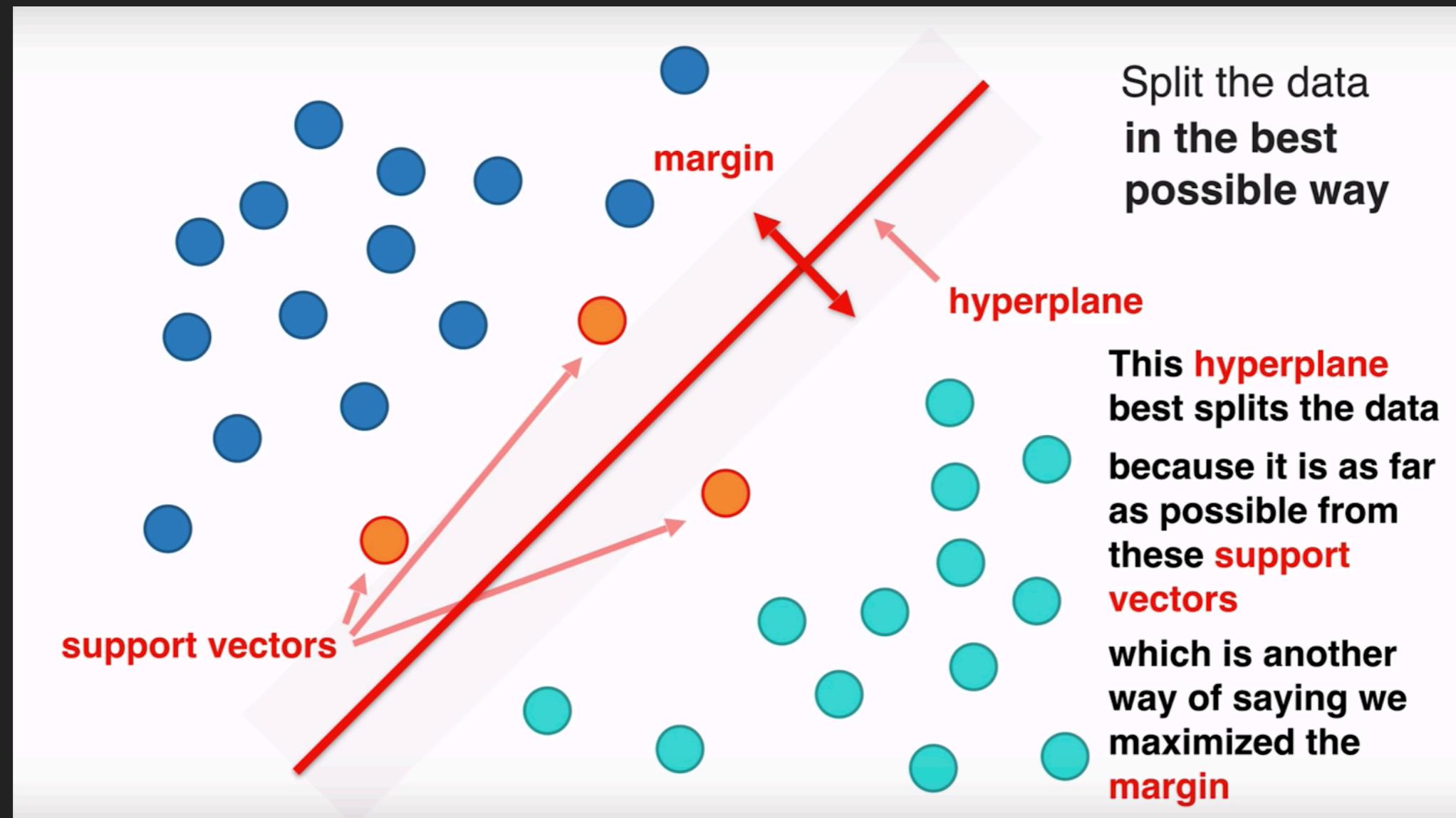
TRADING STRATEGIES OVERVIEW

- ▶ Technical Analysis [Exercise]

MACHINE LEARNING TRADING : SVM

- ▶ Predict signal trading = 1, -1
- ▶ Where : 1 = Buy, -1 = Sell

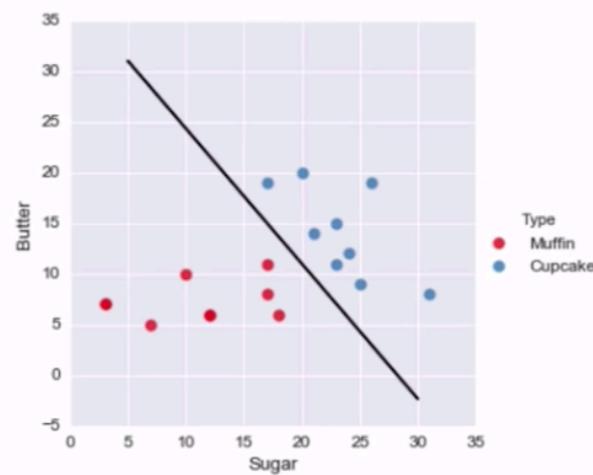
MACHINE LEARNING TRADING : SVM



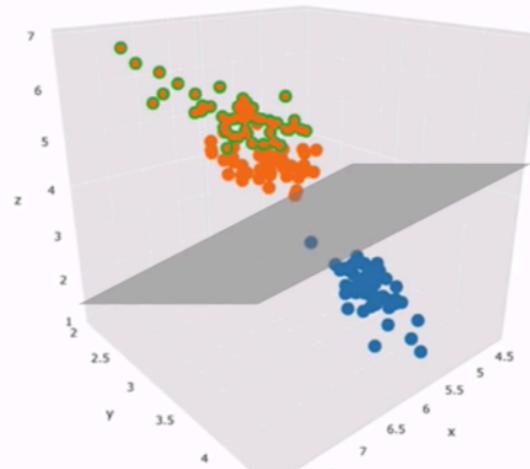
MACHINE LEARNING TRADING

Higher Dimensions: Visual

2D: Separate
with Line



3D: Separate
with Plane



4D+: Separate
with Hyperplane

Hard to
Visualize

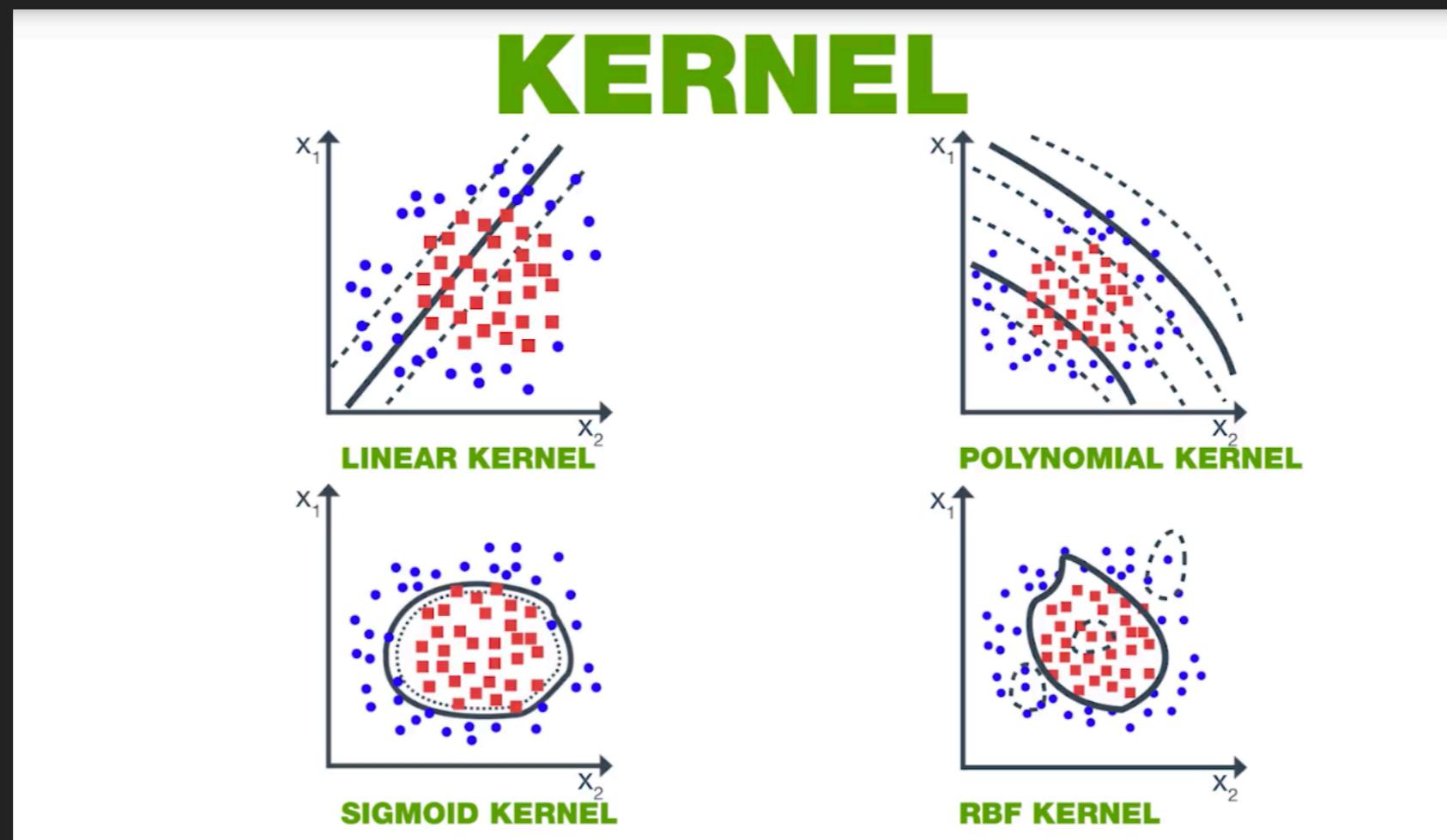
Higher Dimensions

C Parameter

Multiple Classes

Kernel Trick

MACHINE LEARNING TRADING : SVM



MACHINE LEARNING TRADING : SVM

KERNEL

Kernel	Inner Products	Parameters
Linear Kernel	$K(x_i, x_j) = x_i \cdot x_j$	no parameters used
Polynomial Kernel	$K(x_i, x_j) = (1 + x_i \cdot x_j)^d$	d is degree or power of the polynomial. Specified by the user
Sigmoid Kernel	$K(x_i, x_j) = \tanh(\beta_0 x_i \cdot x_j + \beta_1)$	β_0 is slope and β_1 is intercept. Works only for some value of β_0 and β_1
RBF Kernel	$K(x_i, x_j) = \exp(-\gamma \ x_i - x_j\ ^2)$	γ is a positive constant and is equal to $1/2 \sigma^2$ where, σ is a free parameter

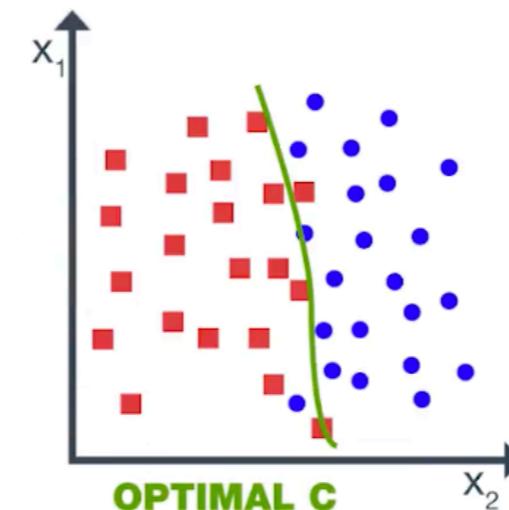
MACHINE LEARNING TRADING : SVM

C PARAMETER

**TRADEOFF BETWEEN CLASSIFICATION OF TRAINING
POINTS AND SMOOTH DECISION BOUNDARY**

LARGE C - MORE SUPPORT VECTORS

SMALL C - LESS SUPPORT VECTORS



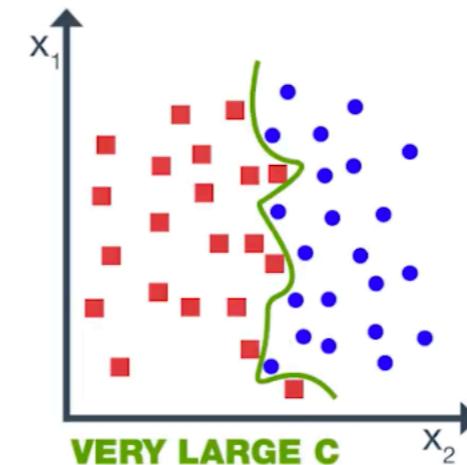
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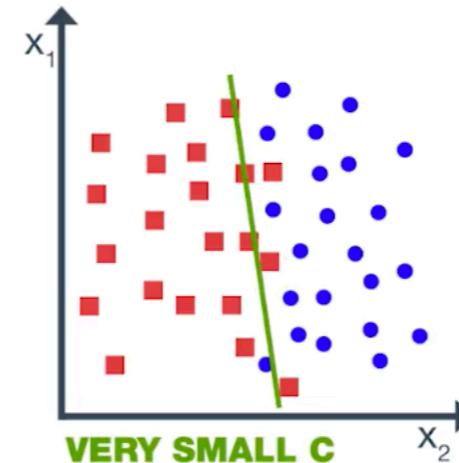
MACHINE LEARNING TRADING : SVM

C PARAMETER

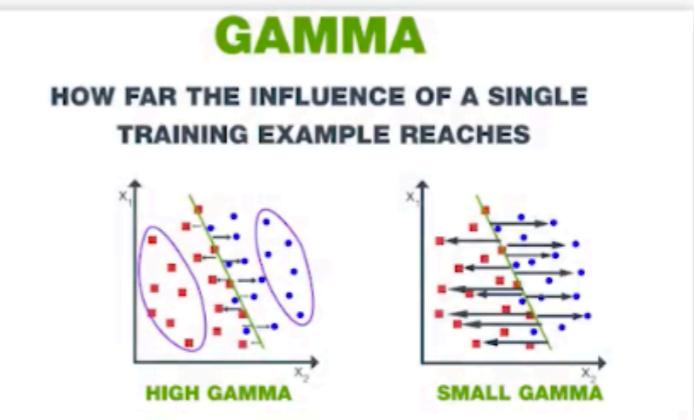
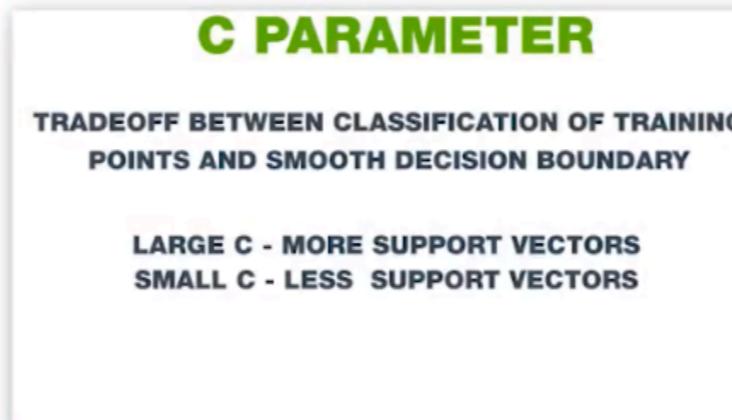
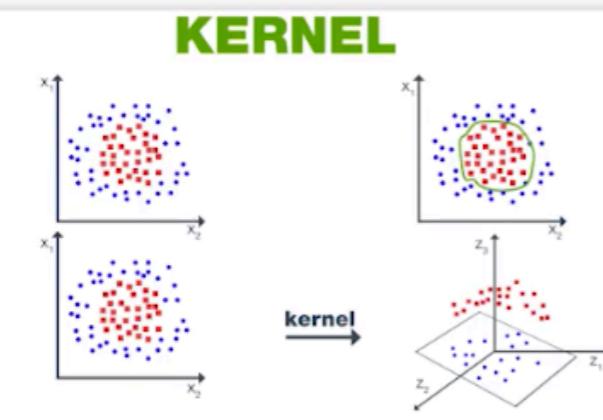
**TRADEOFF BETWEEN CLASSIFICATION OF TRAINING
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LARGE C - MORE SUPPORT VECTORS

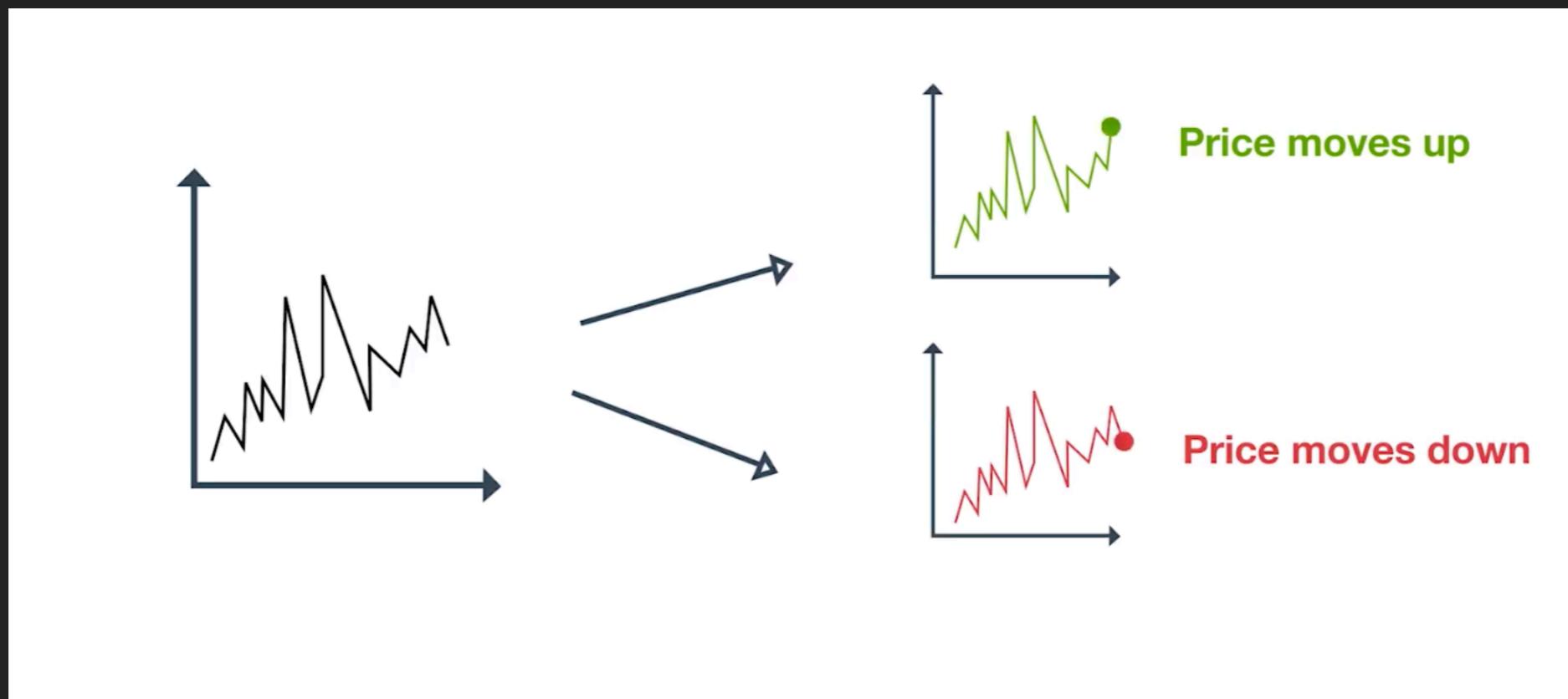
SMALL C - LESS SUPPORT VECTORS



MACHINE LEARNING TRADING : SVM



MACHINE LEARNING TRADING : SVM



MACHINE LEARNING TRADING : SVM

MACHINE LEARNING TRADING : SVM

MACHINE LEARNING TRADING : SVM

PLAY GROUND

- ▶ Quantopian
- ▶ Quanstart
- ▶ Quantconnect
- ▶ Quandl

