Notes

Dependence

* Dependence refers to a situation where the value of one variable influences or is influenced by another variable.
* In other words, if two variables are dependent, knowing the value of one gives information about the value of the other.

Types of Dependence

* Functional Dependence (Deterministic Relationship)
  + One variable is completely determined by the other.
  + Example:
    - The area of a circle depends on its radius.
    - The distance traveled depends on speed and time.
  + In these cases, there is no randomness-one variable always determines the other.
* Statistical Dependence (Probabilistic Relationship)
  + One variable influences another, but not in a fixed mathematical way.
  + Example:
    - Stock prices & interest rates: When interest rates rise, stock prices fall, but not always.
    - Exercise & weight loss: More exercise usually leads to weight loss, but not in a perfectly predictable way.
  + In these cases, there is randomness, and the relationship is analyzed using correlation or regression.
* Measuring Dependence:
  + To measure dependence between two variables, we use statistical techniques:
    - Covariance:
      * Measures how two variables change together.
      * Interpretation:
        + Positive Covariance – As one variable increases, the other increases.
        + Negative covariance – As one variable increases, the other decreases.
        + Zero covariance – No relationship
    - Problem with covariance – It depends on the scale of the data and is hard to interpret.
    - Pearson Correlation (Standardized Dependence Measure)
      * Removes the scale issue in covariance by normalizing values.
      * Range:
        + R = 1; Perfect positive dependence
        + R = -1; Perfect negative dependence
        + R = 0; No dependence
      * Correlation is a better measure of dependence than covariance.
    - Spearman’s Rank Correlation (Monotonic Dependence)
      * Measures non-linear dependence.
      * If one variable always increases when the other increases, even if not at a constant rate, Spearman’s correlation captures it.
* Dependence vs. Independence
  + If two variables are. Dependent, they are related in some way.
  + If two variables are independent, knowing one gives no information about the other.

Problem Statement:

* Aim to develop a volume-based stock trading strategy that identifies buy and sell signals based on trading volume spikes and price trends. The goal is to determine whether unusual trading activity predicts price movements, allowing traders to make informed decisions.

Solution:

* Simulated 1 year of stock market trading data, including trading volume and stock prices.
* Calculated moving averages (10-day, 50-day) and volume spikes (20-day average).
* Define Buy/Sell Signals.
  + Buy Signal: When trading volume spikes and short-term prices trend is upward.
  + Sell Signal: When trading volume spikes and short-term price trend is downward
* Visualized stock price trends with buy and sell markers to confirm signal accuracy.
* Extracted trade recommendations, listing entry/exit points based on volume-price dependence.

Outcome

* The strategy effectively identifies volume-driven price trends, helping traders time their trades based on the market activity.
* It can be extended for real stock data and back testing to assess profitability.