From Stationarity to Deep Learning: A Comparative Framework for Stock Price and Volatility Forecasting

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Time-Series Model

Introduction

A time series model specifies how the random variables $\{X_t\}$ behave jointly over time. This can be done in two main ways:

1. **Full Joint Distribution:** The model might completely specify the joint probability distribution of $\{X_t\}$.
2. **Moments (Means and Covariances):** In many practical situations, especially when dealing with linear processes or Gaussian assumption: it is sufficient to specify just the means and covariances (or autocovariances) of the process. This is because for Gaussian processes, the mean and covariance completely determine the joint distribution.

! Definition

A **time series model** for the observed data $\{x_t\}$ is a specification of the joint distributions (or possibly only the means and covariances) of a sequence of random variables $\{X_t\}$ of which $\{x_t\}$ is postulated to be a realization. Here, x_t is the single outcome of stochastic process X_t.