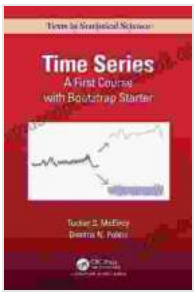
Time Series First Course With Bootstrap Starter: A Comprehensive Guide

Time series analysis is a powerful statistical technique used to analyze and forecast data that is collected over time. It finds applications in various fields such as finance, healthcare, and environmental science. This comprehensive guide will provide a thorough understanding of time series analysis, focusing on the fundamentals and practical implementation using the Bootstrap Starter library in Python.

Time series data consists of observations collected sequentially over time, with each observation representing the value of a variable at a specific point in time. Key characteristics of time series data include:

- **Trend:** A long-term increase or decrease in the data.
- **Seasonality:** Regularly повторяющиеся patterns, such as daily, weekly, or yearly cycles.
- **Stationarity:** The statistical properties of the data remain constant over time, meaning the mean, variance, and autocorrelation are not changing.

Bootstrap Starter is a Python library that provides intuitive and powerful tools for time series analysis. It enables you to:



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- Visualize time series data to identify patterns and trends.
- Decompose time series into trend, seasonality, and residual components.
- Fit and evaluate time series forecasting models.

Time series forecasting models predict future values based on historical data. Common models include:

- **Autoregressive Integrated Moving Average (ARIMA):** Models that combine autoregressive (AR) and moving average (MA) components.
- **Seasonal Autoregressive Integrated Moving Average (SARIMA):** ARIMA models with seasonal components.
- **Exponential Smoothing (ETS):** Models that capture trend and seasonality using exponential smoothing.

Let's explore some hands-on examples to illustrate the power of Bootstrap Starter:

Example 1: Visualizing a Time Series

python import bootstrap_starter as bs import pandas as pd

Load time series data

data = pd.read_csv('time_series_data.csv', index_col='Date', parse_dates=True)

Visualize the time series

bs.plot_time_series(data['value'])

Example 2: Decomposing a Time Series

python

Decompose the time series

decomposition = bs.decompose_time_series(data['value'], seasonality_period=7)

Plot the decomposed components

bs.plot_decomposition(decomposition)

Example 3: Forecasting with ARIMA Model

python

Fit an ARIMA model

model = bs.fit_arima(data['value'], order=(1, 1, 1))

Forecast future values

forecast = model.forecast(steps=12)

Plot the forecast

bs.plot_forecast(data['value'], forecast)

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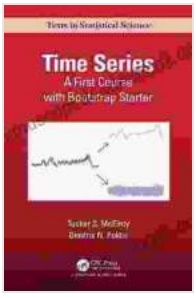

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by Sarah Bennett

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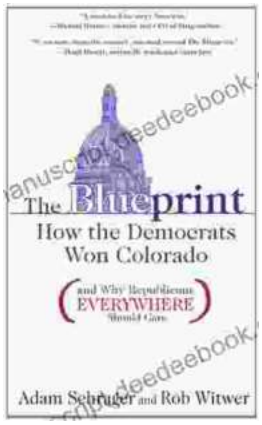

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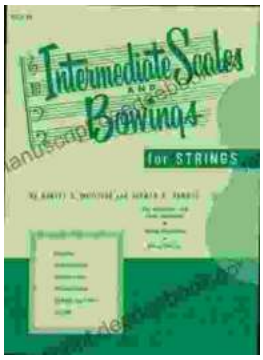

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