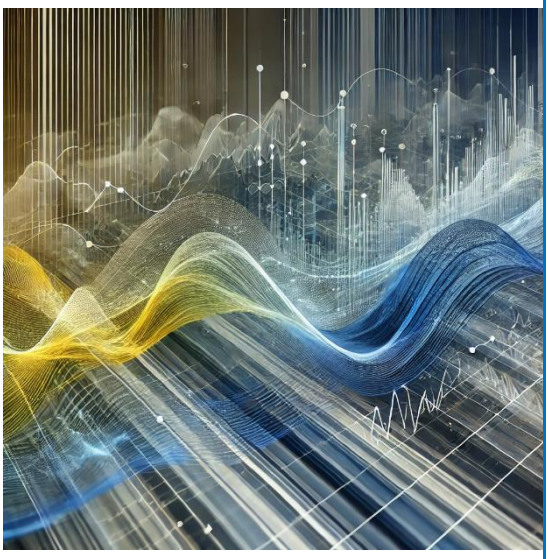
Geometric Progression

We Bring AI to Reality.

Time Series Analysis using Python:

Master Time Series Techniques from the Basics to Advanced with a Focus on Financial Applications

Overview



Welcome to our comprehensive course on Time Series Analysis with Python, tailored for analysts, data scientists and business professionals aiming to master time-dependent data analysis. This course equips you with skills essential to tackle real-world time series problems using Python, blending theoretical knowledge with practical, hands-on applications.

Our curriculum is meticulously designed, covering everything from foundational concepts of time series to advanced forecasting models, including ARIMA, SARIMAX and **state-of-the-art classical machine learning and deep learning methods**. The course ensures you gain expertise in Python's time series libraries and frameworks, making you proficient in applying the latest forecasting techniques in diverse domains.

What sets this course apart is the balance of theory and practical exercises. With interactive sessions, you'll not only gain technical skills but also understand the implications of each method in business and analytics settings. Each session is designed to build progressively on the last, allowing for a comprehensive learning experience.

We will use econometric time series data such as inflation and GDP, stock market data such as share prices and yields. If preferred, you can request your own specific data set.

Additional Features:

- Includes Lifetime access to comprehensive electronic course materials, insightful videos, and curated resources for deeper exploration.
- Cheat Sheets.
- Recorded sessions for future reference.

Please refer to the detailed agenda below for more information.

Level	Introduction to Advanced.
Duration	Customized to your needs.
Requirements	Computer with internet access. Contact us for files to download and setup.
Suitable For	Analysts, Data Scientists, Business Professionals, and anyone dealing with time-dependent data.
Not Suitable For	Anyone without a basic understanding of Python or elementary data analysis fundamentals.

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Tutor: Mark Raffaelli CFA, FRM

Mark obtained his **CFA Charter** in 2000 and became a **Fellow of the Global Association of Risk Professionals (FRM)** in 2001. His experience spans:

- **Trading spot and derivative products** professionally.
- **Developing quantitative financial models** for surveillance, performance attribution, price validation, pricing, risk and automation.
- **Building software and mobile apps** for the investment and insurance industries.
- **Applying machine- and deep-learning techniques** (scikit-learn, TensorFlow, PyTorch) to capital-markets problems for banks, asset managers and corporates.
- **Performing time-series analysis, regime-shift detection and optimisation** —with and without AI.
- **Designing next-generation AI solutions**: agent-based workflows, retrieval-augmented-generation (RAG) pipelines and fine-tuned large-language-model tools—built with frameworks such as LangChain, LangGraph and **Model Context Protocol (MCP)**—so clients can move from proof-of-concept to production quickly.
- **Implementing enterprise-scale AI strategies** that turn ideas into measurable value.

Mark has also contributed to the South African bond market, writing pricing and curve specifications for Floating-Rate Notes (FRNs) and Inflation-Linked Bonds (ILBs)—standards still used today—and serving on the Quant Committee for indices and curves.

Known for his engaging style, Mark breaks down technical ideas, removes the jargon and leaves attendees confident to apply what they've learned.

Things delegates have said about this course:

- *From understanding autocorrelation to building complex neural networks for forecasting, this course provided a complete journey through time series analysis with Python. Highly recommended!*
- *I was particularly impressed by the course's coverage of newer methods like N-BEATS and TimeGPT. It truly brings you to the forefront of time series analysis.*
- *This course didn't just teach theory; the hands-on sessions gave me practical experience with cutting-edge forecasting tools.*
- *I specifically attended the course to understand the progression from ARMA to ARIMA and then SARIMA and SARIMAX models. I was however taken aback by the results from using AI to make time series forecasts.*
- *Thanks Mark, the use of Jupyter notebooks with exercises and solutions was very useful.*

Organisations represented at our previous public courses include:

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Detailed Agenda

1. Jargon of Time Series

Delegates will be able to:

- Define and understand key terminology in time series analysis, such as *error*, *trend*, *seasonality and exogenous data*.
- Comprehend *Stationarity* and perform the *ADF test* to check for stationarity in time series data.
- Transforming non-stationary data with differencing and numerous other methods more suited for financial time series such as the fractional differentiation technique.
- Understand *Correlation* in time series data and conduct the *Granger causality test* to determine causal relationships.
- Understand Autocorrelation and run ACF and PCF plots.
- Model a Random Walk.
- Calculate SMA and EWMA in time series.
- Interpret results and understand when to apply each method in forecasting and smoothing.
- Splitting data into training and test sets.
- Understand variations in constructing a time series forecasting model and setting up a baseline.

2. Regressions and its Limitations in Time Series

Delegates will be able to:

- Perform regression analysis on data.
- Recognize and address limitations of linear regressions when used with time-dependent data.

3. Forecasting with Holt-Winters Method

Delegates will be able to:

- Understand the components of the Holt-Winters model.
- Apply the Holt-Winters method to time series data for forecasting.
- Put together some python functions to plot the train, test and predict data.
- Bootstrap confidence intervals and plotting the results.

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4. Autoregressive (AR) & Autoregressive Moving Average (ARMA) Model

Delegates will be able to:

- Develop AR models for forecasting.
- Identify and interpret the autoregressive coefficients and assess model accuracy.
- Build ARMA models for time series data that combines autoregressive and moving average components.
- Evaluate model effectiveness and suitability for various time series patterns.

5. Autoregressive Integrated Moving Average (ARIMA) & Seasonal Autoregressive Integrated Moving Average (SARIMA) Model

Delegates will be able to:

- Implement ARIMA models for non-stationary time series data.
- Differentiate between AR, MA, and ARIMA models and apply model tuning methods.
- Develop SARIMA models for time series data with seasonal patterns.
- Interpret the results of these models

6. ARIMAX & SARIMAX Models

Delegates will be able to:

- Incorporate exogenous variables for enhanced forecasting accuracy.
- Understand and implement ARIMAX and SARIMAX models.
- Interpret the results of these models

7. Vector Autoregression (VAR), VARMA, and VARMAX Models

Delegates will be able to:

- Apply VAR models for multivariate time series analysis.
- Develop VARMA and VARMAX models and interpret multivariate relationships over time.

Please note for the sections of the course that follow, we assume that delegates have an understanding of:

- **Machine learning algorithms using Python and the Sklearn library.**
- **Either Pytorch or Tensorflow for neural network implementation.**

Mark can separately structure an "accelerated AI program" customised for delegates focused on time series if required.

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8. Classical Machine Learning Methods for Time Series

Delegates will be able to:

- Use *Random Forests* for feature selection and forecasting.
- Apply *Support Vector Machines (SVM)* in time series classification.
- Explore *Gradient Boosting* and *XGBoosting* for handling complex time series datasets.

9. Deep Learning Methods

Delegates will be able to:

- Develop models using *Artificial Neural Networks (ANN)* and understand their limitations in time series.
- Implement *Convolutional Neural Networks (CNN)* for pattern recognition in time series data.
- Use *Recurrent Neural Networks (RNN)*, including *LSTMs* for sequential data modelling.

10. Other New Methods

Delegates will be able to:

- Explore *Prophet* for quick and interpretable forecasting.
- Apply *WaveNet* for generative time series modelling.
- Experiment with advanced methods like *N-Hits*, *N-Beats*, *TimeGPT and many more* to make time series predictions.
- Explore and use some of the latest time series algorithms.

Contact us to tailor this Time Series Analysis course to your team's specific needs and datasets.

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