



AI in Time Series Prediction and Forecasting for Real-World Systems (Level 3)

Learning Mode:

Online via Zoom

Duration:

5 Days

This course is specifically designed to provide participants with:

- Explore and preprocess time series data from real systems such as energy, finance, and industrial processes
- Design and implement both baseline and machine-learning forecasting models for real-world prediction tasks
- Construct relevant features and input windows to capture temporal patterns in data
- Train and evaluate LSTM and GRU models for accurate short-term and multi-step forecasts
- Interpret forecasting results, compare model performance, and communicate limitations and risks to support decision-making
- Plan and integrate forecasting models into operational workflows for planning, alerts, and control

Projects and challenges:

The course will include a practical forecasting project such as:

- Energy or PV power forecasting for a building or site.
- Demand forecasting for products or services.
- Predicting a machine health indicator or failure risk based on sensor readings.

Course Overview

SUMMARY

This course provides participants with the knowledge and practical skills to analyze, model, and forecast time series data in real-world applications. Participants will learn to transform raw temporal data from energy systems, industrial processes, finance, and IoT deployments into actionable forecasts using both classical methods and advanced machine learning techniques such as LSTM and GRU networks.

Key topics include time series fundamentals, data preprocessing, feature engineering, baseline and deep learning forecasting models, model evaluation, and practical considerations like overfitting, concept drift, and operational integration. Through hands-on projects such as energy load forecasting, demand prediction, or predictive maintenance, participants will gain experience in problem formulation, model development, performance evaluation, and translating forecasts into operational decisions.

By the end of the course, participants will be able to implement end-to-end forecasting workflows, compare model performance, interpret results, and apply forecasts effectively to support planning, resource allocation, and risk management in diverse sectors.

Course Content

MODULE 1

Fundamentals of time series

- Types of time series data and forecasting problems.
- Concepts of trend, seasonality, cycles, and noise.
- Forecasting horizons: short-term, medium-term, long-term

MODULE 2

Data handling and preprocessing

- Resampling, aggregation, and alignment of time series.
- Dealing with missing data and outliers.
- Train/validation/test splits that respect time order and avoid leakage.

MODULE 3

Classical and baseline forecasting methods

- Naive and persistence models, moving averages.
- Simple regression with lag features.
- High-level overview of AR/ARIMA (concepts, not heavy theory).

MODULE 4

Machine learning and deep learning for forecasting

- Feature engineering: lag features, sliding windows, calendar/time-of-day features.
- Introduction to recurrent neural networks, LSTM, and GRU for sequences.
- Building and training a basic LSTM/GRU model for forecasting.
- One-step vs multi-step forecasting strategies.

MODULE 4

Evaluation and practical considerations

- Forecasting metrics: MAE, RMSE, MAPE.
- Backtesting and rolling-window evaluation.
- Overfitting, robustness, and concept drift.
- Updating and maintaining models as new data arrives.