

AI-Powered Operations with Python

Operational analytics, predictive models and monitored decision support

FA-0576 · 2 days

Data & Analytics · Software Development

Apply Python analytics and machine learning to sample operational data, evaluate predictive models and prototype monitored decision-support workflows.

Introduction

This two-day practical course explores how Python-based analytics and machine learning can support operational decisions. It moves from data preparation and exploratory analysis to predictive modelling, anomaly monitoring and a small integration prototype.

Participants work with prepared operational datasets and selected Python libraries. NLP, computer vision, deep learning and streaming infrastructure are introduced through comparisons or demonstrations rather than separate production implementations. The emphasis is on evaluating evidence, recognising limitations and designing bounded, reviewable workflows—not delivering a complete enterprise monitoring or self-healing platform.

Learning outcomes

The course teaches participants to:

- Prepare and explore operational datasets using pandas, NumPy and Python visualisation tools.
- Compare regression, classification and time-series approaches and select suitable evaluation methods.
- Train a small predictive model while avoiding data leakage and separating training from evaluation.
- Prototype anomaly detection, alerting and a simple model-serving workflow.
- Explain the evidence and safeguards needed before using predictions for operational interventions or ongoing model updates.

Prerequisites

- Intermediate Python programming skills, including working with functions and data structures.
- Basic experience with NumPy and pandas; familiarity with Matplotlib is helpful.
- Basic statistics and data-analysis concepts.
- An understanding of business operations and fundamental IT systems.

Training outline

1. Day 1 — Operational Data and Predictive Models

Module 1 — AI in Operational Workflows

- Define operational problems, measurable objectives and the role of machine learning.
- Compare machine learning, NLP with NLTK or spaCy, and computer vision with OpenCV or PyTorch.
- Review illustrative operational scenarios and potential benefits, costs, limitations and ethical considerations.

Module 2 — Data Preparation and Exploration

- Operational data types, collection and the data lifecycle.
- Clean and preprocess a prepared dataset using pandas.
- Explore distributions and relationships using Matplotlib, Seaborn or Plotly.
- Introduce statistical modelling with SciPy and statsmodels; distinguish observed associations from causal conclusions.

Module 3 — Building and Evaluating Predictions

- Select regression or classification baselines using scikit-learn.
- Engineer features without leaking evaluation information into training.
- Separate training, validation and test data; use time-respecting evaluation for forecasts.
- Compare time-series approaches with statsmodels and Prophet.
- Interpret model metrics, uncertainty and operational trade-offs.
- Demonstrate where TensorFlow or Keras may be useful, without requiring a separate deep-learning implementation.

2. Day 2 — Monitoring and Bounded Operational Responses

Module 4 — AI-Powered Monitoring

- Compare batch and streaming monitoring; demonstrate the role of Apache Kafka and Python.
- Prototype model integration using a selected Flask or FastAPI example.
- Explore anomaly detection with scikit-learn or PyOD.
- Discuss predictive-maintenance data requirements and the difference between a demonstration and a validated maintenance system.
- Design alerts and notifications with thresholds, review steps and escalation paths.

Module 5 — Problem Prediction and Decision Support

- Use predictive outputs to explore operational risk scenarios and mitigation options.
- Investigate possible contributors to an issue; do not treat predictive correlations as proof of root cause.
- Demonstrate a bounded response script with approval, logging and rollback considerations.
- Separate automated recommendations from decisions requiring operational authority.
- Discuss model monitoring, retraining and incremental learning: online updates require algorithms designed to support them.

Module 6 — Integration Review

- Review a small operational analytics and monitoring prototype.
- Communicate findings, model limitations and outstanding data-quality issues.
- Identify checks needed before integrating the prototype into an existing workflow.