Data Science and Machine Learning with Python Training

Duration: **5 Day**

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Overview

Data Science and Machine Learning with Python is a comprehensive five-day course for professionals who already have experience with data analysis and want to develop their knowledge of Data Science, Analytics, Machine Learning, and Artificial Intelligence.

The programme is suitable both for learners who want to progress from traditional analytics into Data Science and for professionals who work alongside Data Scientists and want a clearer understanding of the techniques, tools, and processes involved.

Throughout the course, participants explore the typical lifecycle of a Data Science project, from defining the problem and exploring the available data through preprocessing and model development to evaluation, deployment, and monitoring.

The programme also examines potential Data Science applications, common project pitfalls, data governance, ethical responsibilities, team roles, Machine Learning and AI model development, exploratory analysis, data visualisation, and strategies for deploying analytical models.

Theoretical concepts are reinforced with comprehensive practical labs. Participants use Python and relevant Data Science libraries to prepare and analyse datasets, build Machine Learning models, evaluate their performance, and explore deployment approaches.

Prerequisites

This is not an introductory Python programming course.

Participants should already be comfortable using Python for data-related tasks and should have experience with:

- Working with tabular data in Python
- NumPy
- Pandas
- DataFrame structures
- Basic data cleaning and transformation
- Simple data analysis

A foundational understanding of Data Science, Machine Learning, AI, and associated governance considerations will also help learners gain maximum value from the course.

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Who Should Attend

The course is suitable for technically oriented professionals who already have some experience working with data.

Typical participants include:

- Data Analysts
- Aspiring Data Scientists
- Software Developers
- Data Engineers
- Analytics Professionals
- Technical professionals who work alongside Data Scientists
- Python users moving towards Machine Learning
- Mid-level and senior leaders seeking a better understanding of how Data Science can be implemented within their organisations

Participants should be familiar with table structures, tabular data, Python-based data manipulation, and basic analytical techniques.

What You Will Learn

By the end of the course, participants will be able to:

- Explain the core concepts of Data Science and Machine Learning
- Describe the role and skillset of a Data Scientist
- Evaluate common Data Science use cases
- Explain the stages of a Data Science project using CRISP-DM
- Prepare, analyse, and visualise data with Python
- Apply descriptive and inferential statistical techniques
- Conduct Exploratory Data Analysis
- Handle missing, duplicated, and outlying data
- Apply scaling, encoding, and feature selection
- Develop regression models
- Build classification models
- Evaluate and compare Machine Learning models
- Apply clustering and dimensionality reduction techniques
- Consider ethical and legal issues within Data Science projects
- Select appropriate approaches for Machine Learning model deployment
- Identify metrics for monitoring deployed models
- Understand potential next steps into Deep Learning and more advanced Data Science topics

Outline

1. Introduction to Data Science and Machine Learning

This module introduces the structure of Data Science projects and the role of Machine Learning within them.

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Topics include:

- The role of the Data Scientist
- Skills required for Data Science
- Common Data Science applications
- Industry use cases
- CRISP-DM methodology
- The Data Science project lifecycle
- Characteristics of problems suitable for Data Science
- Identifying suitable projects and use cases
- Defining project success
- Evaluating the success of a Data Science project

Participants establish a foundation for identifying the right problems and defining measurable outcomes before model development begins.

2. Introduction to Python for Data Science

This module explores the Python environment and tools commonly used in Data Science projects.

Topics include:

- Why notebooks are commonly used in Data Science
- Manipulating datasets with Python
- Python Data Science libraries
- Working with NumPy and Pandas
- Virtual environments
- Data analysis workflows
- Data visualisation with Python

Participants use Python to prepare, explore, and visualise datasets for subsequent analysis and modelling.

3. Descriptive and Inferential Statistics with Python

This module examines the role of statistics in understanding data and supporting analytical decisions.

Topics include:

- Descriptive statistics
- Inferential statistics
- Measures of central tendency
- Measures of variation
- Correlation
- Data distributions
- Hypothesis testing
- Statistical significance
- Statistical visualisations
- Exploratory Data Analysis

Participants use statistical techniques to understand dataset characteristics and assess the significance of observed patterns and relationships.

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4. Preprocessing Data for Analysis

This module focuses on preparing raw datasets for analysis and Machine Learning.

Topics include:

- Duplicate data
- Missing values
- Outliers
- Data cleaning
- Feature scaling
- Categorical data encoding
- Feature selection
- Training datasets
- Testing datasets
- Validation datasets
- Feature engineering

Participants learn how preprocessing decisions can directly affect the quality and reliability of Machine Learning models.

5. Supervised Learning: Regression

This module introduces regression techniques for predicting numerical outcomes.

Topics include:

- Regression in Machine Learning
- Simple Linear Regression
- Multiple Linear Regression
- Non-linear regression approaches
- Building regression models
- Measuring model performance
- Evaluating regression models
- Comparing regression approaches

Participants build and evaluate regression models using Python.

6. Supervised Learning: Classification

This module focuses on techniques for predicting categorical outcomes.

Topics include:

- Classification in Machine Learning
- Logistic Regression
- Multiple Logistic Regression
- Decision Trees
- Random Forest
- Building classification models
- Evaluating classification performance
- Comparing classification models

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Participants apply different classification algorithms and evaluate their suitability for particular problems.

7. Model Selection and Evaluation

This module examines how to select an appropriate model and determine whether its performance is sufficient for the intended purpose.

Topics include:

- Comparing regression models
- Comparing classification models
- Model performance evaluation
- Testing and validation
- Establishing baselines
- Evaluating model behaviour
- Determining “how good is good enough”

Participants develop a more structured approach to model selection rather than relying on a single performance measure.

8. Unsupervised Learning

This module introduces Machine Learning techniques for datasets without labelled target outcomes.

Topics include:

- Unsupervised Learning
- Clustering
- K-Means clustering
- Evaluating clusters
- Dimensionality reduction
- Applying dimensionality reduction techniques
- Evaluating results

Participants use unsupervised techniques to identify patterns, groups, and underlying structures within data.

9. Ethics for Data Scientists

This module examines the legal, ethical, and professional responsibilities associated with Data Science and AI.

Topics include:

- Relevant legislation and standards
- Legal considerations
- Ethical considerations
- Moral considerations
- Ethical data handling
- Responsible use of data
- Ethical risks in Machine Learning

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- Ethical considerations in Deep Learning and AI
- Relevant legal requirements for professional environments

Participants consider not only whether a solution is technically possible, but whether its use is responsible, appropriate, and compliant.

10. Deploying Models and Insights

This module explores how analytical and Machine Learning models can move from development into practical use.

Topics include:

- Analytical model deployment
- Selecting a deployment strategy
- Comparing deployment approaches
- Model failure risks
- Controls for preventing model failures
- Deploying Machine Learning models using Python
- Production model monitoring
- Model monitoring metrics
- Tracking model performance over time

The aim is to help participants understand how a model can progress beyond experimentation and become part of a reliable operational solution.

11. Where to Go Next

The final module considers further development opportunities in Data Science and AI.

Topics include:

- The role of Deep Learning in modern Artificial Intelligence
- Advanced statistics
- Time Series and Forecasting
- Mathematics and Statistics for Data Science
- Big Data Analytics
- Python and Spark
- Generative AI
- Deep Learning
- Professional Data Science qualifications
- Professional memberships and career development