

Python, Data Analysis & AI Boot Camp

Duration: 10 days

Day 1: Python Programming Fundamentals

Module 1: Introduction to Python

- Overview of Python and its ecosystem
- Setting up Python environment
- Using Jupyter Notebook and VS Code
- Python syntax and coding standards

Module 2: Variables and Data Types

- Numeric data types
- Strings and string manipulation
- Boolean data type
- Type conversion and casting

Module 3: Operators and Expressions

- Arithmetic operators
- Comparison operators
- Logical operators
- Assignment operators

Module 4: Control Flow

- Conditional statements (if, elif, else)
- Nested conditions
- Match-case statements
- Practical exercises

Module 5: Loops

- For loops
- While loops
- Loop control statements
- Iteration techniques

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- Building simple Python programs
- Data manipulation exercises
- Problem-solving scenarios

Day 2: Python Data Structures and Functions

Module 6: Python Collections

- Lists
- Tuples
- Sets

- Dictionaries

Module 7: Working with Functions

- Function creation
- Parameters and return values
- Default and keyword arguments
- Lambda functions

Module 8: Error Handling

- Understanding exceptions
- Try-except blocks
- Multiple exception handling
- Custom exception basics

Module 9: File Handling

- Reading text files
- Writing text files
- Working with CSV files
- Context managers

Module 10: Introduction to NumPy

- Why NumPy
- Arrays and array operations
- Indexing and slicing
- Mathematical computations

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- Data processing using lists and dictionaries
- CSV file analysis
- NumPy-based calculations

Day 3: Comprehensive Pandas – Core Concepts

Module 11: Introduction to Pandas

- Pandas architecture
- Series
- DataFrames
- Data import/export operations

Module 12: Data Exploration and Inspection

- Viewing and understanding datasets
- Metadata analysis
- Summary statistics
- Data profiling

Module 13: Data Selection and Filtering

- Row and column selection

- Indexing techniques
- Conditional filtering
- Sorting data

Module 14: Data Cleaning and Preparation

- Handling missing values
- Removing duplicates
- Data type conversion
- String operations

Module 15: Data Transformation

- Creating calculated columns
- Applying custom functions
- Mapping and replacing values
- Data aggregation basics

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- Exploring real-world datasets
- Data cleaning projects
- Building analytical datasets

Day 4: Advanced Pandas for Data Analysis

- Module 16: Grouping and Aggregation
- GroupBy operations
- Aggregation functions
- Multi-level aggregations
- Custom aggregations

Module 17: Combining Datasets

- Concatenation
- Merge operations
- Join operations
- Data alignment concepts

Module 18: Reshaping Data

- Pivot tables
- Melt operations
- Stack and unstack
- Cross-tabulation

Module 19: Time Series Analysis

- Date and time handling
- Datetime indexing
- Resampling
- Rolling calculations

Module 20: Advanced Analytical Operations

- Window functions
- Ranking data
- Statistical summaries
- Performance optimization techniques

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- Sales analytics
- Customer analytics
- Time-series data analysis

Day 5: Data Visualization with Python

Module 21: Introduction to Data Visualization

- Principles of effective visualization
- Selecting appropriate charts
- Storytelling with data
- Visualization workflow

Module 22: Visualization using Matplotlib

- Line charts
- Bar charts
- Histograms
- Scatter plots
- Customizing charts

Module 23: Visualization using Seaborn

- Statistical visualizations
- Distribution plots
- Box plots
- Heatmaps
- Pair plots

Module 24: Interactive Visualizations

- Introduction to Plotly
- Interactive charts
- Dashboard-ready visualizations
- Exporting visualizations

Module 25: End-to-End Data Analysis Project

- Data acquisition
- Data preparation using Pandas
- Exploratory Data Analysis (EDA)
- Visualization and insights generation
- Presenting findings

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- Business analytics dashboard

- Exploratory data analysis project
- Final capstone exercise

Day 6: Artificial Intelligence, Machine Learning & Generative AI Fundamentals

Module 26: Introduction to Artificial Intelligence

- Evolution of AI
- AI vs ML vs DL
- Types of AI
- Real-world AI applications
- AI in Healthcare, Finance, and Retail

Module 27: Machine Learning Fundamentals

- What is Machine Learning
- Supervised Learning
- Unsupervised Learning
- Reinforcement Learning
- Machine Learning lifecycle

Module 28: Deep Learning Overview

- Evolution from ML to DL
- Neural Networks fundamentals
- Deep Learning applications
- Computer Vision and NLP overview

Module 29: Introduction to Generative AI

- What is Generative AI
- Foundation Models
- Large Language Models (LLMs)
- Text, Image, and Code Generation
- Generative AI use cases

Module 30: Introduction to Agentic AI

- What is Agentic AI
- AI Agents and Multi-Agent Systems
- Planning, Reasoning, and Tool Usage
- Agentic AI Architecture Patterns
- Industry use cases

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- AI application identification workshop
- Machine Learning lifecycle walkthrough
- Exploring pre-built AI and Generative AI applications

Day 7: Machine Learning for Classification

Module 31: Data Preparation for Machine Learning

- Feature engineering fundamentals
- Data preprocessing
- Encoding categorical variables
- Feature scaling
- Train-test split

Module 32: Classification Concepts

- Classification workflow
- Binary Classification
- Multi-class Classification
- Imbalanced datasets
- Classification use cases

Module 33: Classification Algorithms

- Logistic Regression
- Decision Trees
- Random Forest
- K-Nearest Neighbors
- Model comparison

Module 34: Model Evaluation

- Confusion Matrix
- Precision and Recall
- F1 Score
- ROC-AUC
- Cross Validation

Module 35: Model Optimization

- Hyperparameter tuning
- Feature selection
- Overfitting and Underfitting
- Model performance improvement

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Healthcare Lab: Insurance Claim Fraud Detection

- Data preprocessing
- Feature engineering
- Building classification models
- Model evaluation
- Fraud prediction analysis

Healthcare Lab: Disease Risk Classification

- Patient health data analysis
- Predicting disease risk categories
- Performance comparison across models

Day 8: Machine Learning for Regression

Module 36: Regression Fundamentals

- Understanding prediction problems
- Continuous target variables
- Regression workflow
- Business applications

Module 37: Regression Algorithms

- Linear Regression
- Multiple Linear Regression
- Polynomial Regression
- Decision Tree Regression
- Random Forest Regression

Module 38: Model Evaluation for Regression

- Mean Absolute Error (MAE)
- Mean Squared Error (MSE)
- Root Mean Squared Error (RMSE)
- R-Squared

Module 39: Feature Engineering for Regression

- Feature transformation
- Handling outliers
- Feature importance
- Data preparation techniques

Module 40: Regression Model Improvement

- Hyperparameter tuning
- Model comparison
- Prediction analysis
- Model interpretation

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Healthcare Lab: Hospital Length of Stay Prediction

- Predicting patient stay duration
- Regression model development
- Error analysis

Healthcare Lab: Insurance Claim Cost Prediction

- Claims data preparation
- Model training
- Cost estimation and interpretation

Day 9: Deep Learning for Computer Vision

Module 41: Introduction to Deep Learning

- Artificial Neural Networks

- Forward and Back Propagation
- Activation Functions
- Loss Functions
- Training Neural Networks

Module 42: Deep Learning with TensorFlow and Keras

- TensorFlow ecosystem
- Building neural networks
- Training and validation
- Model evaluation

Module 43: Convolutional Neural Networks (CNNs)

- CNN architecture
- Feature extraction
- Image classification
- Transfer learning concepts

Module 44: Image Segmentation

- Semantic Segmentation
- Instance Segmentation
- Medical imaging applications
- Segmentation workflows

Module 45: Object Detection

- Object Detection concepts
- Bounding boxes and annotations
- Detection architectures overview
- Real-world use cases

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Healthcare Lab: Medical Image Segmentation

- Tumor segmentation workflow
- Image preprocessing
- Segmentation model training
- Performance evaluation

Healthcare Lab: Medical Object Detection

- Detecting abnormalities in medical images
- Dataset preparation
- Model training and validation

Day 10: Generative AI, Prompt Engineering, and Responsible AI

Module 46: Introduction to Generative AI

- Generative AI ecosystem
- Foundation Models
- Large Language Models

- Retrieval-Augmented Generation (RAG)
- Enterprise use cases

Module 47: Prompt Engineering Fundamentals

- Prompt design principles
- Zero-shot prompting
- Few-shot prompting
- Chain-of-thought concepts
- Prompt optimization techniques

Module 48: Practical Generative AI Applications

- Text generation
- Summarization
- Content creation
- Document intelligence
- Healthcare and business use cases

Module 49: Fundamentals of Agentic AI

- Agent workflows
- Planning and reasoning
- Tool calling concepts
- Multi-agent collaboration
- Agentic AI use cases

Module 50: Responsible AI and AI Ethics

- Responsible AI principles
- Fairness and Bias
- Transparency and Explainability
- Privacy and Security
- Governance and Compliance
- Ethical AI deployment
- AI risk management

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Generative AI Lab

Prompt engineering exercises

- Summarization and content generation
- Information extraction using LLMs
- Agentic AI Lab
- Design of a simple AI agent workflow
- Agent planning and tool usage demonstration