

Expert Python: Metaprogramming, Threading & Geopandas

Learn to apply Python metaprogramming, threading, database and geopandas techniques for geospatial data processing.

23

MODULES

114

TOPICS

COURSE OVERVIEW

This course covers core Python fundamentals including data types, OS services, pythonic idioms, modules and classes, before moving into metaprogramming techniques such as decorators and monkey patching. It then addresses programmer tools, database access, network programming, threading and multiprocessing, and working with XML, JSON and C extensions. Later modules focus on file handling and conversion, PostgreSQL database operations and error handling, and geospatial workflows using geopandas, shapely and matplotlib, including shapefiles, geo databases, GeoDataFrames, spatial analysis and vector data manipulation.

WHO THIS COURSE IS FOR

Python Developers

Data Engineers

GIS Analysts

Backend Developers

Database Developers

PREREQUISITES

- Working Knowledge of Python Programming

LEARNING OBJECTIVES

- Describe core Python data types, control structures and idioms
- Apply metaprogramming techniques such as decorators and monkey patching
- Analyse programs using pylint, unittest, debugging and profiling tools
- Implement database access and transaction control with the DB API
- Apply threading and multiprocessing to concurrent programming problems
- Convert and manipulate XML, JSON and CSV file formats
- Implement geospatial workflows using geopandas and shapely
- Configure PostgreSQL operations and handle related errors

23 Modules, 114 Topics

01

Python Refresher

TOPICS

- Data types
- Sequences
- Mapping
- Types
- Program Structure
- Files and Console
- Conditionals
- Loops
- Built-Ins

02

OS Services

TOPICS

The OS Module · Environment Variables · Launching external commands · Walking directory trees · Paths, directories, and filenames · Working with file systems · Dates and times

03

Pythonic Programming

TOPICS

- The Zen of Python
- Common idioms Lambda functions List comprehensions
- Generator expressions
- String formatting

04

Modules and Packages

TOPICS

Initialization code · Namespaces · Executing modules as scripts · Documentation · Packages and name resolution · Naming conventions · Using imports

05

Classes Defining Classes

TOPICS

Instance methods and data Properties · Initializers · Class and static methods/data Inheritance

06

Metaprogramming

TOPICS

Implicit properties `globals()` and `locals()` · Working with attributes · The `inspect` module · Decorators · Monkey patching

07

Programmer Tools Analyzing Programs

TOPICS

Using `pylint` · Testing code · Using `unittest` · Debugging · Profiling and benchmarking

08

Database Access The DB API

TOPICS

Available Interfaces · Connecting to a server · Creating and executing a cursor · Fetching data · Parameterized statements · Metadata · Transaction control

09

Network Programming

TOPICS

Sockets Clients Servers · Application protocols · Forking servers · Binary data

10

Multiprogramming When to Use Threads?

TOPICS

The Global Interpreter Lock The `threading` module Simple threading · Sharing variables The `queue` module · Debugging threaded programs Multiprocessing · Other alternatives

11

XML and JSON Working with XML

TOPICS

DOM and `Sax` · Introducing `ElementTree` and `xml` · Parsing XML · Navigating the document · Creating a new XML document · JSON · Parsing JSON into Python · Converting Python into JSON

12

Extending Python

TOPICS

About non-Python modules · Overview of a C extension · Writing C by hand · Using `SWIG` · Loading modules with `ctypes`

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File Handling and Conversion

TOPICS

- Opening and Reading Files
- Writing and Appending Data to Files
- Handling Different File Formats (CSV, JSON, XML)
- Using os and os.path for File Operations
- Converting Files Between Formats (e.g., CSV to JSON)

14

File Conversion to Shapefile (SHP)

TOPICS

Introduction to Shapefiles · Using geopandas to Convert Files to SHP · Exporting Data to Shapefile

15

Adding Data into the Geo Database

TOPICS

- Introduction to Geo Databases
- Creating and Managing Geo Databases
- Inserting Data into Geo Databases using geopandas
- Updating and Deleting Data in Geo Databases

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PostgreSQL Database Operations

TOPICS

- Connecting to PostgreSQL in Python
- Basic SQL Operations (SELECT, INSERT, UPDATE, DELETE)
- Creating and Managing Tables

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Error Handling with PostgreSQL

TOPICS

- Introduction to Error Handling in Python
- Common PostgreSQL Errors and Exceptions
- Using try, except, and finally Blocks
- Implementing Transaction Management and Rollbacks
- Logging Errors for PostgreSQL Operations

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Data Combination and Transformation

TOPICS

- Merging and Joining DataFrames in pandas
- Using geoPandas for Geospatial Data Manipulation
- Fetching and Processing Data from APIs using requests
- Data Cleaning and Transformation Techniques
- Working with Large Datasets Efficiently

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File Conversion into GeoDataFrame

TOPICS

- Introduction to GeoDataFrame
- Reading Different File Formats into a GeoDataFrame
- Data Cleaning and Preparation for Conversion
- Exporting GeoDataFrame to Various Formats (e.g., SHP, GeoJSON)
- Handling Coordinate Reference Systems (CRS)

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Email Alerts in Python

TOPICS

Setting Up Email Servers (smtplib) · Composing and Sending Emails · Sending Emails with Attachments · Automating Email Alerts for Various Events · Handling Email Errors and Exceptions

21

Spatial Analysis in Python

TOPICS

- Introduction to Spatial Analysis Concepts
- Analyzing Spatial Relationships using geopandas
- Visualizing Spatial Data with matplotlib

22

Geometric Operations with Shapely

TOPICS

Introduction to shapely Geometry Objects · Creating and Manipulating Geometric Shapes · Combining shapely with geopandas for Analysis

23

Vector Data Manipulation with Geopandas

TOPICS

- Introduction to Vector Data in GIS
- Creating and Manipulating Geo DataFrames
- Performing Geospatial Operations (e.g., clipping, dissolving)
- Exporting and Sharing Vector Data

WHAT IS INCLUDED

Everything You Need to Succeed

- Koenig course material for every module
- Delivery by certified instructors and subject matter experts
- Hands-on exercises throughout the course
- Course completion certificate from Koenig

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Who We Are

Established in 1993, Koenig Solutions is a globally recognised training provider with 35+ technology partnerships, 5,000+ training programmes and a network of certified instructors and subject matter experts, supporting individuals and enterprise teams worldwide.

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