Neurootix

Course Outline

Advanced Python for AI

Session 1: Environment, Hello Python & Basic Types

Setup & Tools :

- Python installation
- Google Colab
- VS Code Insiders
- GitHub basics

Core Concepts :

- Running .py and .ipynb files
- Numbers and arithmetic
- Booleans and basic expressions

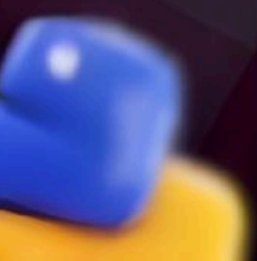
Session 2: Variables, Strings & String Methods

Core Concepts :

- Variables and assignment
- Type conversion
- f-strings

Strings :

- Indexing and slicing
- Common string methods
- split strip replace lower upper format



Neurootix

Session 3: Lists, Nested Lists & List Methods

Lists :

- Creating lists and nested lists
- Indexing and slicing
- Mutability and references

List Methods :

- append extend insert
- pop remove sort copy

Session 4: Functions, Modules & Control Flow

Functions :

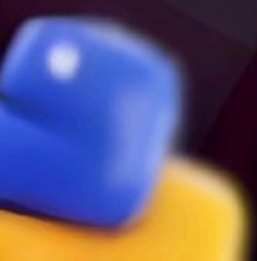
- Defining functions
- Parameters args kwargs
- Return values
- Docstrings

Modules :

- Importing modules
- Different import styles

Control Flow :

- if elif else
- Practical decision patterns



Neurootix

Session 5: Loops, Comprehensions & Iteration Patterns

Loops :

- for and while
- enumerate and zip
- Iterating dictionaries

Comprehensions :

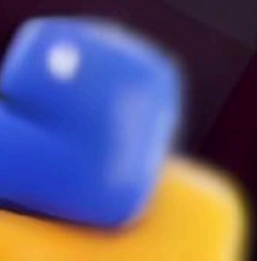
- List comprehensions
- Dict and set comprehensions
- Generator expressions

Functional Tools :

- lambda
- map filter

Performance :

- Iteration tradeoffs
- Readability vs speed



Neurootix

Session 6: NumPy Basics & Introduction to pandas

NumPy :

- Arrays creation
- 1D and 2D arrays
- Indexing and slicing
- Vectorized operations
- Mean median basic statistics

pandas :

- Series and DataFrame
- read_csv
- head info describe
- Column selection

Hands-on :

- Load CSV dataset
- Convert lists to arrays
- Compute summary statistics

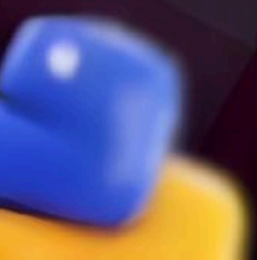
Session 7: Dictionaries & pandas Indexing and Aggregation

Dictionaries :

- Creation and manipulation
- Nested dictionaries
- Converting dict to DataFrame

pandas Advanced :

- loc vs iloc
- Boolean filtering
- groupby and aggregation
- joins and merges
- Handling missing values NaN



Neurootix

Session 8: Matplotlib Visualization & GitHub Project Sprint

Visualization :

- Line plots
- Scatter plots
- Histograms
- Boxplots

Customization :

- Labels and titles
- Ticks and legends
- Colors and sizes
- Subplots
- Saving figures

Project :

- Mini data analysis project
- Push notebook and code to GitHub

Neurootix

Session 9: Image Processing Fundamentals

Concepts :

- What is image processing
- Real-world applications

scikit-image :

- Introduction and setup

Images as Arrays :

- RGB vs Grayscale
- Image shapes and sizes
- Colors using NumPy
- Flipping and transformations

IImage Analysis :

- Histograms
- Thresholding

Session 10: Filters, Contrast & Morphology

Image Enhancement :

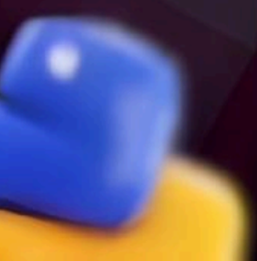
- Filters
- Contrast adjustment

Transformations :

- Scaling
- Rotation

Morphology :

- Erosion
- Dilation
- Opening and closing



Neurootix

Session 11: Image Restoration, Noise & Segmentation

Image Quality :

- Noise types
- Image restoration

Segmentation :

- Threshold-based segmentation
- Contours detection

Session 12: Large Language Models Foundations

Core Concepts :

- What are LLMs
- NLP overview
- Transformers architecture

LLM Components :

- Tokenization
- Embeddings
- Attention mechanism
- Model pipeline overview

Neurootix

Session 13: Final Project

Project Goals :

- Apply Python, NumPy, pandas, visualization, and AI concepts
- Choose one focus area:
    - Data analysis
    - Image processing
    - Intro-level AI or LLM task

Deliverables :

- Clean notebook or Python scripts
- Visualizations
- README file
- GitHub repository submission

neurootix.com

neurootix@gmail.com