Introduction to Python

T5 Bootcamp by SDAIA

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Saudi Data & AI Authority

Python Course Overview

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Outline

- Motivation
  - Why learn python?
  - Python in Data Science and AI
- Python Course Outline

Motivation

Why learn Python?

- Python is useful in many areas including:
  - Artificial Intelligence
  - Data Science
  - Machine Learning
  - Web Development
  - Internet of Things (IoT)

Python in Data Science and AI

- According to the 2019 Kaggle **Data Science and Machine Learning** Survey, ¾ of the over 10,000 respondents worldwide reported that they use Python regularly.
- Several different surveys done in 2019 established that over 80% of **data professionals** use Python worldwide.
- Glassdoor reported that in 2019 more than 75% of **data science** positions listed included Python in their job descriptions.

Code is intelligence!

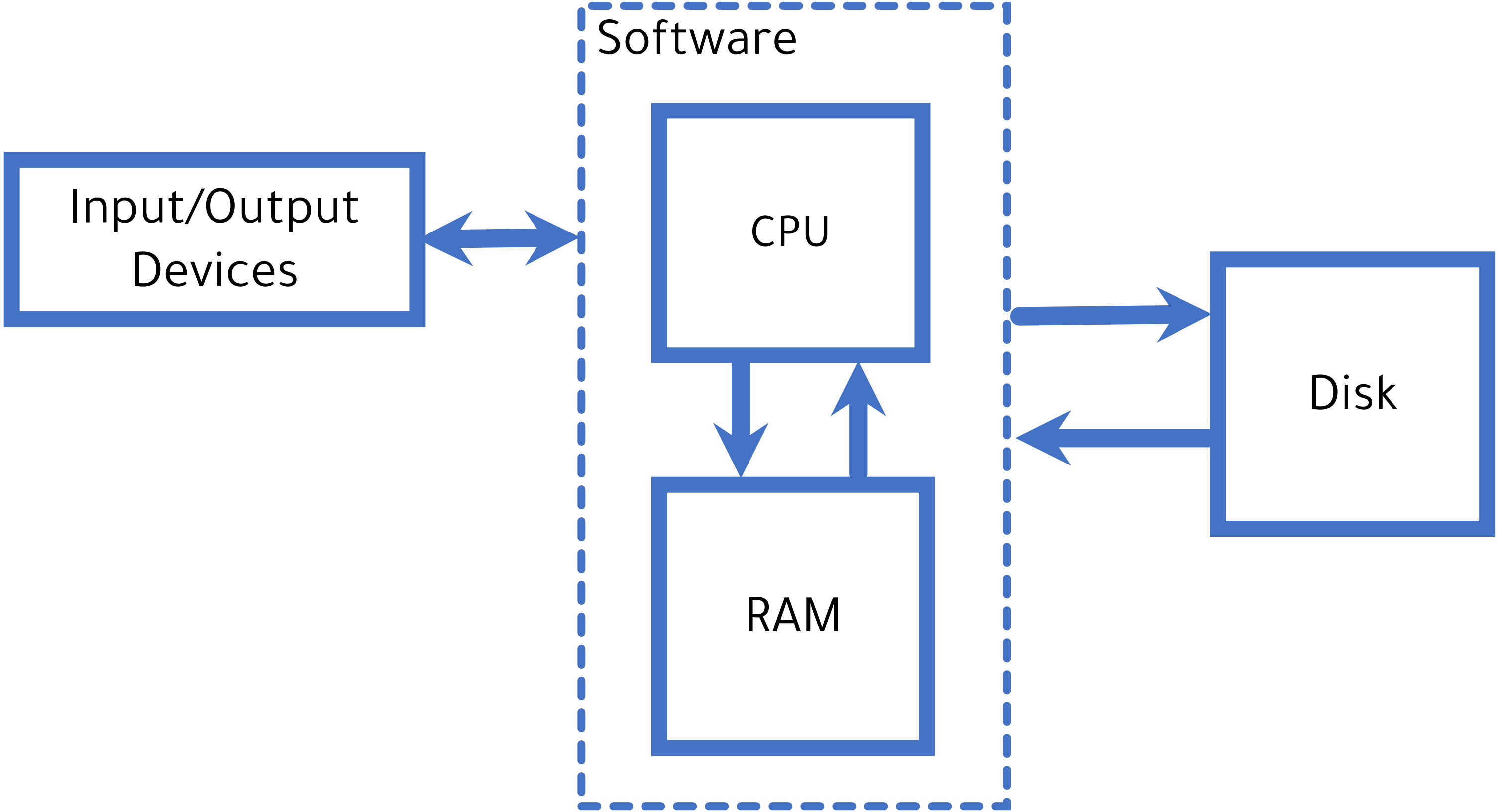
- We think, encode our knowledge into logical steps (algorithm), write it in a language that computers understand (Python)

- A ***program*** is a sequence of stored instructions for computers to do

- Computers are useless if they don't interact with the world

- To interact with the real-world, we need input and output (I/O)

Generic Computer Architecture

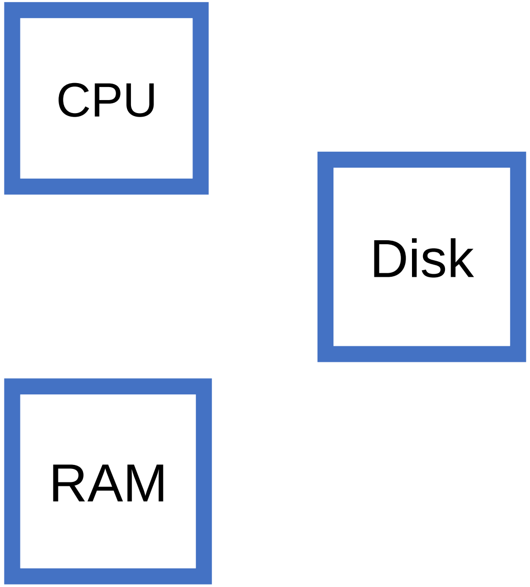


Computers’ brain and memory

- **CPU** (Central Processing Unit) is the brain that runs instructions.

- **Main Memory**: Fast small temporary storage
  - Also known as RAM (Random Access Memory)
  - Data lost on shutdown / reboot
  - Think of it like our short-term memory

- **Secondary Memory**: Slower large permanent storage
  - Usually referred to as: Disk drive / Memory stick
  - Data is saved until deleted
  - Think of it like our long-term memory



CPU

Disk

RAM

Computers' eyes, ears, and limbs

- **Input Devices**:
  - Not only: Keyboard, Mouse, Touch Screen
  - But also: Temperature, Motion, Sound, RADAR, LIDAR, and other sensors

- **Output Devices**:
  - Not only: Screen, Speakers, Printer
  - But also: Light, Laser, Robots, Motors, Machines, and others

- Programs talk to other programs; i.e., one program's output may be another program's input.
- An ***API*** (Application Programming Interface) defines how they talk.

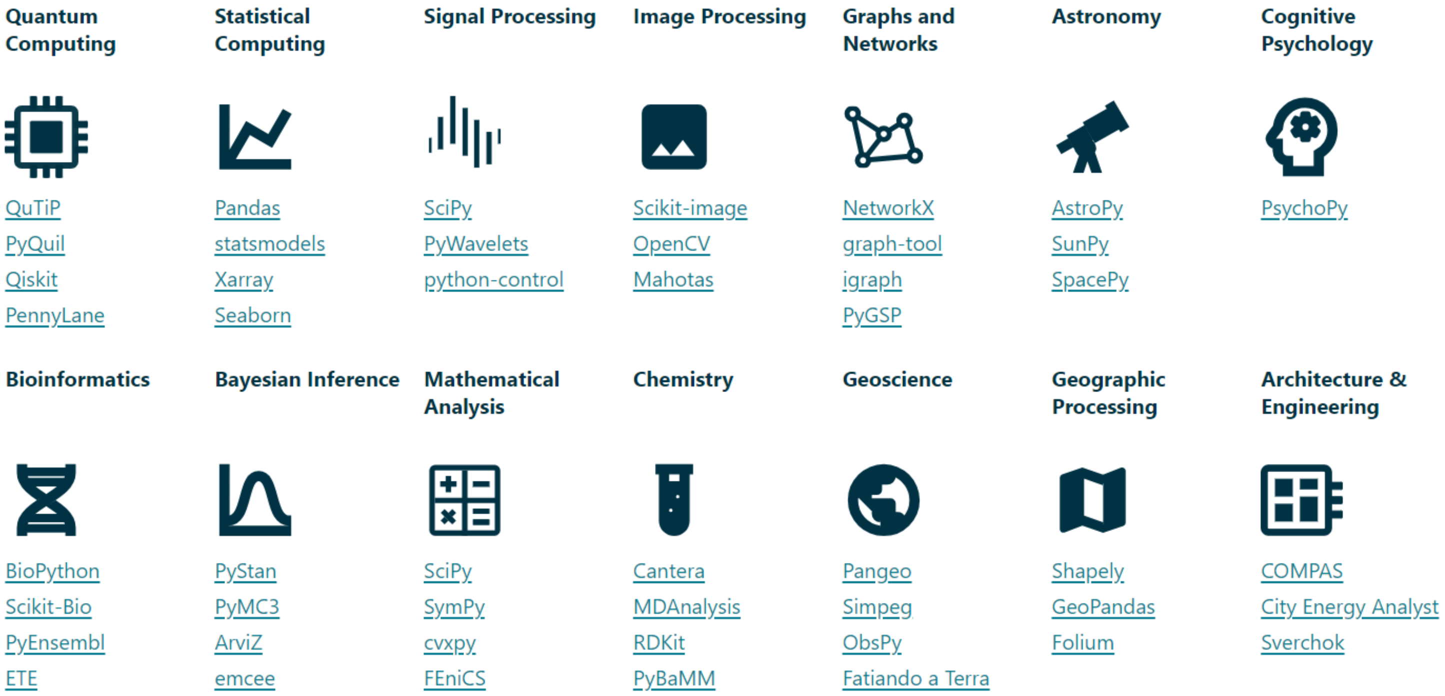
Why learn programming?

- You are intelligent and can learn, create, and critique
- Computers are simplistic but extremely fast

- It is easier for you to learn Python than for the computer to learn English

- Nowadays, AI can write code. But, they don't do that independent of humans instruction, at a high level.
- Remember: AI may be a copilot, but you are the pilot!

Python’s power is in its community and libraries



Quantum Computing
- QuTiP
- PyQuil
- Qiskit
- PennyLane

Statistical Computing
- Pandas
- statsmodels
- Xarray
- Seaborn

Signal Processing
- SciPy
- PyWavelets
- python-control

Image Processing
- Scikit-image
- OpenCV
- Mahotas

Graphs and Networks
- NetworkX
- graph-tool
- igraph
- PyGSP

Astronomy
- AstroPy
- SunPy
- SpacePy

Cognitive Psychology
- PsychoPy

Bioinformatics
- BioPython
- Scikit-Bio
- PyEnsembl
- ETE

Bayesian Inference
- PyStan
- PyMC3
- ArviZ
- emcee

Mathematical Analysis
- SciPy
- SymPy
- cvxpy
- FEniCS

Chemistry
- Cantera
- MDAnalysis
- RDKit
- PyBaMM

Geoscience
- Pangeo
- Simpeg
- ObsPy
- Fatiando a Terra

Geographic Processing
- Shapely
- GeoPandas
- Folium

Architecture & Engineering
- COMPAS
- City Energy Analyst
- Sverchok

Source: https://numpy.org/

Overview

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- Overview of Python language, ecosystem, and community
- Package management
- Variables, expressions, statements
  - Numbers
  - Strings
- Control-flow
  - Loops
- Functions
- Containers
  - Lists
  - Sets, Dictionaries, Tuples
- Exceptions and errors
- File I/O
- Date and time
- Object Oriented Programming
  - Polymorphism
  - Inheritance
  - Operator Overloading
- Modules and Packages
- Threading

Thank you

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