Introduction to **Data Analytics** with **Python**

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Overview

- Explore the basics of **Python programming** for data analytics
- Explain how to work with **datasets**
- Explain basic skills needed for **data analysis** with pandas:
  - **Importing Data**
  - **Exploratory Data Analysis**
  - **Data Visualisation**
- Hands-On Example: Palmer Penguins

By the end of this session you will have: a basic grasp of Python 🐍 , pandas 🐼, and … Palmer Penguins 🐧 🐧 🐧 ! 💥

✨ What is Data Analytics? ✨

- Collect, process, analyse datasets using **statistics** and **programming**
- Identify trends, solve problems, produce actionable insights, and inform decision-making
- Science of analyzing data to reveal **patterns**, derive **insights** and inform **decisions**

Skills and knowledge of data analytics allows you to **solve real-world problems**!

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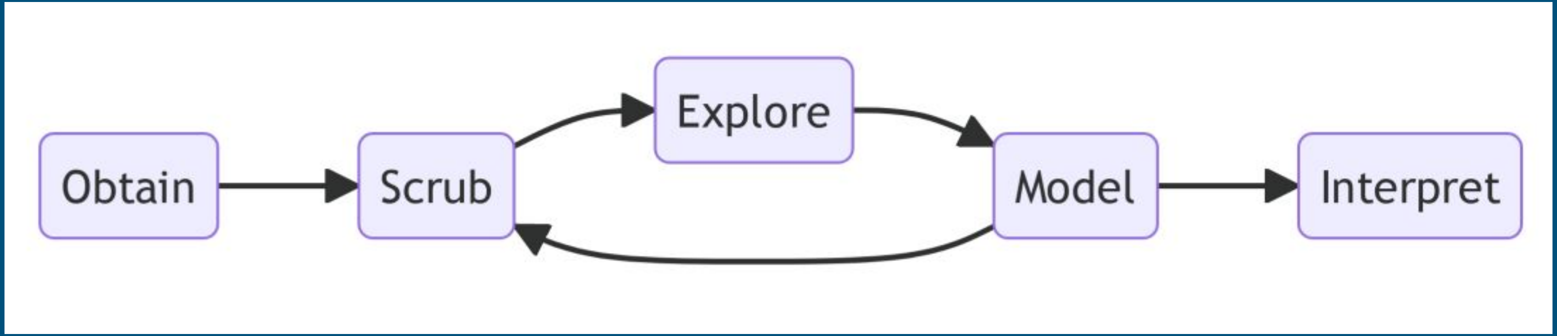
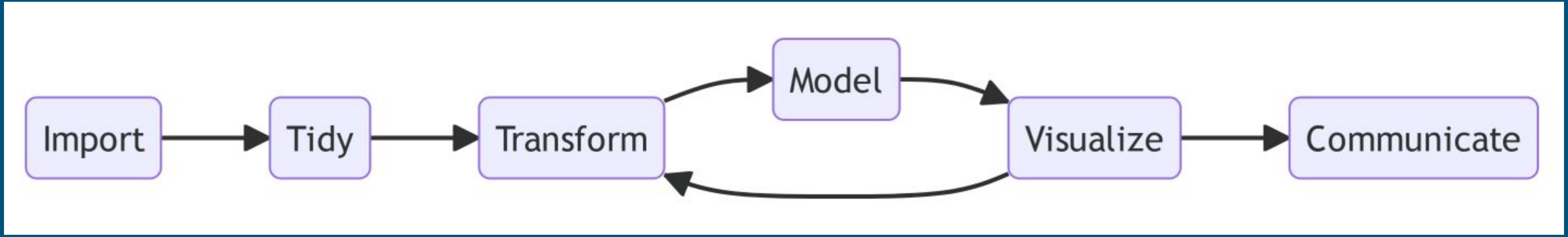
What is Data Analytics?





What is Python? 🐍

Computer programming language

- Invented by Dutch programmer Guido van Rossum in Christmas 1989, first released 1991
- “Python” named after British comedy *Monty Python’s Flying Circus*
- Now one of the world’s **most popular** programming languages!

“Computer Programming for Everybody” (1999)

“We believe that Python is a good language for teaching [programming] to absolute beginners”

- Designed to develop computer literacy for coding “newbies”
- Simple syntax similar to the English language
- Free and open source software! 🤗

“Pythonic”: Zen of Python 🙏

“Beautiful is better than ugly.

Explicit is better than implicit.

Simple is better than complex …

There should be one-- and preferably only one --obvious way to do it …

Now is better than never”

by Tim Peters (1999)

`TO DO`: In a **Jupyter** code cell, try typing `import this`, and then click on the **Run Cell** arrow. What happens?

`Note:` Writing “Pythonic” code is related to writing “clean” code!

Why Python? 🐍

1. **Free and Open Source Software Community** 🤗

- Half-a-million free and open source software **packages (or ‘libraries’)** developed for Python Package Index (PyPi) (2024) (e.g. `numpy`, `pandas`, `matplotlib`)
- Python Software Foundation supported by global technology companies (e.g. Google, Meta, Microsoft)
- Conferences organised worldwide (e.g. PyCon, PyData, PyLadies, SciPy)! See NumFOCUS

Why Python? 🐍

2. Popular Programming Language 👏

- Surveys show Python is **one of most popular programming languages**!
- My Python Surveys `streamlit` app summarises recent survey results 👀

Why Python? 🐍

3. Core Tool for Data Analysis 🔍

- **SQL** (1974)
- **Bash** Command Line Interface (1988)
- **Python** (1989)
- **Git** (2005)

What is Jupyter?

- Project Jupyter: open source project for data analysis, data science, and scientific computing.

- "Jupyter": named after three core scientific computing languages: Julia, **Py**thon, **R**.

- **Jupyter Notebooks**: interactive computing environments built for data analysis, which can be used in your web browser, or using Jupyter Notebook files in a local development environment (e.g. open `notebook.ipynb` in PyCharm or Visual Studio Code)

`Note`: Jupyter Notebooks are built on top of the `IPython` console - an interactive command line shell - another core tool for data analysts and data scientists!

Jupyter Notebooks: Strengths and Weaknesses

Good for …

- Teaching!
- Drafting, exploring, experimenting
- Sharing your work with colleagues or stakeholders (e.g. convert Jupyter Notebook to a PDF or slideshow presentation)

… but not so good for:

- Developing applications
- Putting your applications into production
- Version control (e.g. `git`)

What is Pandas? 🐼

Pandas: powerful Python package for **data analysis**

Advantages

- Developed for working with **structured** (tabular, relational, labeled) datasets (e.g. spreadsheet-style datasets)
- Developed for working with **time series** data (e.g. weather measurements, monthly sales, stock market prices, sensor data)
- Supports importing and exporting data from a wide range of common **file formats** used for data analysis (e.g. CSV, Excel, SQL, JSON, HTML)

Disadvantage

- `pandas` can have slow performance when using large datasets; consider using `polars` for larger datasets

What is Matplotlib?

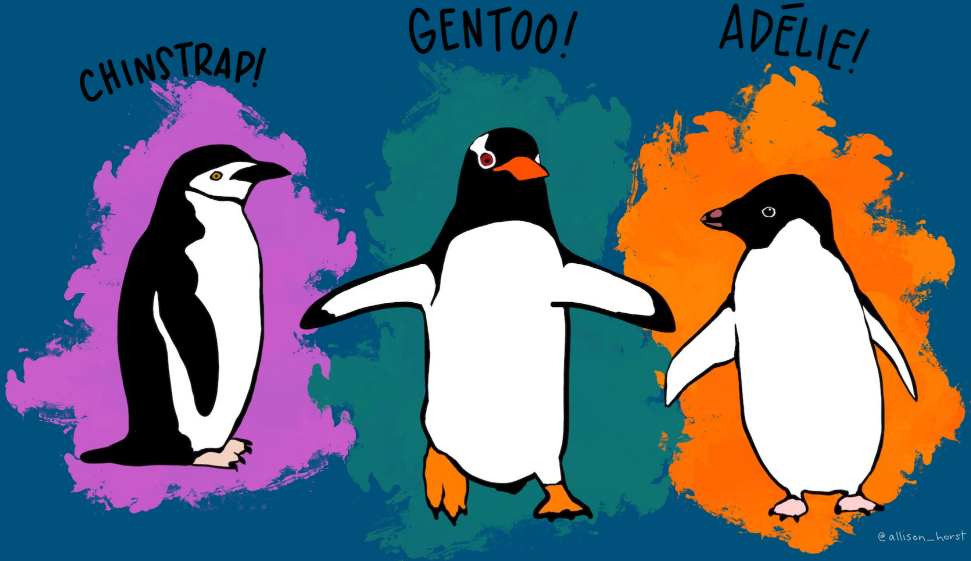
- Matplotlib is a comprehensive package for creating static, animated, and interactive visualizations in Python. We can plot with `matplotlib` directly from `pandas`! 🤗

- Seaborn is a Python **data visualisation** package based on `matplotlib`.

- `seaborn` provides a high-level interface for drawing attractive and informative statistical graphics.

Hands-On Example

Dataset: Palmer Penguins



Hands-On Example 🐧

Photo: S. Sternbach

The `palmerpenguins` dataset by Allison Horst, Alison Hill, and Kristen Gorman was first made publicly available as an R package.

The goal of the Palmer Penguins dataset is to replace the highly overused **Iris** dataset for data exploration & visualization.

- 344 penguins
- 3 penguin species (Adélie, chinstrap, and gentoo)

Image: Dr. Kristen Gorman in the field, surrounded by penguins, at islands near Palmer Archipelago, Antarctica

💃 Next Steps 💃

Modeling Data with Python

- How to **model** data
- **Multivariate** modeling
- Build a simple **web app**

We’ll build an **interactive web dashboard** like this!

👀 Further Resources 👀

Essential Resource

- Pandas Cheat Sheet

Basic Resources

- **Data Analysis with Python** certificate with **FreeCodeCamp.org**: a free certification!
- **Computer Programming for Everybody**: a manifesto by Guido van Rossum, inventor of Python
- **The Untold Story of Palmer Penguins**: from the creators of `palmerpenguins`

Advanced Resources

- **The Python Tutorial**: by the Python Software Foundation
- **Data Analysis Examples** from *Python for Data Analysis* by Wes McKinney, inventor of Pandas!