

Introduction to Python

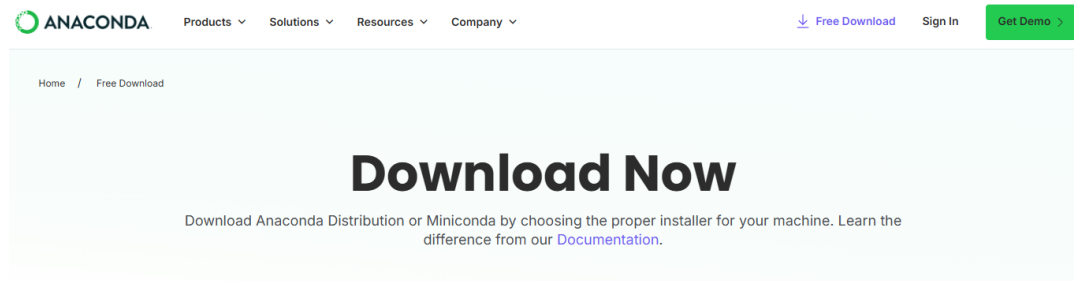
IE500 Data Mining




Installation




- Install Anaconda (Python Distribution)
 - <https://www.anaconda.com/download/success>
 - No need for registration
 - Click on „Download Miniconda Installer“
 - But then use „Distribution Installers“





Distribution Installers




For installation assistance, refer to [troubleshooting](#).

Windows

Mac

Linux

Miniconda Installers



For installation assistance, refer to [troubleshooting](#).

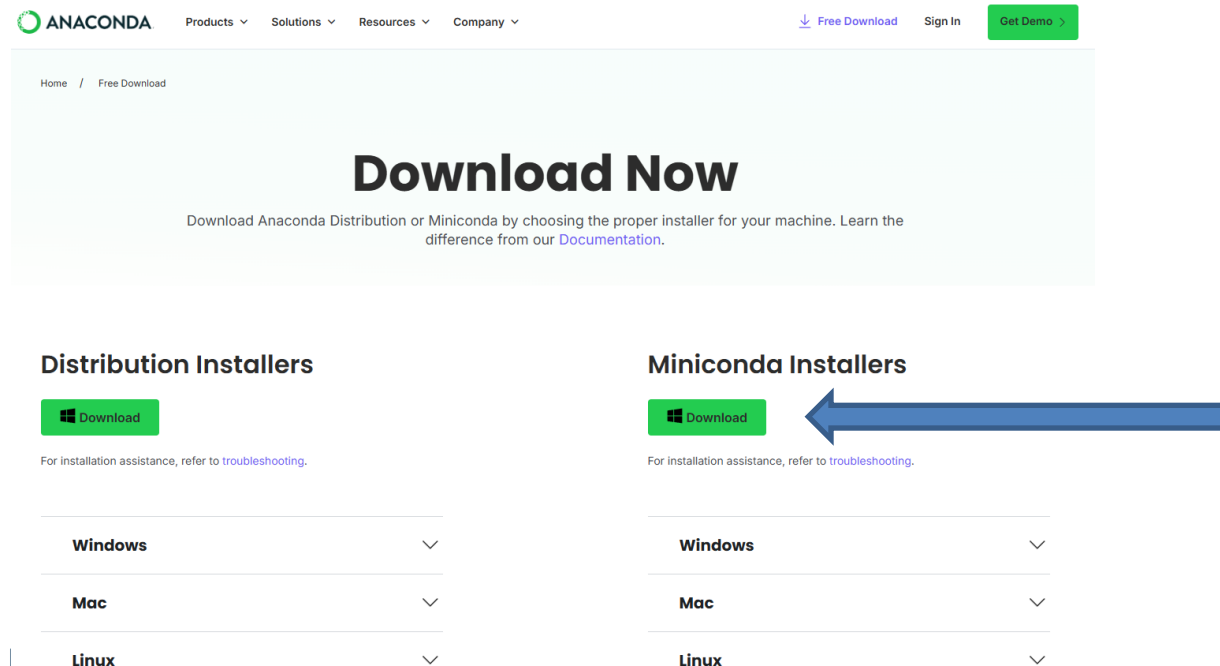
Windows

Mac

Linux

Installation

- Install Anaconda (Python Distribution)
 - <https://www.anaconda.com/download/success>
 - If you don't have at least 3 GB disc space
 - Option 1 (better): Get a bigger disc!
 - Option 2: install miniconda



The screenshot shows the Anaconda website's download page. At the top, there's a navigation bar with the Anaconda logo, links for Products, Solutions, Resources, and Company, and buttons for Free Download, Sign In, and Get Demo. The main heading is "Download Now", followed by a subtext: "Download Anaconda Distribution or Miniconda by choosing the proper installer for your machine. Learn the difference from our Documentation." Below this, there are two sections: "Distribution Installers" and "Miniconda Installers". Each section has a "Download" button and a link to "troubleshooting". Under each section, there are three rows for operating systems: Windows, Mac, and Linux, each with a dropdown arrow. A large blue arrow points from the "Miniconda Installers" section towards the "Distribution Installers" section.

Distribution Installers

[Download](#)

For installation assistance, refer to [troubleshooting](#).

Windows	▼
Mac	▼
Linux	▼

Miniconda Installers

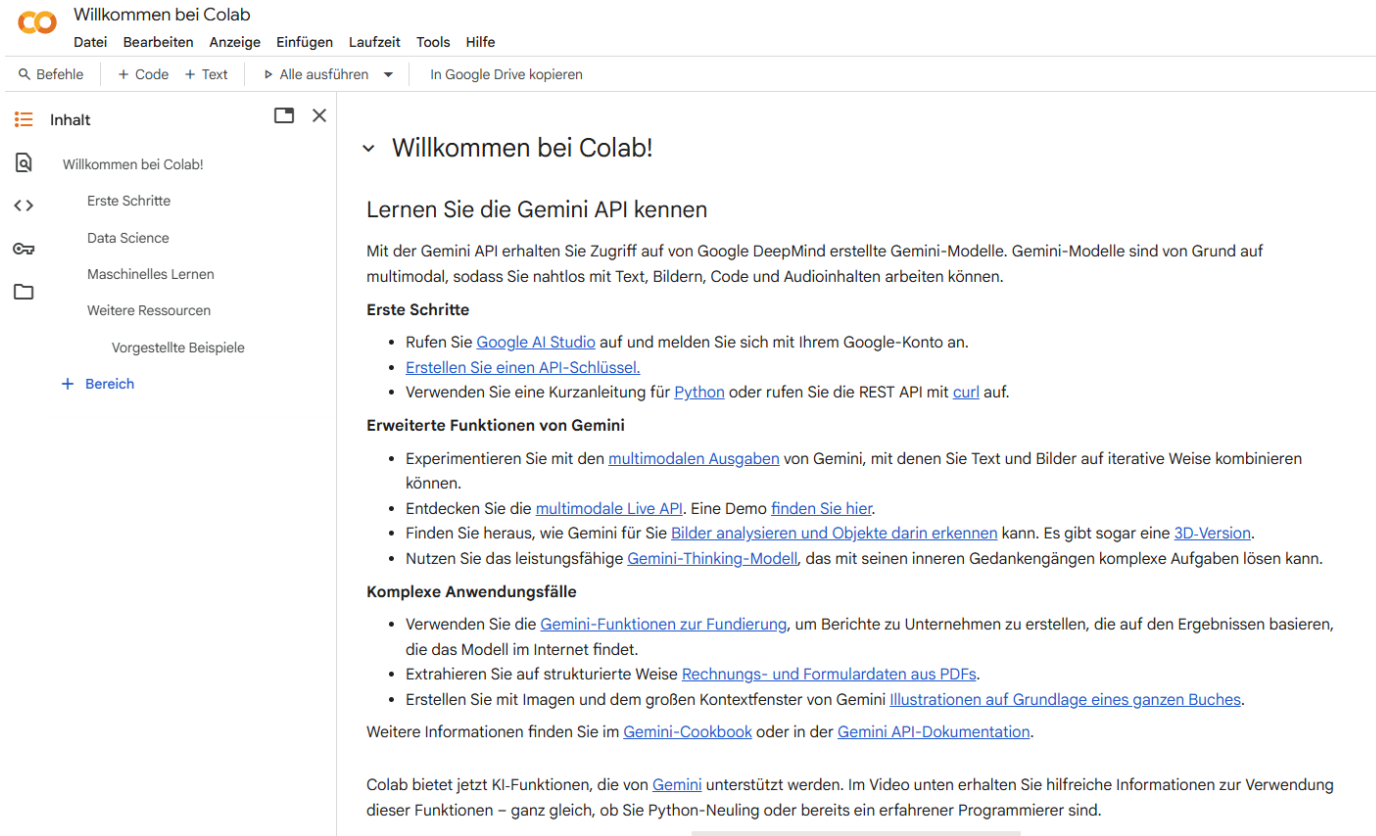
[Download](#)

For installation assistance, refer to [troubleshooting](#).

Windows	▼
Mac	▼
Linux	▼

Installation

- Alternative: Use Google Colab
 - <https://colab.research.google.com/>



Willkommen bei Colab

Datei Bearbeiten Anzeige Einfügen Laufzeit Tools Hilfe

Befehle + Code + Text Alle ausführen In Google Drive kopieren

Inhalt

Willkommen bei Colab!

Erste Schritte

Data Science

Maschinelles Lernen

Weitere Ressourcen

Vorgestellte Beispiele

+ Bereich

Willkommen bei Colab!

Lernen Sie die Gemini API kennen

Mit der Gemini API erhalten Sie Zugriff auf von Google DeepMind erstellte Gemini-Modelle. Gemini-Modelle sind von Grund auf multimodal, sodass Sie nahtlos mit Text, Bildern, Code und Audioinhalten arbeiten können.

Erste Schritte

- Rufen Sie [Google AI Studio](#) auf und melden Sie sich mit Ihrem Google-Konto an.
- [Erstellen Sie einen API-Schlüssel](#).
- Verwenden Sie eine Kurzanleitung für [Python](#) oder rufen Sie die REST API mit [curl](#) auf.

Erweiterte Funktionen von Gemini

- Experimentieren Sie mit den [multimodalen Ausgaben](#) von Gemini, mit denen Sie Text und Bilder auf iterative Weise kombinieren können.
- Entdecken Sie die [multimodale Live API](#). Eine Demo [finden Sie hier](#).
- Finden Sie heraus, wie Gemini für Sie [Bilder analysieren und Objekte darin erkennen](#) kann. Es gibt sogar eine [3D-Version](#).
- Nutzen Sie das leistungsfähige [Gemini-Thinking-Modell](#), das mit seinen inneren Gedankengängen komplexe Aufgaben lösen kann.

Komplexe Anwendungsfälle

- Verwenden Sie die [Gemini-Funktionen zur Fundierung](#), um Berichte zu Unternehmen zu erstellen, die auf den Ergebnissen basieren, die das Modell im Internet findet.
- Extrahieren Sie auf strukturierte Weise [Rechnungs- und Formulardaten aus PDFs](#).
- Erstellen Sie mit Imagen und dem großen Kontextfenster von Gemini [Illustrationen auf Grundlage eines ganzen Buches](#).

Weitere Informationen finden Sie im [Gemini-Cookbook](#) oder in der [Gemini API-Dokumentation](#).

Colab bietet jetzt KI-Funktionen, die von [Gemini](#) unterstützt werden. Im Video unten erhalten Sie hilfreiche Informationen zur Verwendung dieser Funktionen – ganz gleich, ob Sie Python-Neuling oder bereits ein erfahrener Programmierer sind.

Python

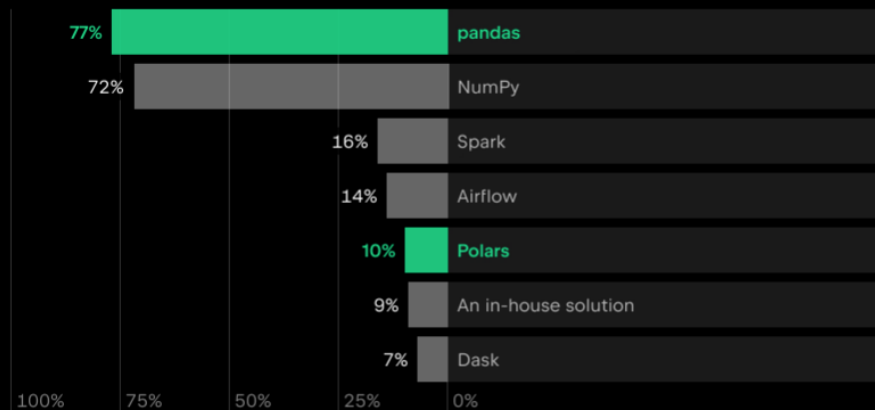
- Started in 1989 by Guido van Rossum
 - The name is a tribute to the British comedy group Monty Python
- High-level, general-purpose programming language
 - Multi-paradigm: functional, imperative, object-oriented, reflective
- Design goals
 - Be extensible, simple, and readable



Popularity

- Survey
 - Published end 2024 by JetBrains
 - Survey open between November 2023 and February 2024

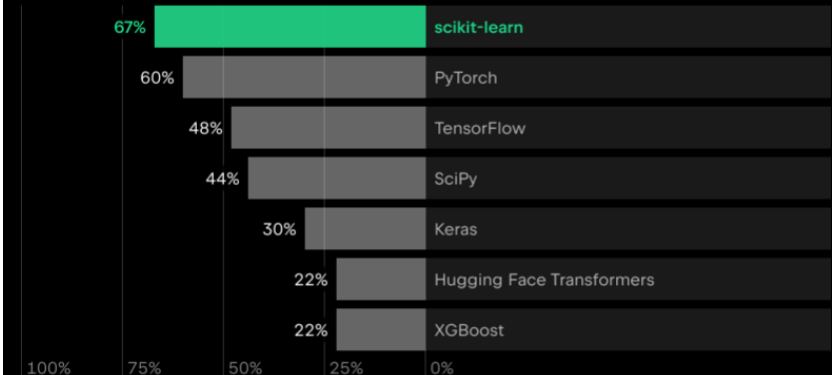
Tools for data exploration and processing



The State of Data Science 2024
jb.gg/state-of-ds



Frameworks for ML model training and prediction



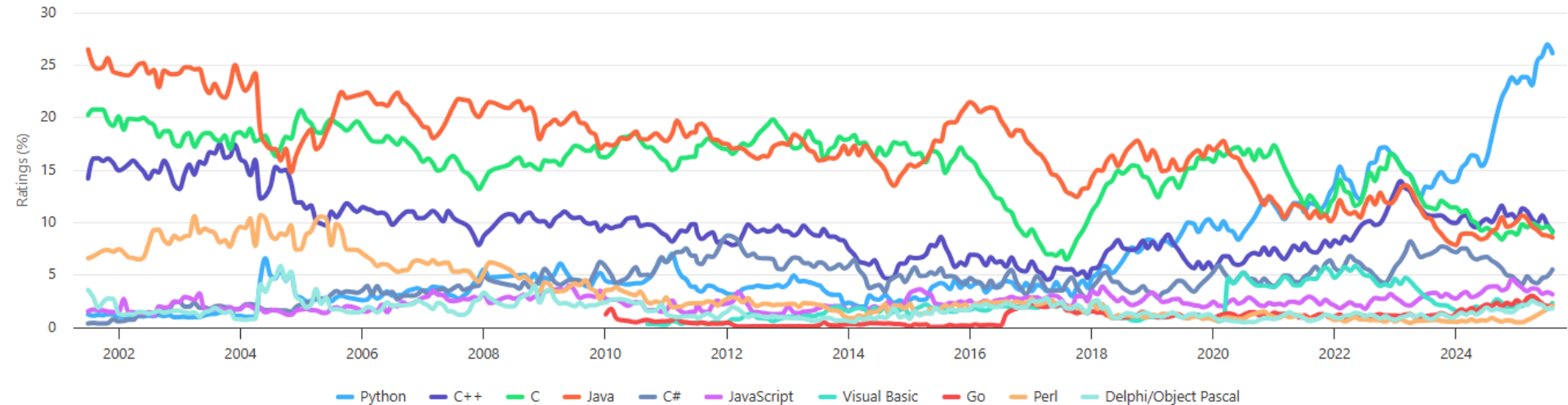
The State of Data Science 2024
jb.gg/state-of-ds







TIOBE Index – August 2025

TIOBE Programming Community Index

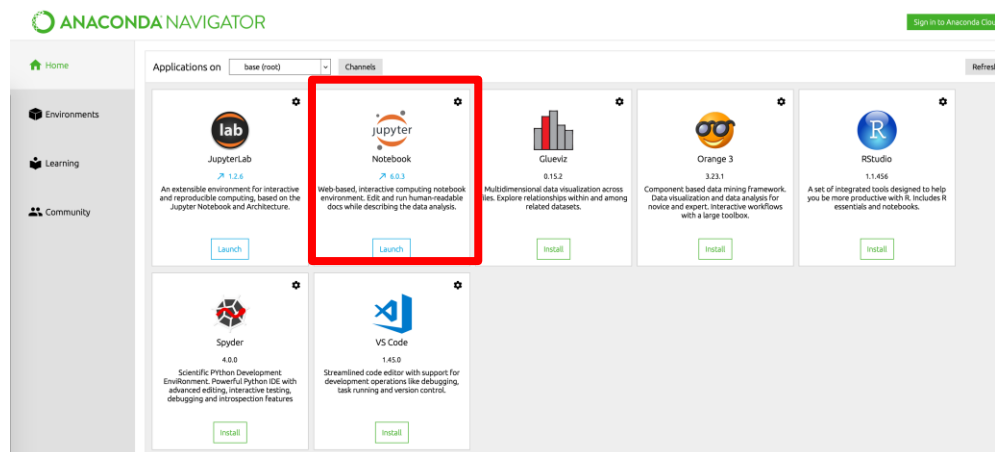
Source: www.tiobe.com



Aug 2025	Aug 2024	Change	Programming Language		Ratings	Change
1	1			Python	26.14%	+8.10%
2	2			C++	9.18%	-0.86%
3	3			C	9.03%	-0.15%
4	4			Java	8.59%	-0.58%
5	5			C#	5.52%	-0.87%
6	6			JavaScript	3.15%	-0.76%
7	8	▲		Visual Basic	2.33%	+0.15%

Jupyter notebooks

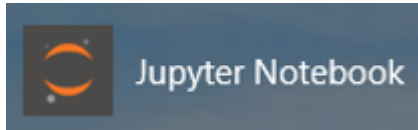
- In the exercises, we will use Jupyter Notebooks
- The start procedure depends on your operating system
 - in general: run the **Anaconda Navigator** and click on **jupyter Notebook**



- The Jupyter Notebook App can access only files within its start-up folder (including any sub-folder)
 - default is your home folder
 - Windows: usually C:\Users\{username}
 - Linux: /home/{username}
 - Mac: /Users/{username}

Jupyter notebooks

- Start Jupyter - Option 1 (Windows)



- Click on the *Jupyter Notebook* icon in the start menu
- To change this folder:
 - Copy the Jupyter Notebook launcher from the menu to the desktop.
 - Right click on the new launcher and change the Target field, change %USERPROFILE% to the full path of the folder which will contain all the notebooks.
 - Use the *Jupyter Notebook* desktop launcher to start the notebook

Jupyter notebooks

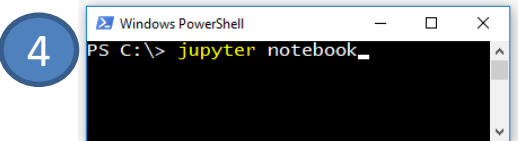
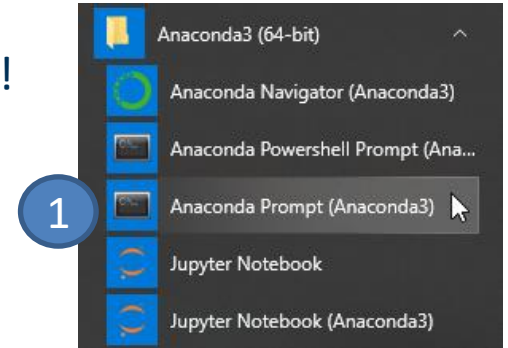
- Start Jupyter – Option 2 (Linux and Windows)

- Run „jupyter notebook“ in command line

- Navigate to folder that you want to access before!

- Or (Windows):

1. Open the Anaconda Prompt
2. Copy the path to your folder
3. Write “cd ” and then make a **right** mouse click into the terminal folder to insert the copied path
4. then type “jupyter notebook” + enter

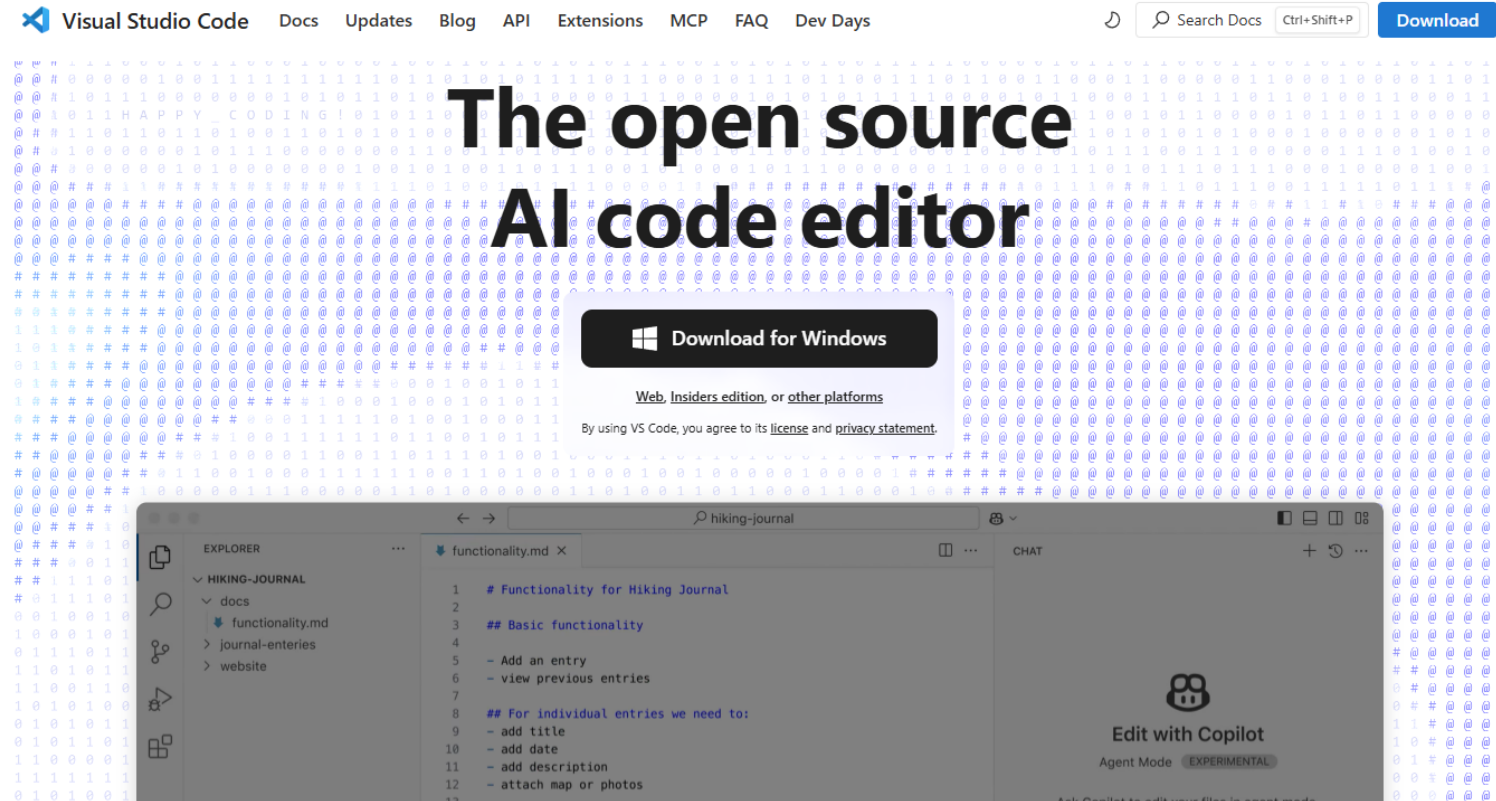


- Start Jupyter – Option 3 (Mac OS)

- Click on spotlight, type “terminal” to open a terminal window
- Enter the startup folder by typing “cd /some_folder_name”.
- Type “jupyter notebook” to launch the Jupyter Notebook App

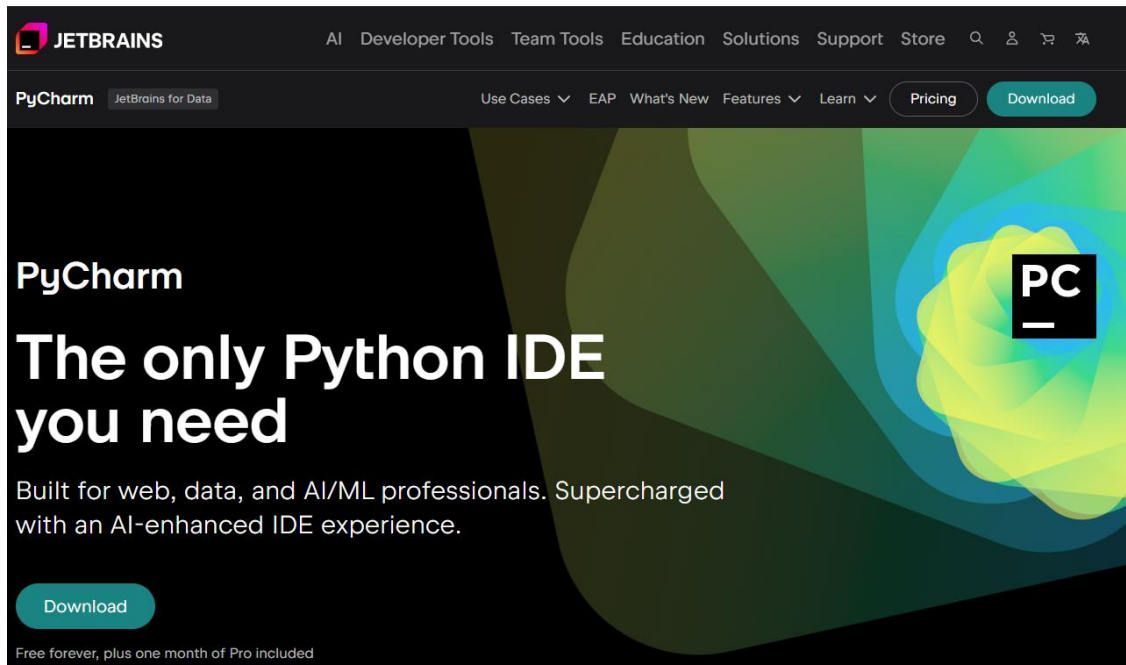
Integrated Development Environment (IDE)

- You can choose whatever coding environment you want
 - Direct Jupyter Notebook (Anaconda – as explained before)
 - Visual Studio Code (VS Code) – nice AI integration



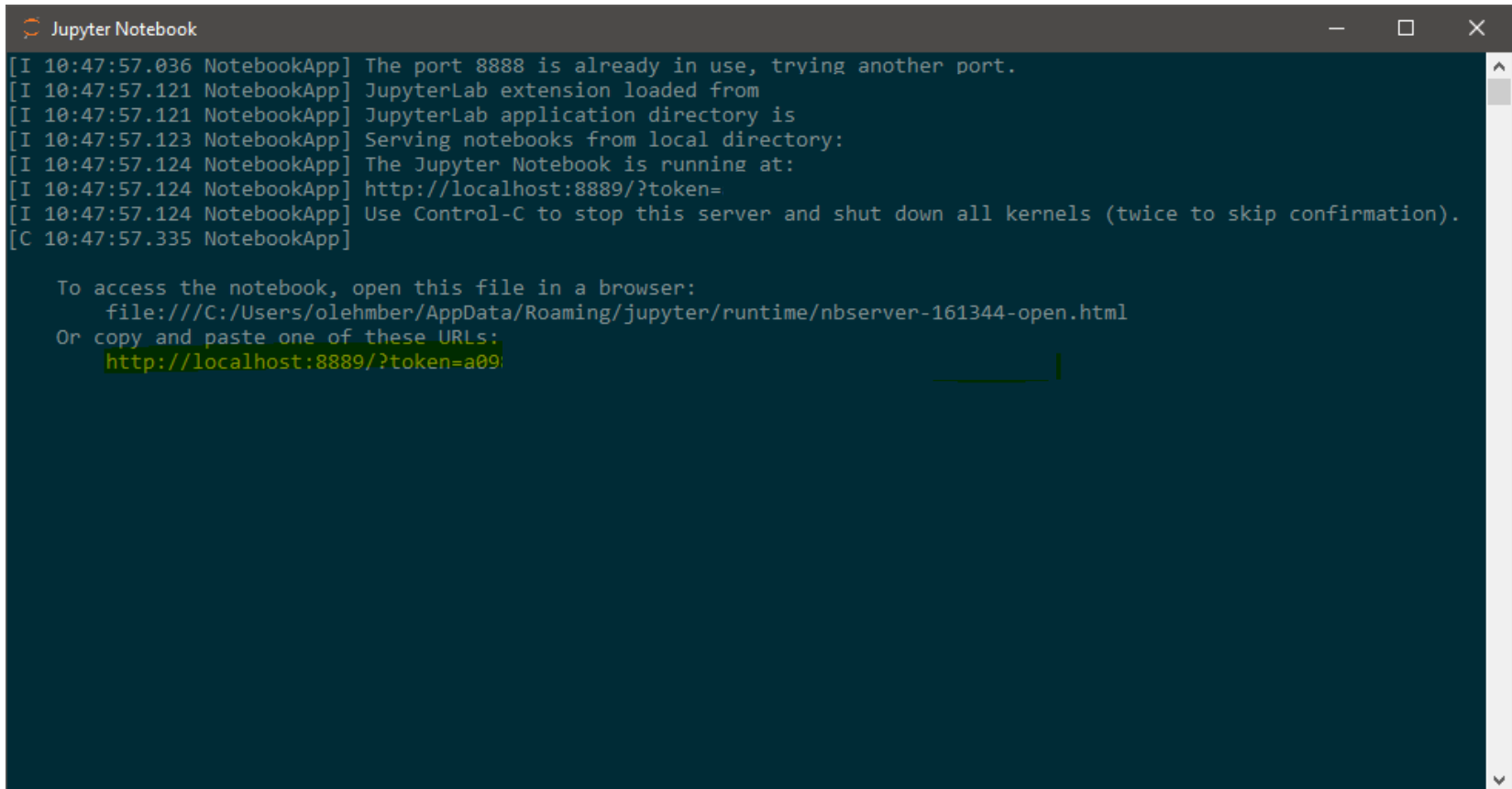
Integrated Development Environment (IDE)

- You can choose whatever coding environment you want
 - Direct Jupyter Notebook (Anaconda – as explained before)
 - Visual Studio Code (VS Code)
 - JetBrains PyCharm



Jupyter notebooks

- A local server is started
- Open the URL on screen in your browser, if not already opened



```
Jupyter Notebook
[I 10:47:57.036 NotebookApp] The port 8888 is already in use, trying another port.
[I 10:47:57.121 NotebookApp] JupyterLab extension loaded from
[I 10:47:57.121 NotebookApp] JupyterLab application directory is
[I 10:47:57.123 NotebookApp] Serving notebooks from local directory:
[I 10:47:57.124 NotebookApp] The Jupyter Notebook is running at:
[I 10:47:57.124 NotebookApp] http://localhost:8889/?token=
[I 10:47:57.124 NotebookApp] Use Control-C to stop this server and shut down all kernels (twice to skip confirmation).
[C 10:47:57.335 NotebookApp]

To access the notebook, open this file in a browser:
    file:///C:/Users/olehmber/AppData/Roaming/jupyter/runtime/nbserver-161344-open.html
Or copy and paste one of these URLs:
    http://localhost:8889/?token=a09
```

Jupyter Home Screen

- Startscreen in browser
 - like a file explorer

upload files to
notebook folder

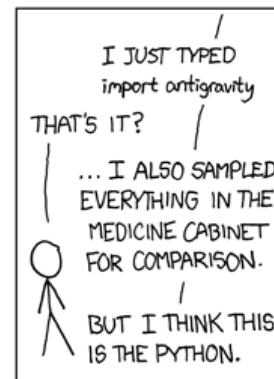
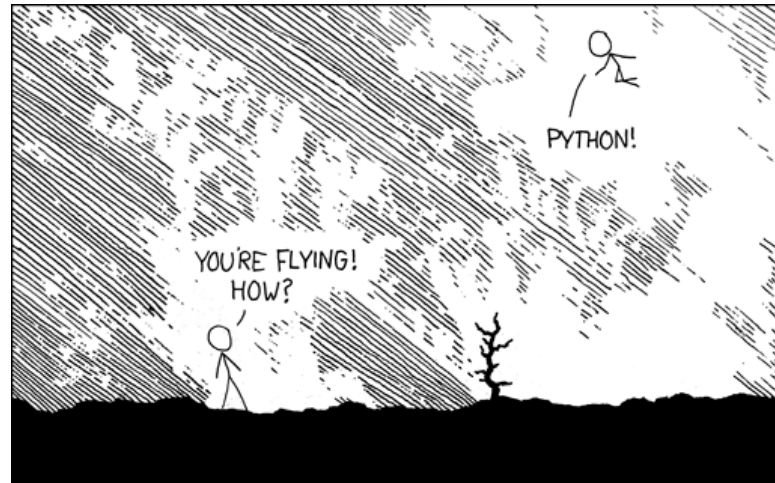
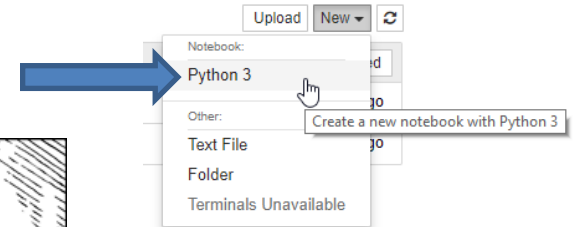
Create new
files/notebooks



file explorer

Now try it out

- Click in browser „New“ -> „Python 3“



<https://xkcd.com/353/>

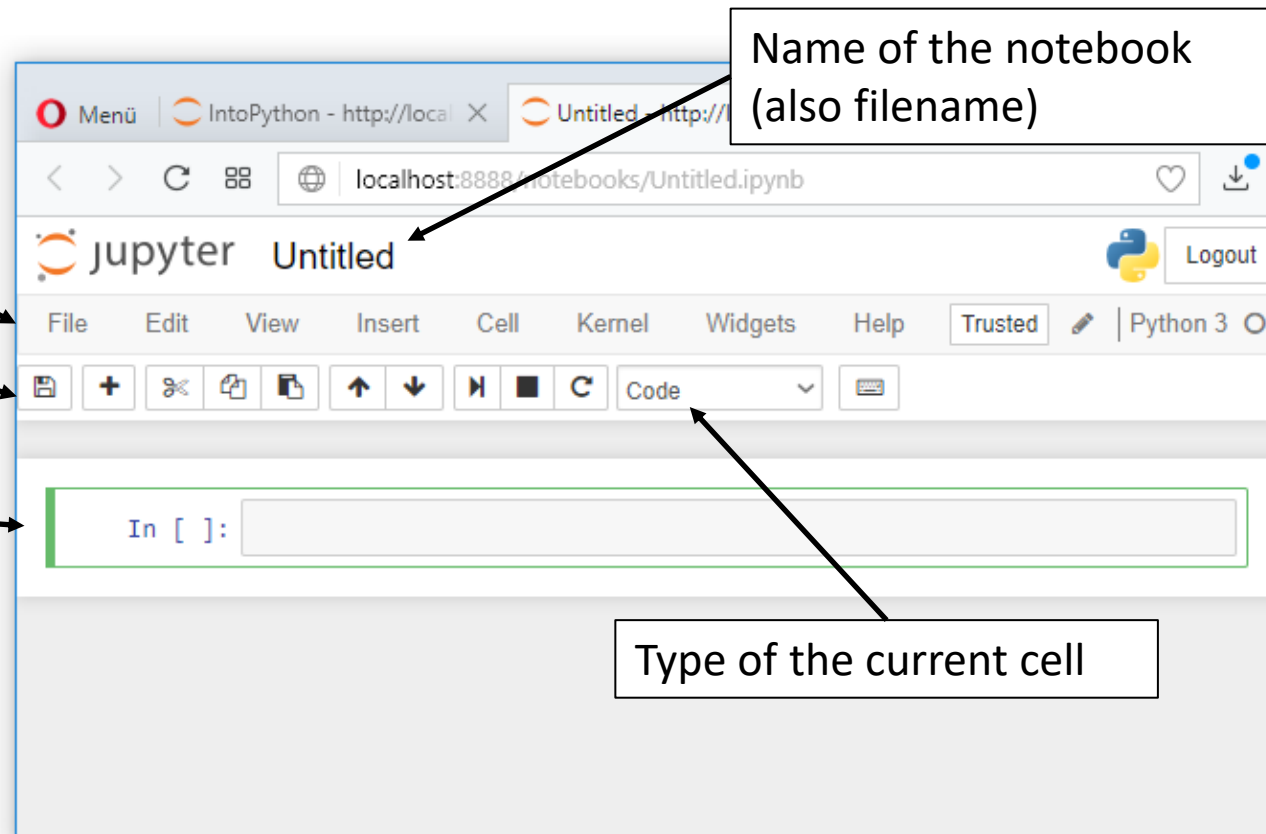
Jupyter Notebook

- Every notebook is composed of cells
 - Cells contain a specific type of content
 - markdown cells (for documentation and structure)
 - code cells

Menu Bar

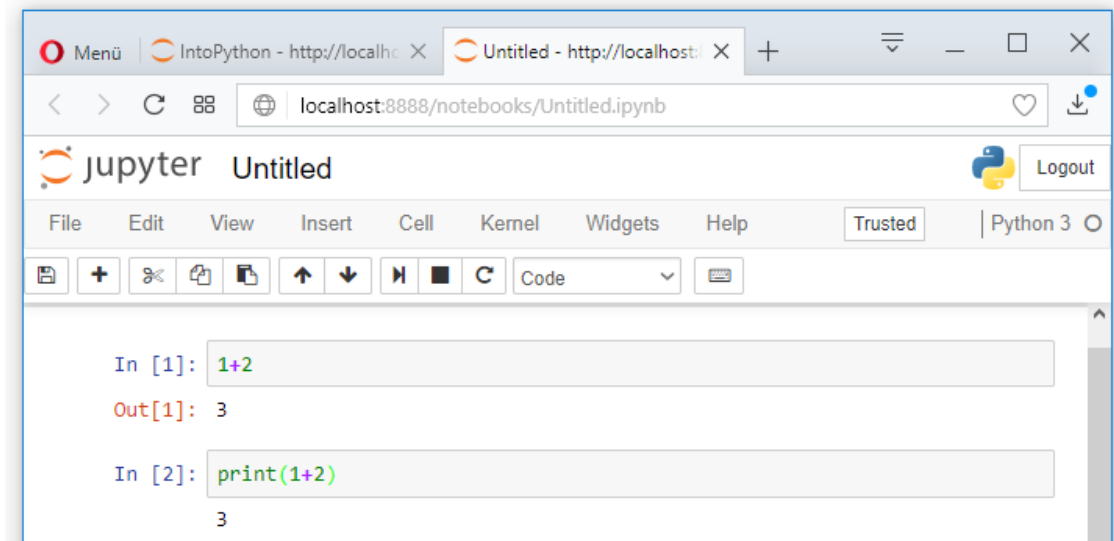
Shortcuts

Cell



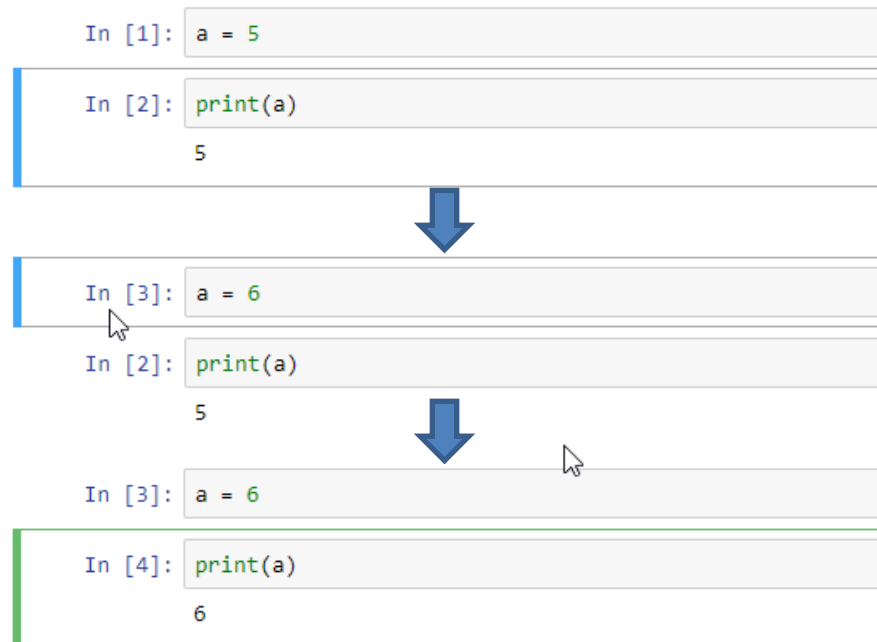
Jupyter Cells

- Code cell:
 - You can type python code (because you created a python notebook)
 - Hit „Ctrl + Enter“ to run the code
 - Hit „Shift + Enter“ to run it and create a new cell
 - Try it and type 1 + 2
 - The output is shown below the cell



Jupyter Cells

- Each „code cell“ can be reevaluated (indicated by a number)
 - All previous results / variables are stored (like in R workspace)



Change code
and run again
[1] -> [3]

run next cell
again [2] -> [4]

Jupyter Cells

- Autocomplete by pressing <tab> when writing

```
In [2]: my_very_long_variable_with_hundreds_of_characters = 5  
my_second_very_long_variable_with_hundreds_of_characters = 6
```

```
In [ ]: my|  
my_second_very_long_variable_with_hundreds_of_characters  
my_very_long_variable_with_hundreds_of_characters
```

- Signature of function by pressing <shift>+<tab>

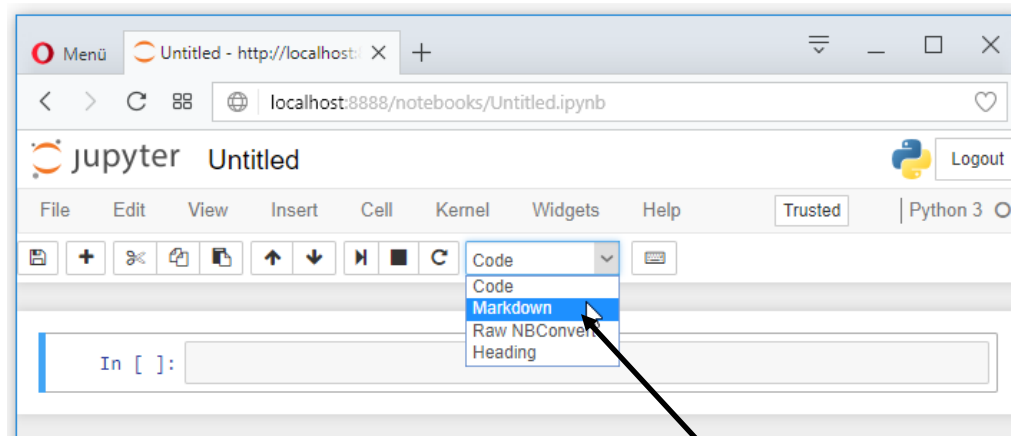
```
corr(datar, color_grades=5)
```

Signature:

```
corr(  
    ['data', "corr_method='spearman'", 'annot=False', 'mask=True', 'line_width=1', "line_  
color='black'", 'color_grades=5', 'auto_sizing=True', "palette='default'", "style='asteti  
5 #from astetik import corr
```

Jupyter Cells

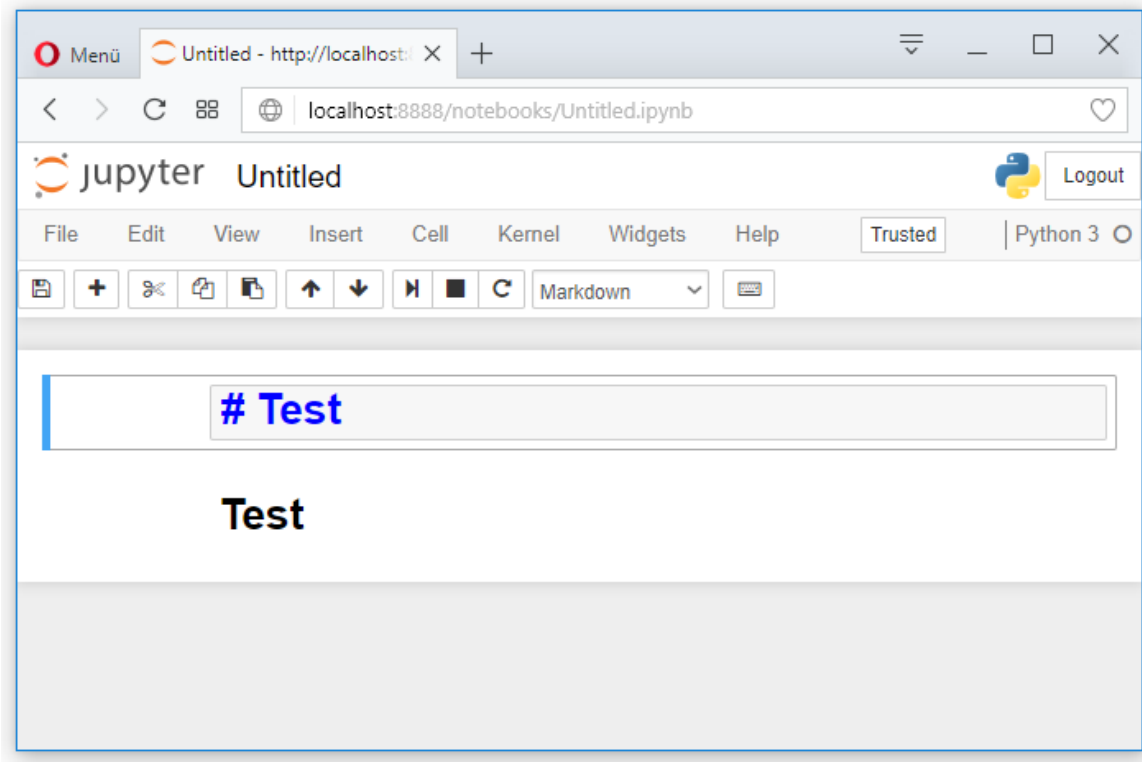
- What makes a notebook a notebook?
 - Markdown cells let you add documentation and notes
 - Create a new cell („Insert->Insert Cell Below“)
 - Change the type to Markdown



Type of the current cell

Jupyter Cells

- What makes a notebook a notebook?
 - Type „# Test“ which creates a heading (add more „#“ for smaller headline)
 - Whitespace after #
 - Evaluate the cell and see the result



Jupyter Cells - Markdown

- Different possibilities to structure

- Header

```
# H1  
## H2  
### H3
```

- Unordered List (use "*", "+", or "-" in front)

```
- Item  
- Item
```

- Ordered list

```
1. Item one  
2. Item two
```

- Links

```
[link to google](https://www.google.com)
```

- Image

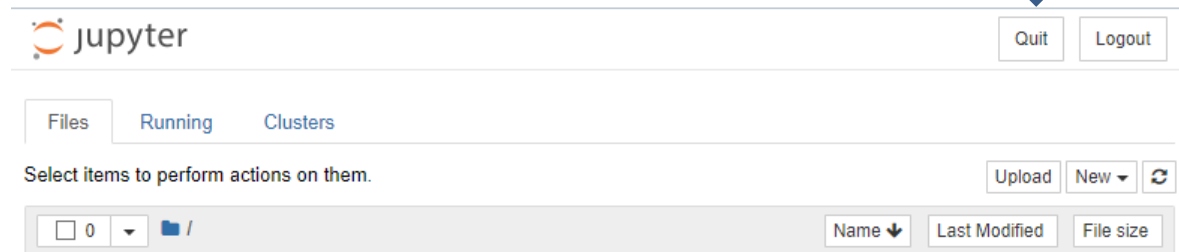
```
![Mannheim Image](https://www.uni-mannheim.de/1/00_UM_Dachmarke_DE_RGB.jpg)
```

- Quote

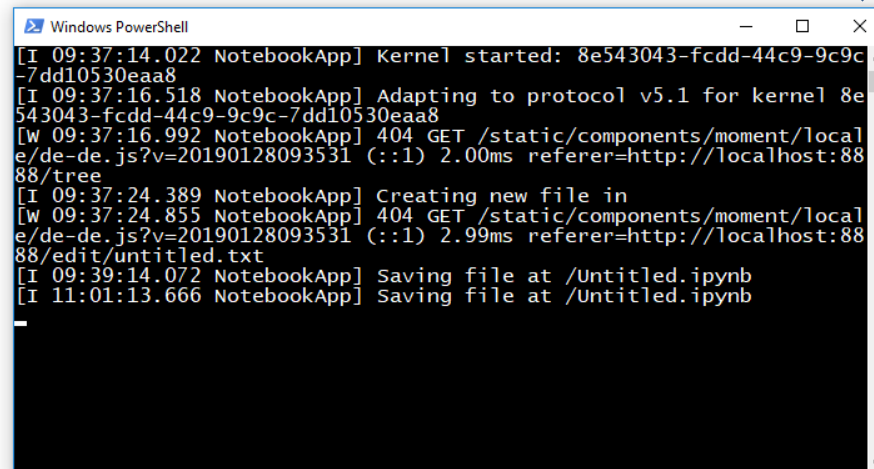
```
> This is a quotation
```

Shut down Jupyter

- Closing the browser (or the tab) will not close the Jupyter server
- Option 1: click on **Quit** in the jupyter homepage



- Option 2: close the associated terminal or press “Ctrl” + “C”

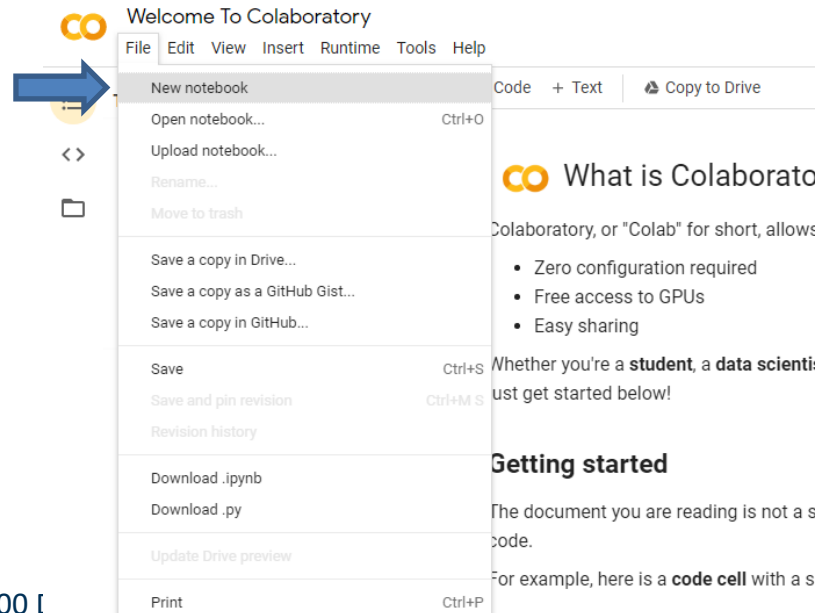


```
Windows PowerShell
[I 09:37:14.022 NotebookApp] Kernel started: 8e543043-fcdd-44c9-9c9c-7dd10530eaa8
[I 09:37:16.518 NotebookApp] Adapting to protocol v5.1 for kernel 8e543043-fcdd-44c9-9c9c-7dd10530eaa8
[W 09:37:16.992 NotebookApp] 404 GET /static/components/moment/locale/de-de.js?v=20190128093531 (::1) 2.00ms referer=http://localhost:8888/tree
[I 09:37:24.389 NotebookApp] Creating new file in
[W 09:37:24.855 NotebookApp] 404 GET /static/components/moment/locale/de-de.js?v=20190128093531 (::1) 2.99ms referer=http://localhost:8888/edit/untitled.txt
[I 09:39:14.072 NotebookApp] Saving file at /Untitled.ipynb
[I 11:01:13.666 NotebookApp] Saving file at /Untitled.ipynb
```

Google Colab

- Runs in the cloud on Google Servers and free to use with Google account
- Uses jupyter notebooks with a modified interface, which are saved in your google drive

Create new notebook

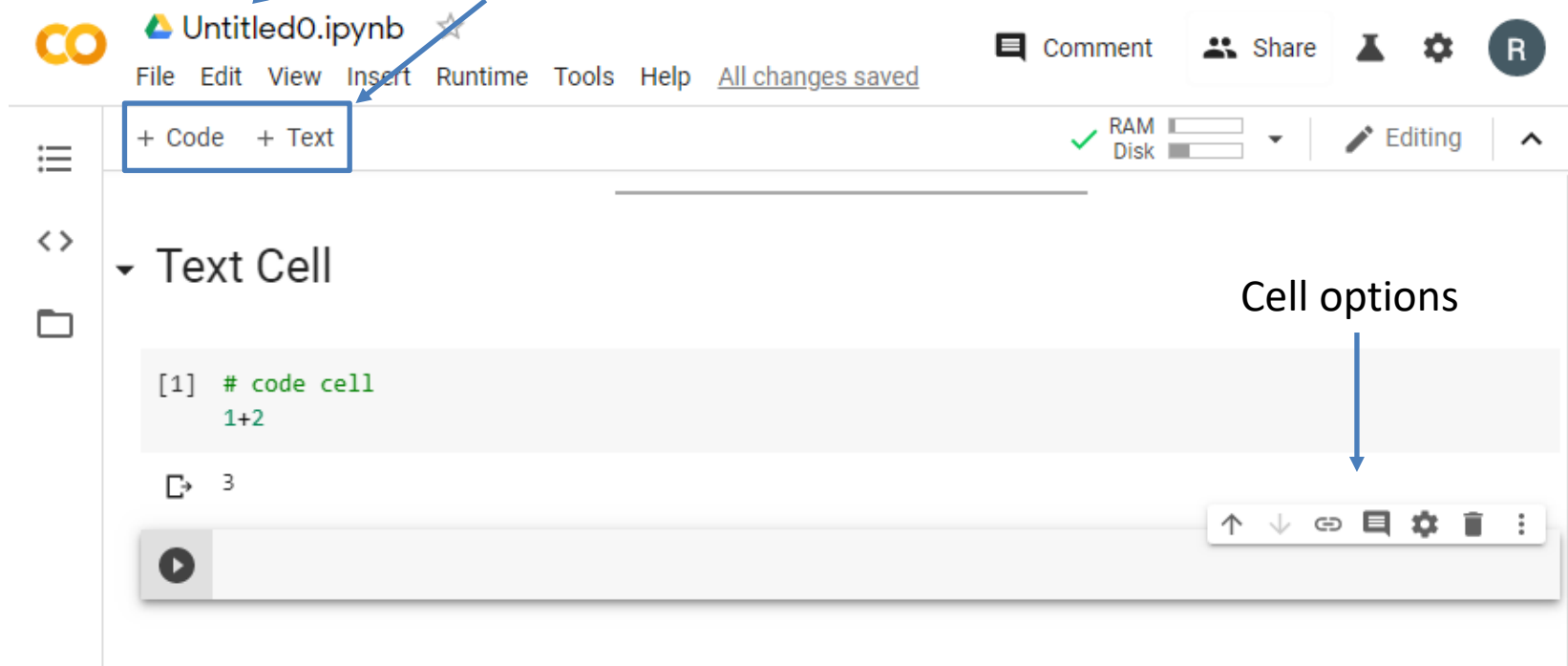


Google Colab Layout

- Code and Text cells
- Shortcuts like Shift+Enter work the same way

Change name of notebook

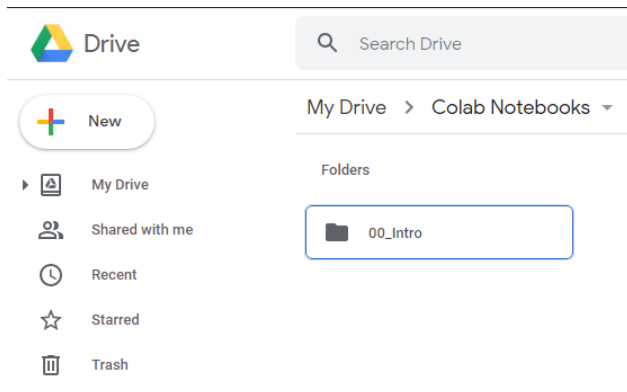
Insert code or text cell



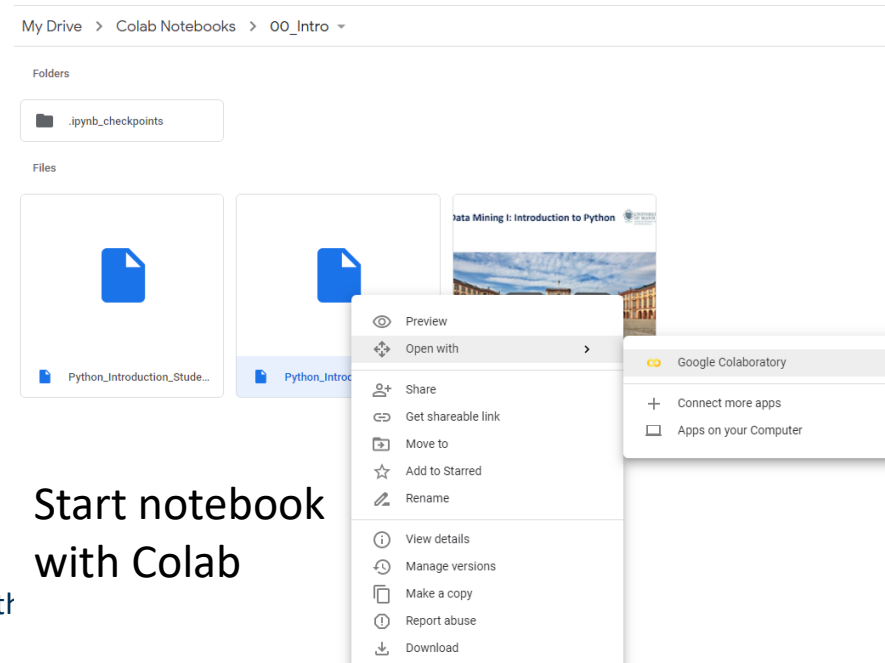
The screenshot displays the Google Colab interface. At the top, the notebook is titled 'Untitled0.ipynb'. Below the title bar, there is a menu with options: File, Edit, View, Insert, Runtime, Tools, and Help. A blue arrow points from the text 'Change name of notebook' to the notebook title. Another blue arrow points from the text 'Insert code or text cell' to the '+ Code' and '+ Text' buttons in the left sidebar. The main workspace shows a 'Text Cell' containing the code `[1] # code cell` and `1+2`. A blue arrow points from the text 'Cell options' to the options menu (three dots) at the bottom right of the cell. The interface also includes a 'Comment' button, a 'Share' button, and a 'RAM Disk' indicator.

Google Colab

- Saves notebooks to folder “Colab Notebooks” on your Google Drive by default
- To facilitate exercises and have stuff “just work”: upload/unzip exercise material in this folder



File Location



Start notebook
with Colab