

# **AI-based Audio Analysis of Music and Soundscapes**

## **Setting up & Using Python**

Dr.-Ing. Jakob Abeßer

Fraunhofer IDMT

[jakob.abesser@idmt.fraunhofer.de](mailto:jakob.abesser@idmt.fraunhofer.de)

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# Python Basics

## Outline

- Python in
    - Local machine
    - Jupyter Notebook
    - Google Colab
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# Python Basics

## Python on local machine

- Install Python

- <https://www.python.org/downloads/>

- *Release Version Python 3.7.14*

- *Run Installer*

- Install Miniconda

- <https://docs.conda.io/en/latest/miniconda.html>

- *Download 64-bit version for your operating system*

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# Python Basics

## Python on local machine

- Start "Anaconda Prompt (Miniconda 3)"
    - This opens up a new terminal / command line window
  - Download
    - <https://github.com/machinelisting/machinelisting.github.io/raw/master/aiaa.yml> (click on link, "File" > "Save Page As" ...)
  - Navigate to the folder, where the YML file was downloaded to (use "**cd [sub directory name]**" or "**cd ..**")
  - Run **conda env create --file aiaa.yml** to create a conda environment with all necessary Python packages
  - Run **conda activate aiaa** to activate this environment
    - You should see "(aiaa) [your current path]" in the Terminal
-

# Python Basics

## Python on local machine

- Let's see if everything works
    - Run `python` to start the python console
    - Try to import our most relevant Python packages:
      - E.g. `import matplotlib`
      - Do the same for `sklearn`, `numpy`, `librosa`, `tensorflow`
    - Exit with `exit()`
  - Now you're ready to use Python on your local machine 😊
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# Python Basics

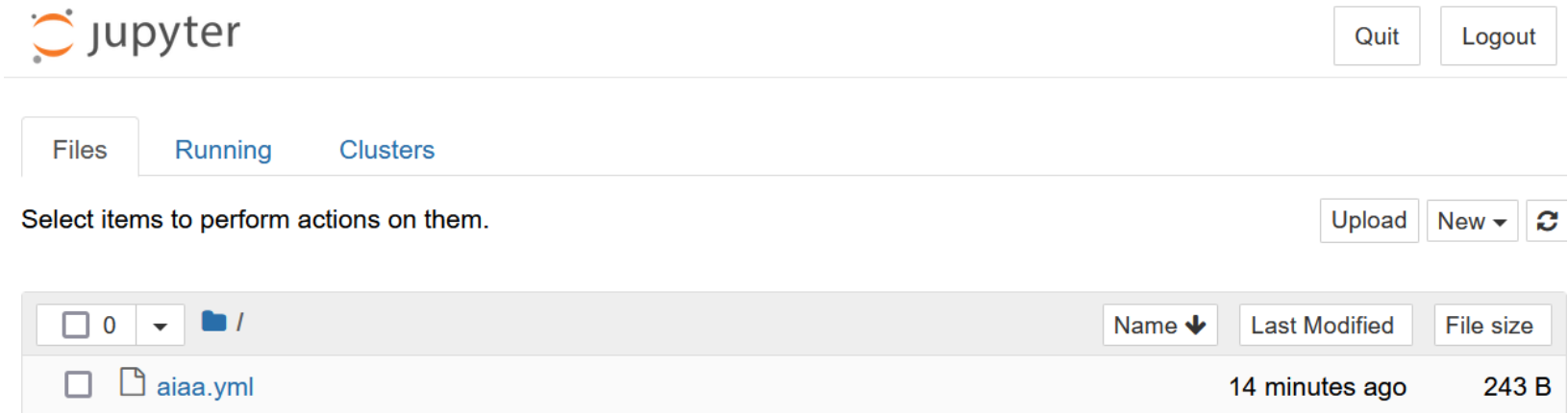
## Python on local machine

- Option 1: Local code development with Python editor
    - Write python code, save it as [name].py text files and run
      - `python my_file.py` (in the terminal) to execute the code
    - Recommended Python IDE (code editors)
      - <https://atom.io/>
      - <https://www.jetbrains.com/pycharm/download/> (the "Community" version is free to use)
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# Python Basics

## Python in Jupyter Notebook

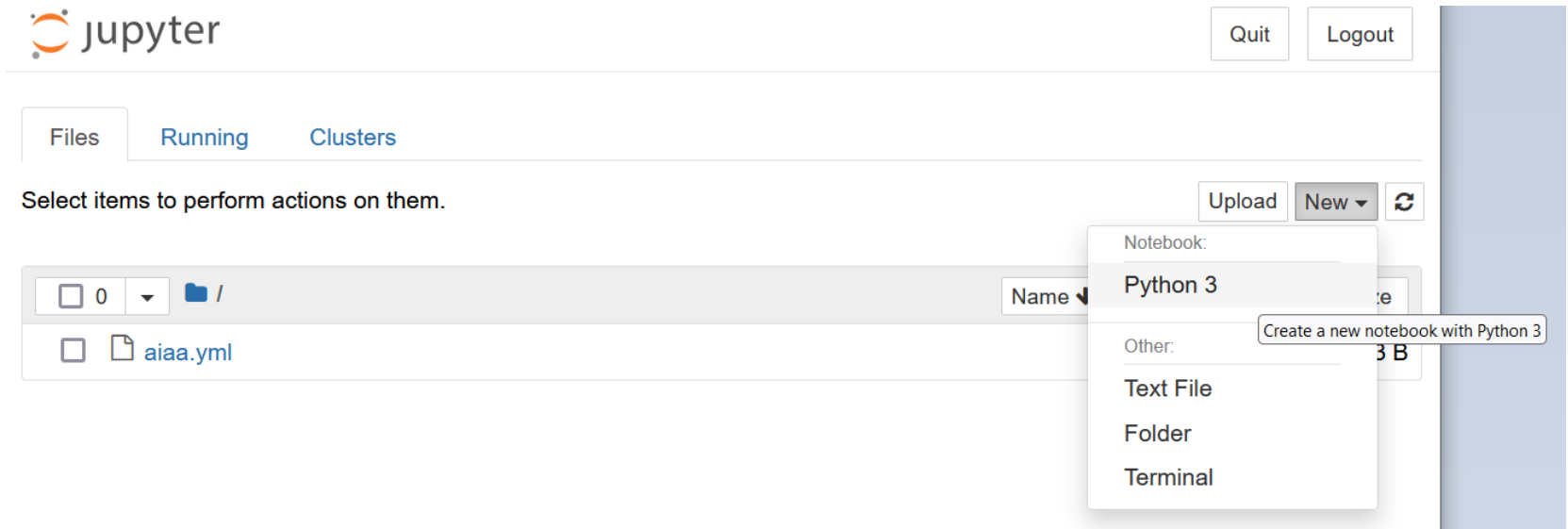
- Option 2: Local code development with Jupyter notebook
  - Run **jupyter notebook** (within the activated aiaa conda environment)
    - This starts a local Python server and opens your browser



# Python Basics

## Python in Jupyter Notebook

- Create new notebook: **New > Python 3**

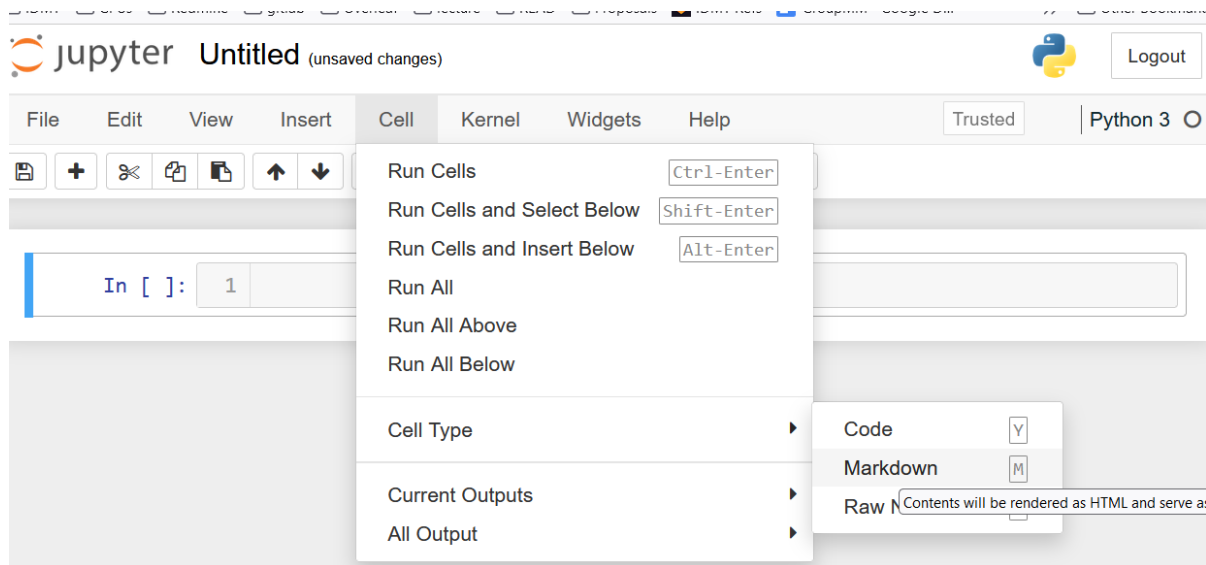




# Python Basics

## Python in Jupyter Notebook

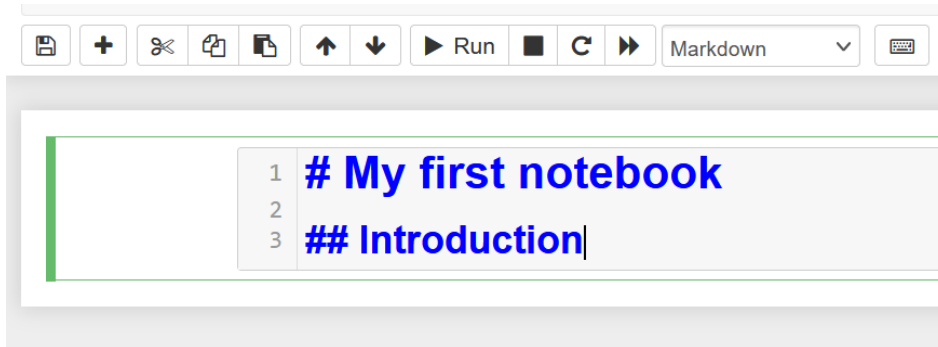
- A Jupyter Notebook contains multiple “cells”, which can be
  - Python code
  - Formatted text (also images etc.) in “markdown” Syntax
- Let's start with a text cell (change cell type to “Markdown”)



# Python Basics

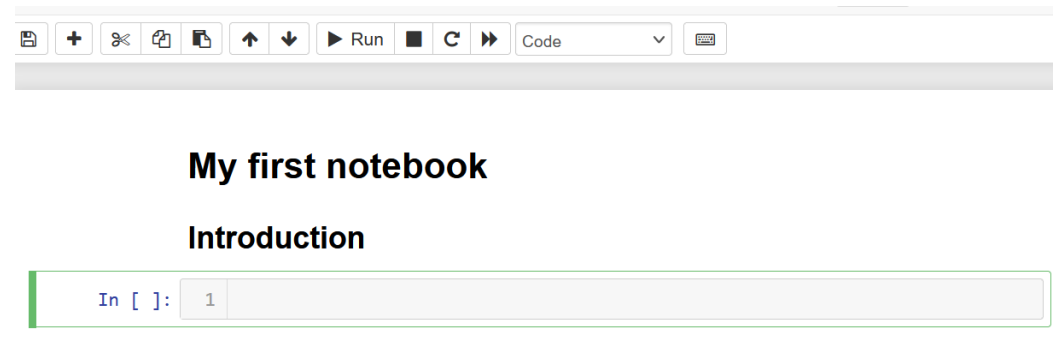
## Python in Jupyter Notebook

- We'll add a header (using the # and ## formatting for level-1 and level-2 headers)



```
1 # My first notebook
2
3 ## Introduction|
```

- Let's compile it (**Shift + Enter**)

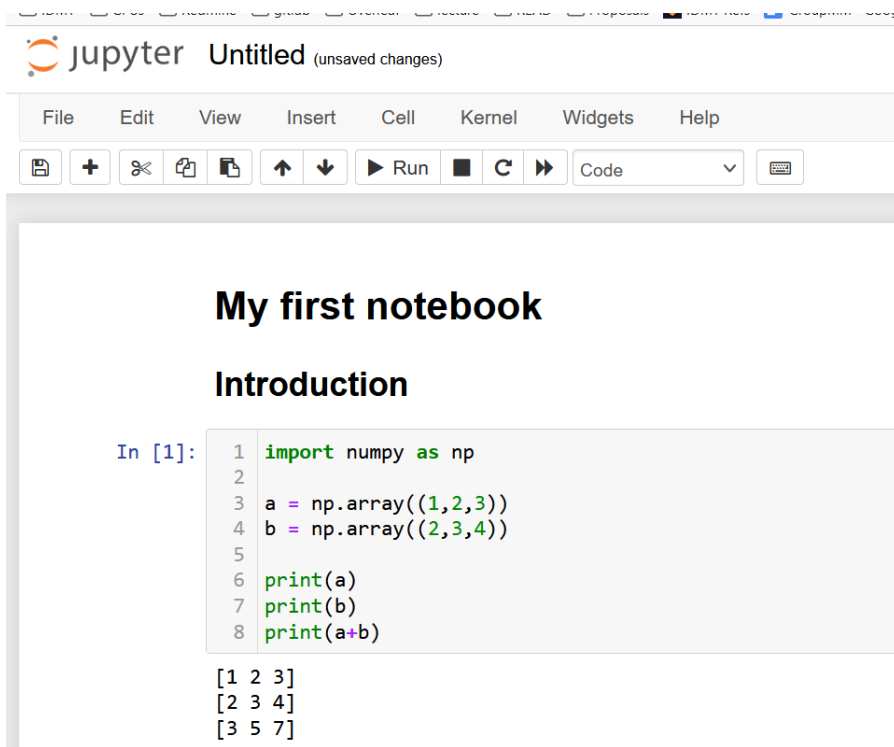


```
In [ ]: 1
```

# Python Basics

## Python in Jupyter Notebook

- In the next cell, we'll first import a python library and then run some code (again, compile with **Shift + Enter**)



The screenshot shows a Jupyter Notebook window titled "Untitled (unsaved changes)". The interface includes a menu bar with "File", "Edit", "View", "Insert", "Cell", "Kernel", "Widgets", and "Help". Below the menu is a toolbar with icons for saving, adding, deleting, and running code. The main area contains a code cell with the following Python code:

```
In [1]: 1 import numpy as np
        2
        3 a = np.array((1,2,3))
        4 b = np.array((2,3,4))
        5
        6 print(a)
        7 print(b)
        8 print(a+b)
```

The output of the code is displayed below the cell:

```
[1 2 3]
[2 3 4]
[3 5 7]
```

# Python Basics

## Python in Jupyter Notebook

- Here are some more links on
    - Markdown formatting:
      - <https://www.markdownguide.org/cheat-sheet/>
    - Useful shortcuts in Jupyter:
      - [https://www.audiolabs-erlangen.de/resources/MIR/FMP/B/B\\_Jupyter.html#Keyboard-Shortcuts](https://www.audiolabs-erlangen.de/resources/MIR/FMP/B/B_Jupyter.html#Keyboard-Shortcuts)
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# Python Basics

## Python in Google Colab

- Advantages

- Run Python code in the browser (no local Python installation necessary)
- Access powerful hardware (GPU, TPU) for deep learning
- Sharing of code to others

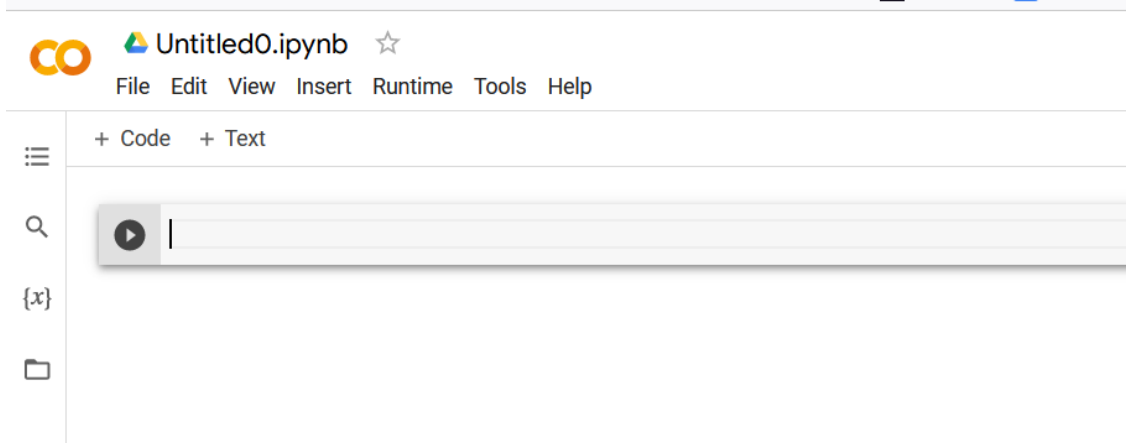
- Requirements

- Google account
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# Python Basics

## Python in Google Colab

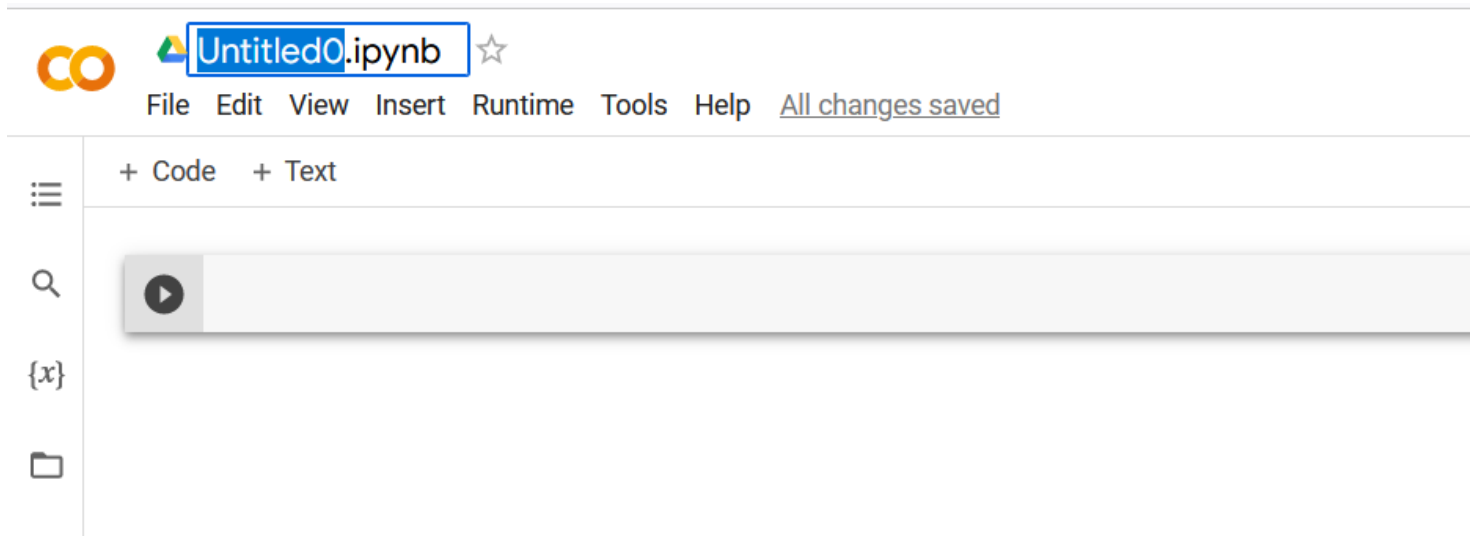
- Setting it up
  - Go to <https://colab.research.google.com/>
  - Sign In (with your google account)
  - "New Notebook"



# Python Basics

## Python in Google Colab

- Change notebook name
  - Click on title



# Python Basics

## Python in Google Colab

- Add / fill cells

- Just as in Jupyter, you can use code or markdown cells



- Run cells with **Shift + Enter**

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# Python Basics

## Python in Google Colab

- Run lecture notebooks in Colab

### Lecture Material (Slides / Jupyter Notebooks)

- AIAA 0 - Introduction
    - [Slides \(PDF\)](#)
  - AIAA 1 - Python
    - [Slides \(PDF\)](#)
    - [Jupyter Notebook \(ipynb\)](#)
      - [Open in Google Colab](#)
  - AIAA 2 - Audio Processing
    - [Slides \(PDF\)](#)
    - [Jupyter Notebook \(ipynb\)](#)
      - [Open in Google Colab](#)
  - Audio Examples
    - [bird.wav](#)
    - [piano.wav](#)
-

# Python Basics

## Python in Google Colab

### ■ Run lecture notebooks in Colab

#### Lecture Material (Slides / Jupyter Notebooks)

- AIAA 0 - Introduction
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  - [Jupyter Notebook \(ipynb\)](#)
  - [Open in Google Colab](#)
- Audio Examples
  - [bird.wav](#)
  - [piano.wav](#)

The screenshot shows the Google Colab interface for a notebook titled 'AIAA\_1\_Python.ipynb'. The top bar includes the Colab logo, the notebook title, and a menu with 'File', 'Edit', 'View', 'Insert', 'Runtime', 'Tools', and 'Help'. Below the menu, there are tabs for '+ Code' and '+ Text', and a 'Copy to Drive' button. The left sidebar contains icons for a menu, search, a variable '{x}', and a document. The main content area is divided into sections: a title 'AI-based Audio Analysis of Music and Soundscapes', a subtitle 'Dr. Jakob Abeßer (jakob.abesser@idmt.fraunhofer.de), 2022', and a main heading 'Fundamentals of Python Programming'. Below this, there is a code cell with the following Python code:

```
[ ] import numpy as np
import matplotlib.pyplot as plt
```

Another section titled 'Python Basics' is visible, containing a sub-section 'Variables' and another code cell with the following Python code:

```
[ ] x = 12
print(x)

y = "Hello world"
print(y)
```