

AI-based Audio Analysis of Music and Soundscapes

Setting up & Using Python

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Python Basics

Outline

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

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*

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 YAML 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 😊

Python Basics

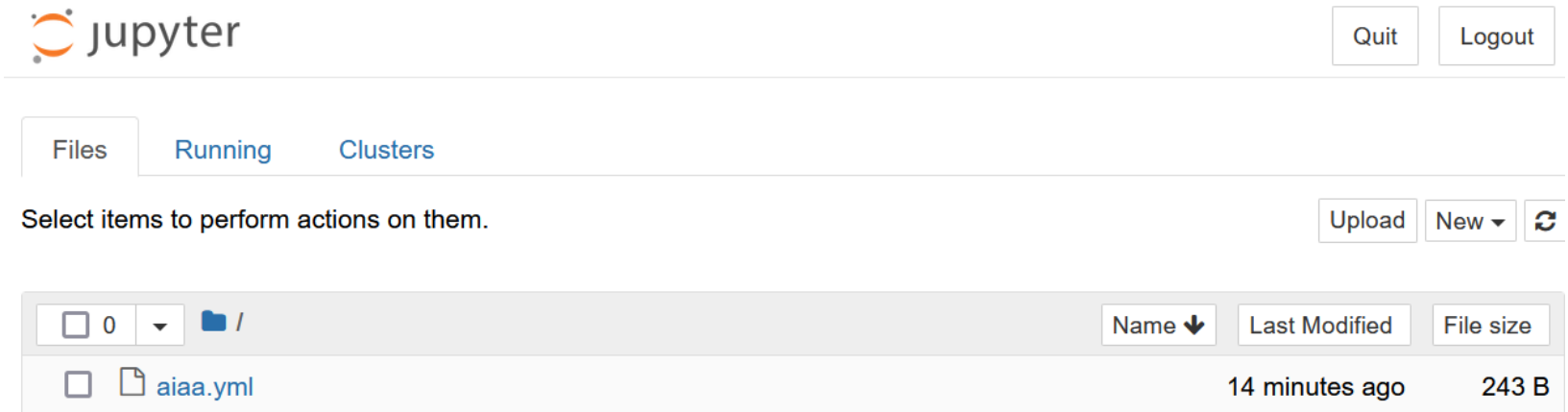
Python on local machine

- 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)
-

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



The screenshot shows the Jupyter Notebook interface. At the top left is the Jupyter logo. On the top right are 'Quit' and 'Logout' buttons. Below the logo are three tabs: 'Files' (selected), 'Running', and 'Clusters'. Below the tabs is the text 'Select items to perform actions on them.' followed by 'Upload', 'New', and a refresh icon. The main area shows a file browser with a table of files:

<input type="checkbox"/>	0		Name ↓	Last Modified	File size
<input type="checkbox"/>		📁 /			
<input type="checkbox"/>		📄	aiaa.yml	14 minutes ago	243 B

Python Basics

Python in Jupyter Notebook

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

 jupyter

Quit

Logout

Files

Running

Clusters

Select items to perform actions on them.

Upload

New ▾



0 ▾

 /

Name ▾

 aiaa.yml

Notebook:

Python 3

Other:

Text File

Folder

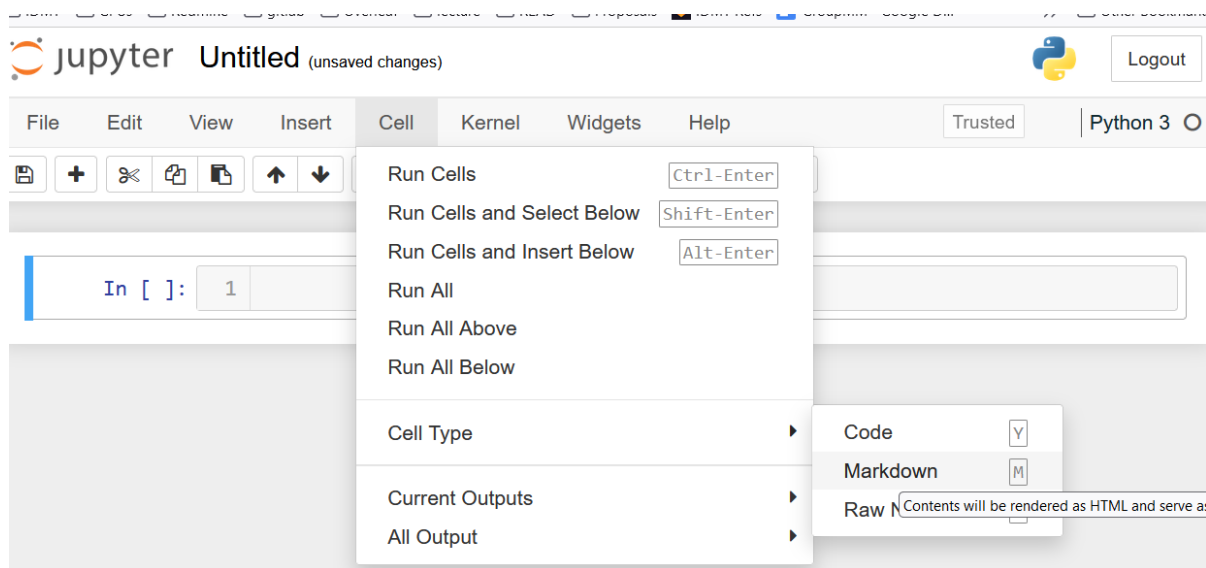
Terminal

Create a new notebook with Python 3

Python Basics

Python in Jupyter Notebook

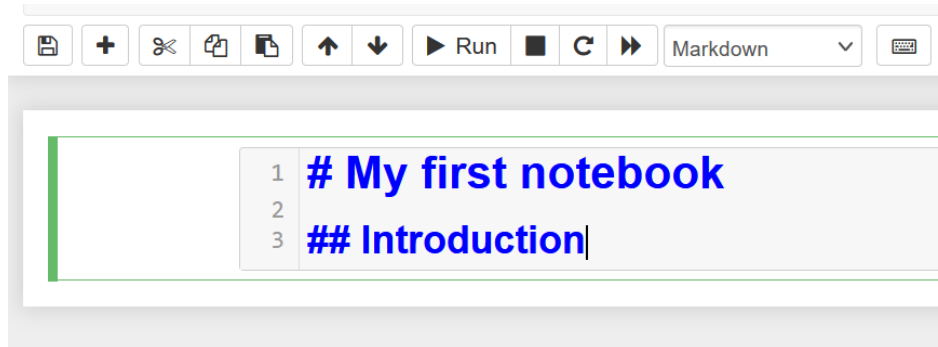
- A Jupyter Notebook contains multiple “cells”, which can be
 - Python code
 - Formatted text (also images etc.) in “markdown” Syntax
- Let’s start with a text cell (change cell type to “Markdown”)



Python Basics

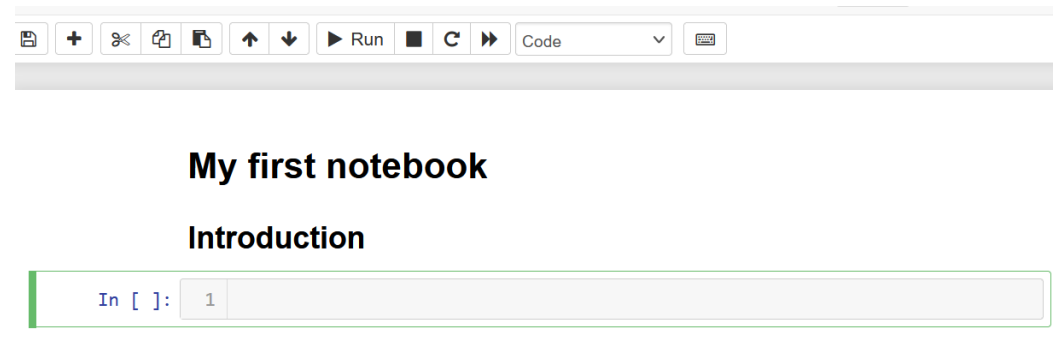
Python in Jupyter Notebook

- 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**)

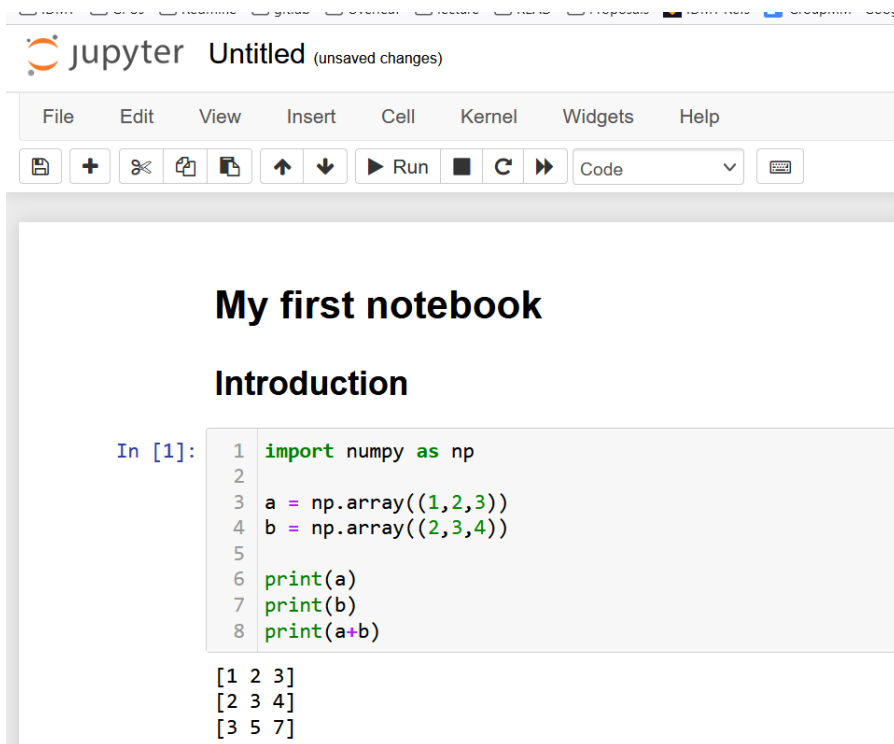


```
In [ ]: 1
```

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 interface. At the top, there's a header with the Jupyter logo and the text "jupyter Untitled (unsaved changes)". Below that is a menu bar with options: File, Edit, View, Insert, Cell, Kernel, Widgets, Help. Under the menu bar is a toolbar with icons for saving, adding cells, undo, redo, and running code. The main area of the notebook contains a code cell with the following text:

```
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)
```

Below the code cell, the output is displayed:

```
[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
-

Python Basics

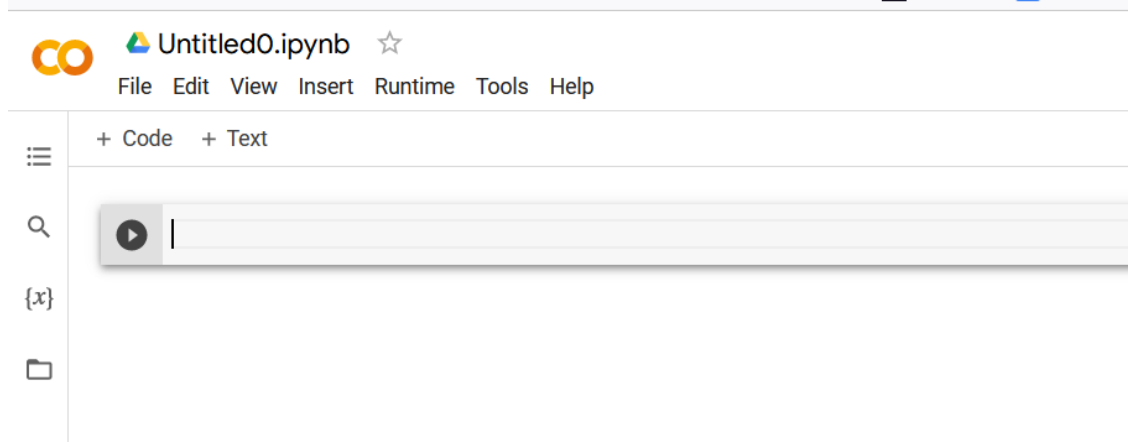
Python in Google Colab

- 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
-

Python Basics

Python in Google Colab

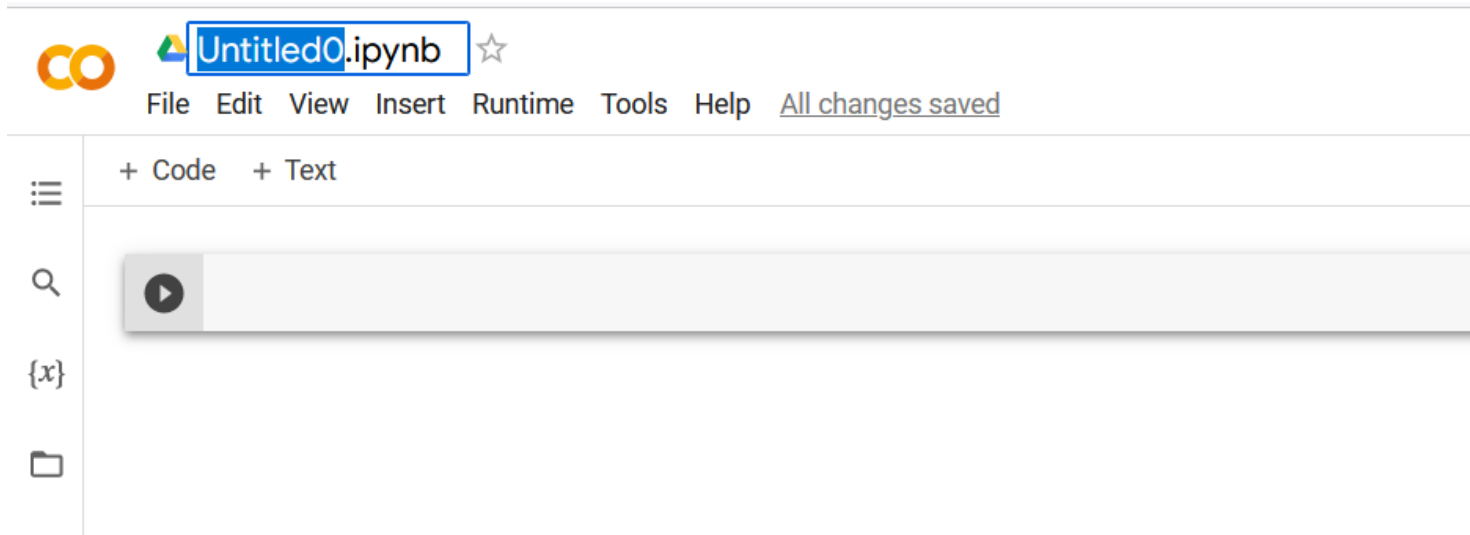
- Setting it up
 - Go to <https://colab.research.google.com/>
 - Sign In (with your google account)
 - "New Notebook"



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**

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](#)

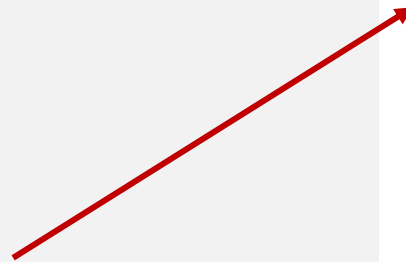
Python Basics

Python in Google Colab

■ Run lecture notebooks in Colab

Lecture Material (Slides / Jupyter Notebooks)

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

A screenshot of a Google Colab notebook. The top bar shows the Colab logo and the notebook name 'AIAA_1_Python.ipynb'. Below the bar are menu options: File, Edit, View, Insert, Runtime, Tools, Help. The main area is divided into sections. The first section is titled 'AI-based Audio Analysis of Music and Soundscapes' and includes the author 'Dr. Jakob Abeßer (jakob.abesser@idmt.fraunhofer.de), 2022' and the subtitle 'Fundamentals of Python Programming'. Below this is a code cell with the following code:

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

The second section is titled 'Python Basics' and has a sub-section 'Variables'. Below this is another code cell with the following code:

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

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