

# 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)

# 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*

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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 😊

# Python Basics

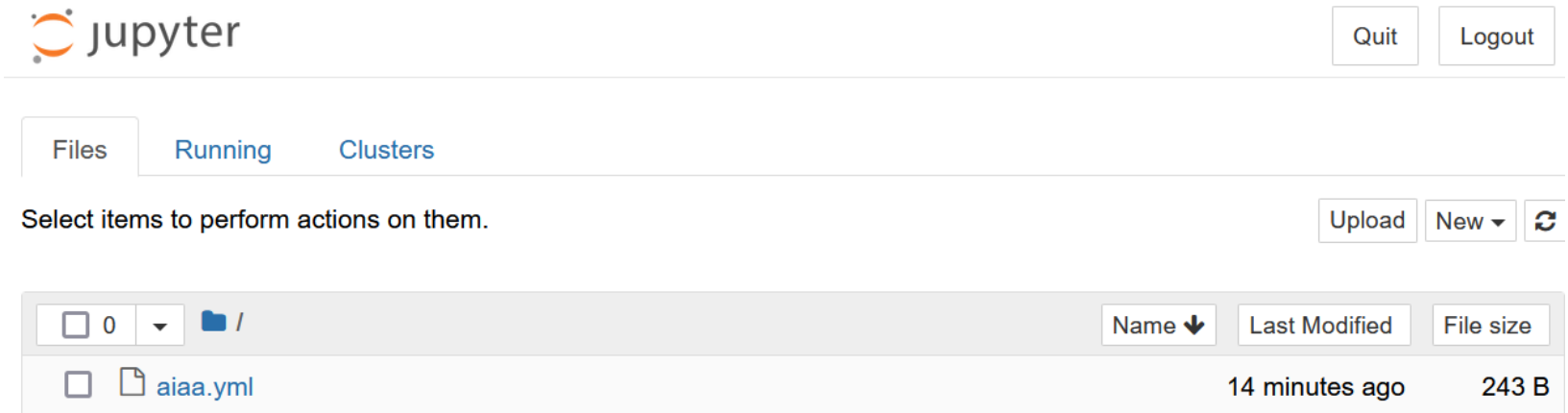
## Python on local machine

- 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.' and three buttons: 'Upload', 'New', and a refresh icon. Below this is a file browser table with columns for 'Name', 'Last Modified', and 'File size'. The table shows a folder icon with '0' items and a file named 'aiaa.yml' with a size of '243 B' and a last modified time of '14 minutes ago'.

	Name ↓	Last Modified	File size
<input type="checkbox"/> 0	/		
<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

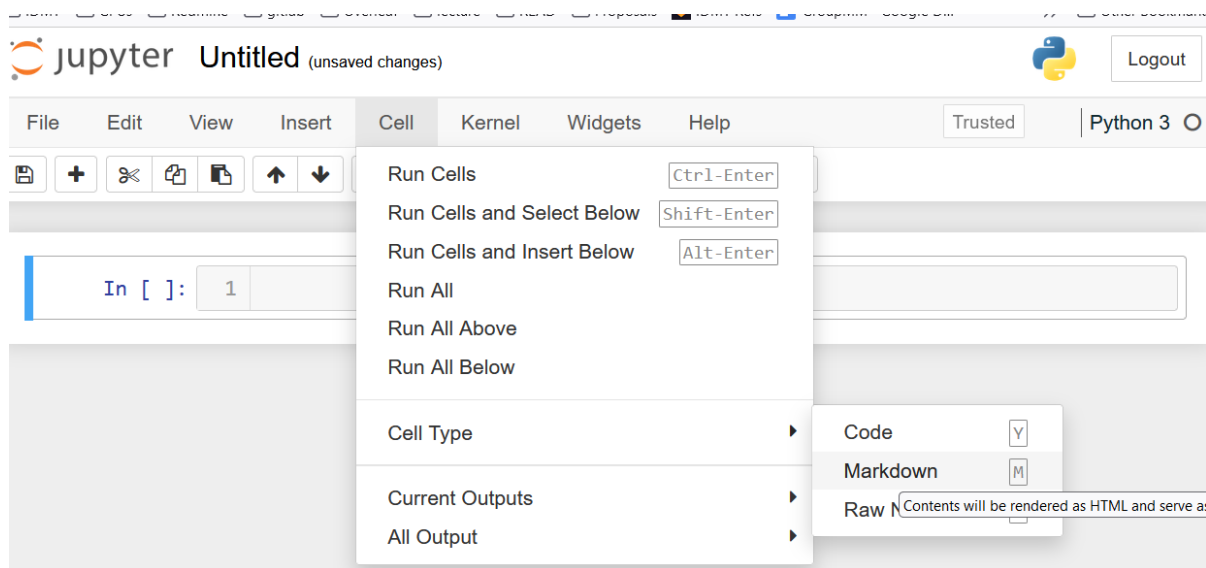
Create a new notebook with Python 3



# Python Basics

## Python in Jupyter Notebook

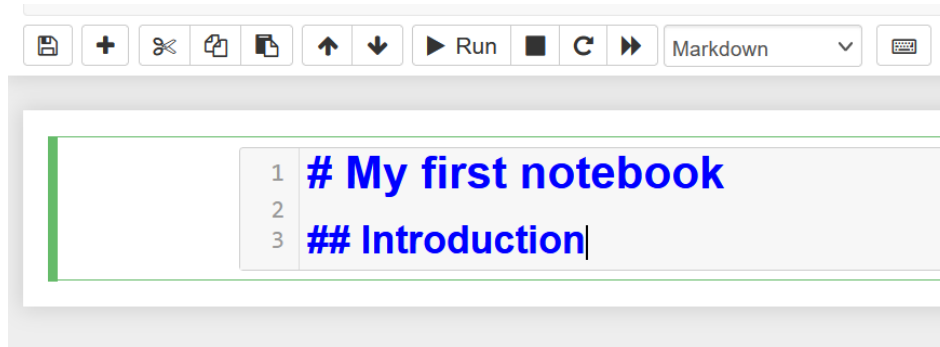
- A Jupyter Notebook contains multiple “cells”, which can be
  - Python code
  - Formatted text (also images etc.) in “markdown” Syntax
- Let’s start with a text cell (change cell type to “Markdown”)



# Python Basics

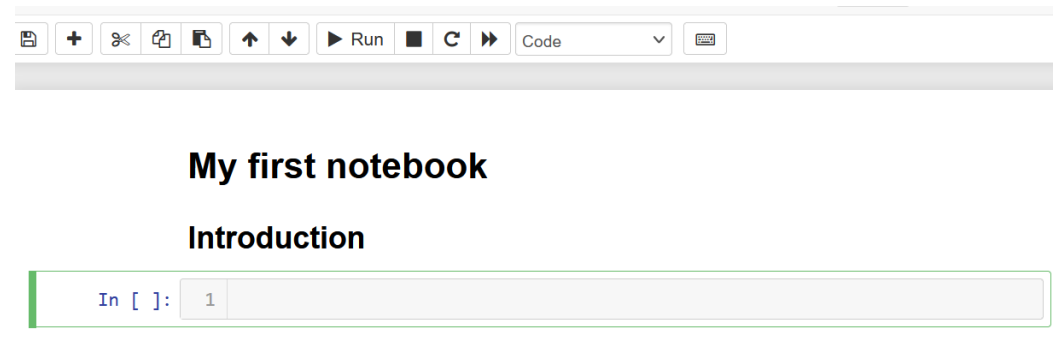
## Python in Jupyter Notebook

- 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)

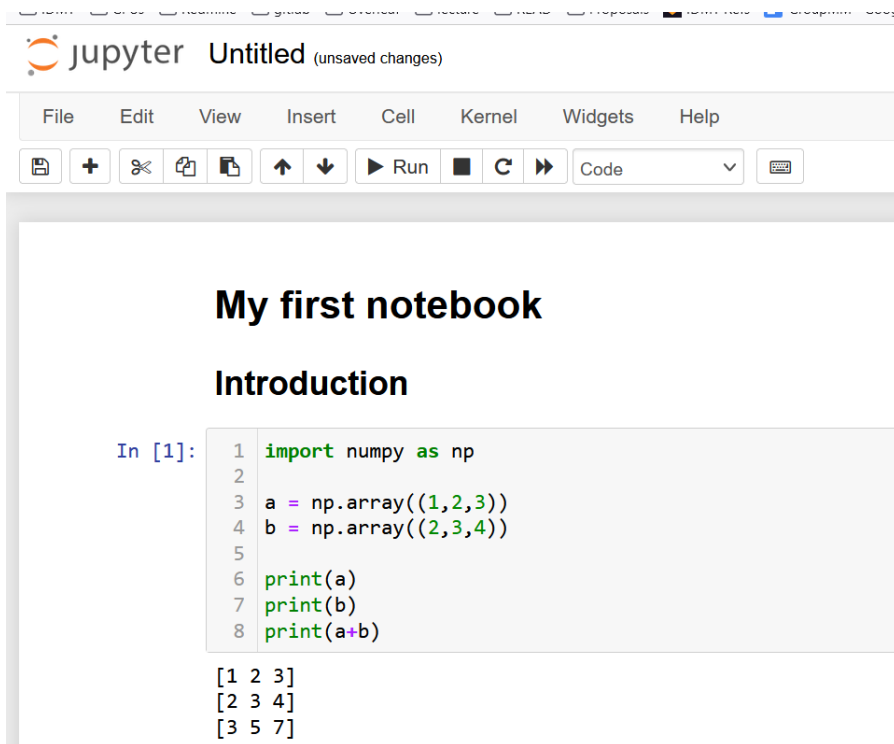


```
In [ ]: 1
```

# 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 this is a menu bar with options: File, Edit, View, Insert, Cell, Kernel, Widgets, and Help. Underneath the menu bar is a toolbar with various icons for file operations, navigation, and execution. The main content area of the notebook is titled "My first notebook" and contains an "Introduction" section. Below the introduction is a code cell labeled "In [1]:". The code in the cell is:

```
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 cell is:

```
[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)
-

# Python Basics

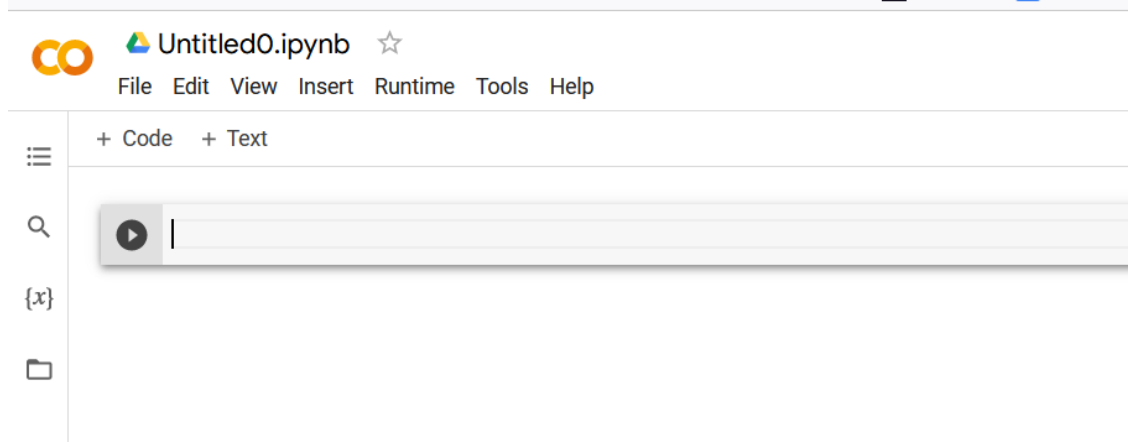
## Python in Google Colab

- 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

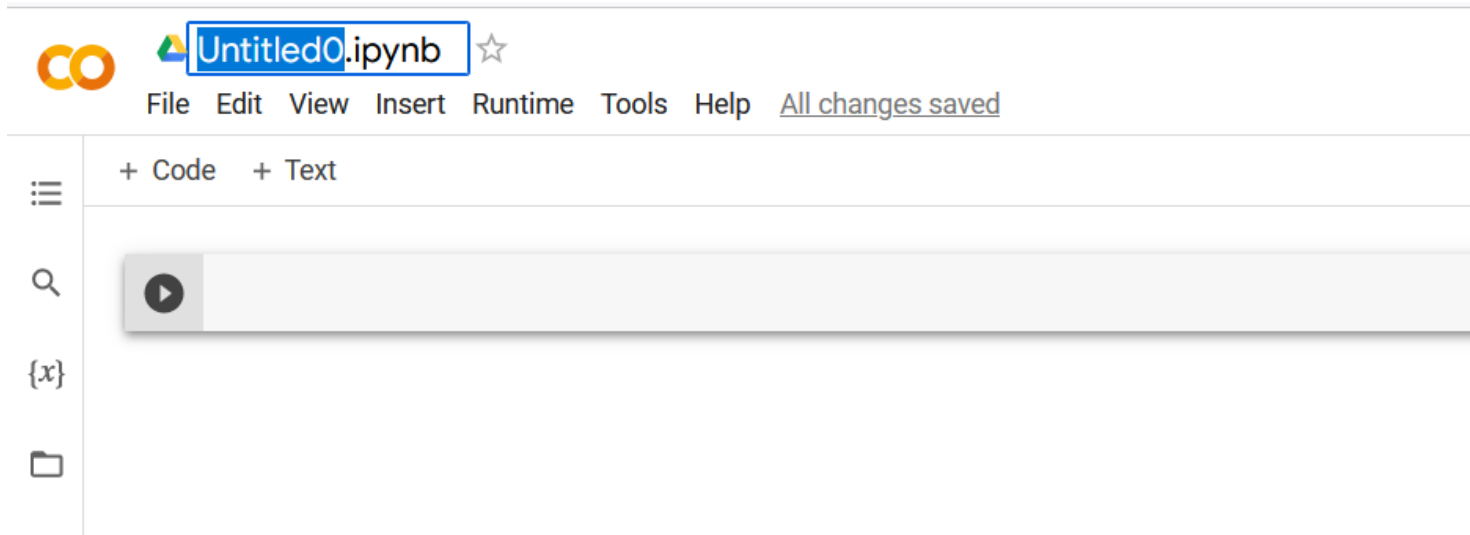
- Setting it up
  - Go to <https://colab.research.google.com/>
  - **Sign In** (with your google account)
  - **"New Notebook"**



# Python Basics

## Python in Google Colab

- Change notebook name
  - Click on title

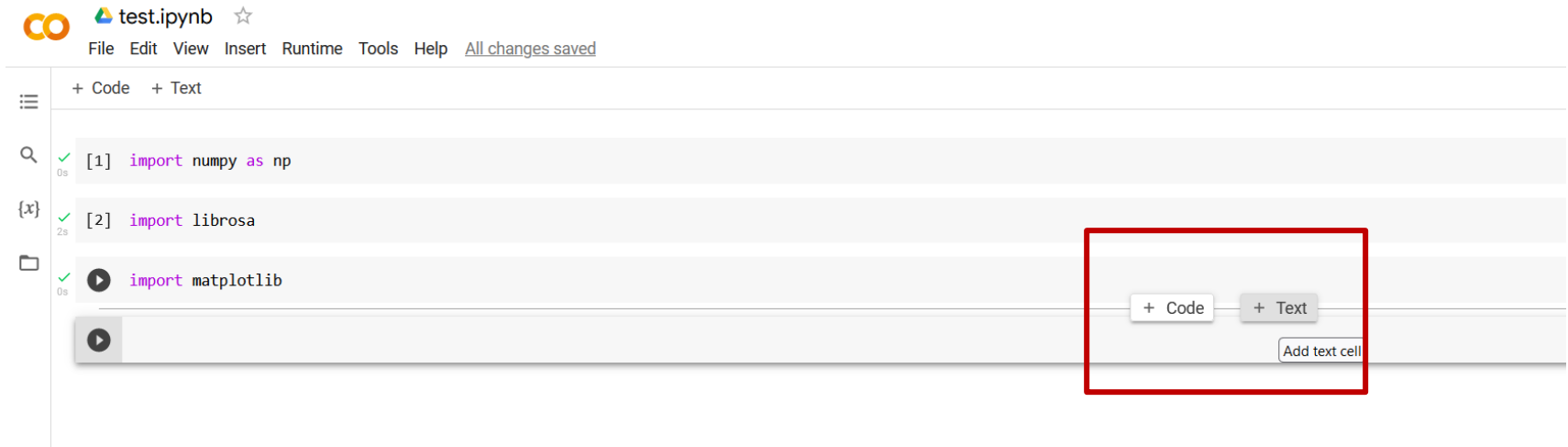


# Python Basics

## 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](#)

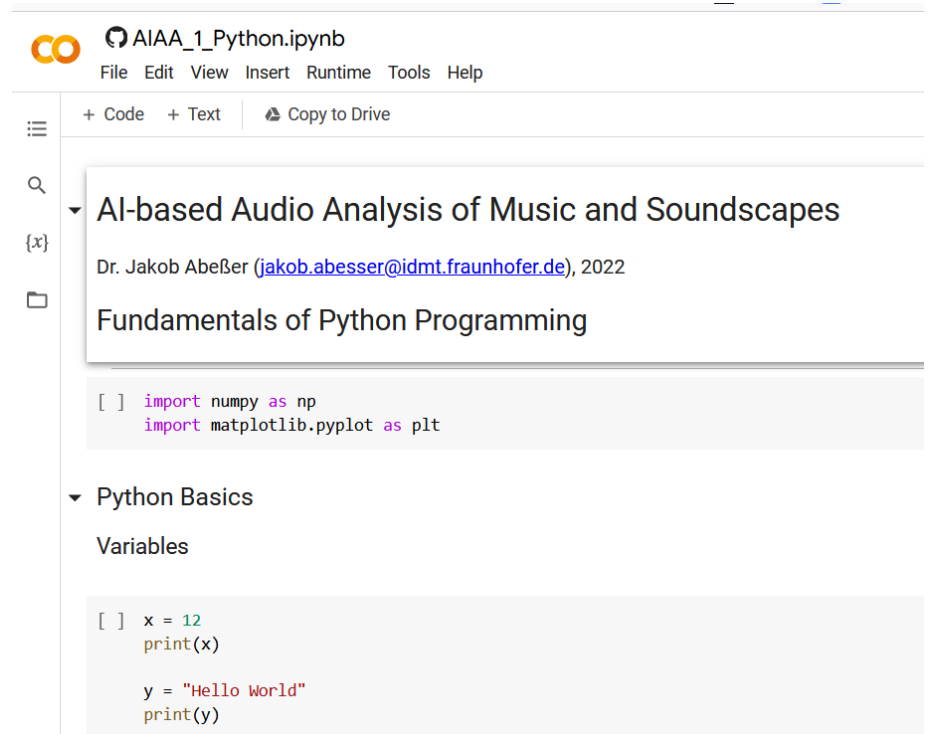
# Python Basics

## Python in Google Colab

### ■ Run lecture notebooks in Colab

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

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- AIAA 2 - Audio Processing
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    - [Open in Google Colab](#)
- Audio Examples
  - [bird.wav](#)
  - [piano.wav](#)



CO AIAA\_1\_Python.ipynb  
File Edit View Insert Runtime Tools Help

+ Code + Text Copy to Drive

AI-based Audio Analysis of Music and Soundscapes  
Dr. Jakob Abeßer ([jakob.abesser@idmt.fraunhofer.de](mailto:jakob.abesser@idmt.fraunhofer.de)), 2022  
Fundamentals of Python Programming

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

Python Basics

Variables

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

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