

Debugging & Matplotlib

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28.11.2023

Matplotlib

Matplotlib is a plotting library.

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- Line plots
- Scatter plots
- Bar plots
- 3D plots
- ...

Works great together with other libraries (e.g. numpy).

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Allows you to customize your plots.

Attention

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- Implicit mode
 - Global state-based interface mode
 - like MATLAB
 - not recommended (but always used on the internet)

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- Implicit mode
- Explicit mode
 - Object-oriented (OO) interface
 - Build up the visualization in an instance of *figure.Figure*
 - **Recommended to use!**

Implicit mode

```
import matplotlib.pyplot as plt  
plt.plot([1, 2, 3, 4], [0, 0.5, 1, 0.2])
```

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import matplotlib.pyplot as plt  
plt.plot([1, 2, 3, 4], [0, 0.5, 1, 0.2])
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Explicit mode

```
import matplotlib.pyplot as plt  
fig = plt.figure()  
ax = fig.subplots()  
ax.plot([1, 2, 3, 4], [0, 0.5, 1, 0.2])
```

Matplotlib - Why explicit?

- More control over your plots

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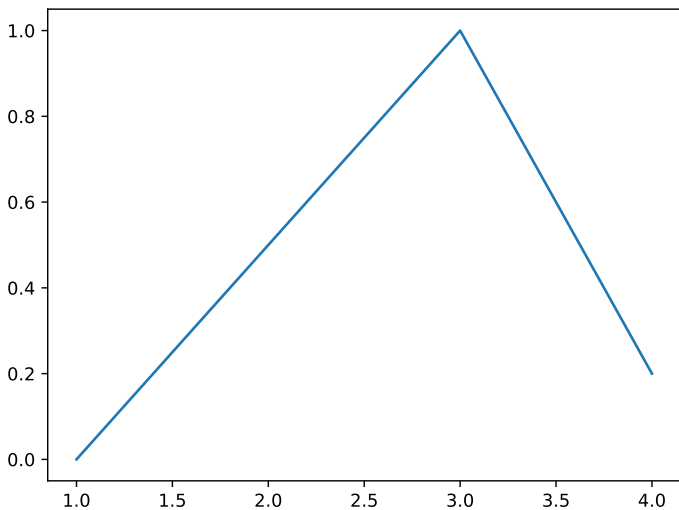
- More control over your plots
- If you have to work on an old unreferenced axes
- Third party often uses explicit mode

Matplotlib - Example

```
import matplotlib.pyplot as plt

fig = plt.figure()
ax = fig.subplots()
ax.plot([1, 2, 3, 4], [0, 0.5, 1, 0.2])
```

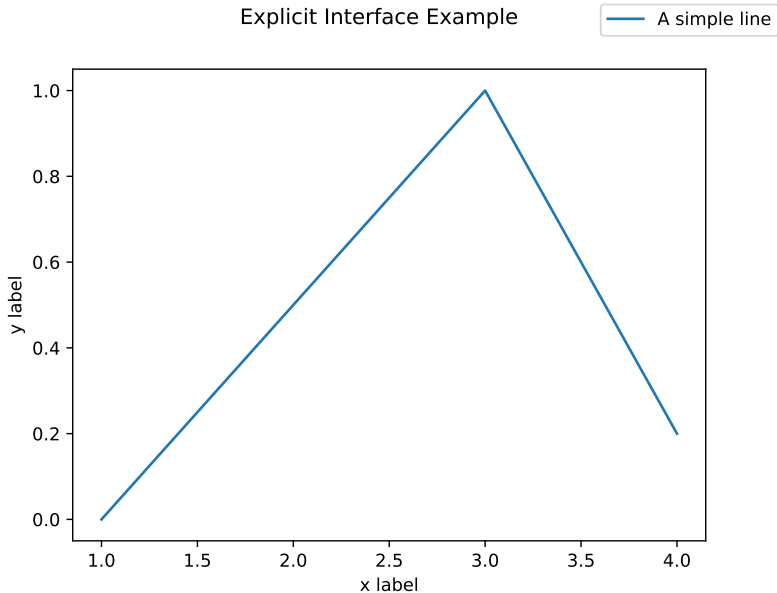
Matplotlib - Example



Matplotlib - Example

```
# Add some text to the figure  
fig.suptitle('Explicit_Interface_Example')  
ax.set_xlabel('x_label')  
ax.set_ylabel('y_label')
```

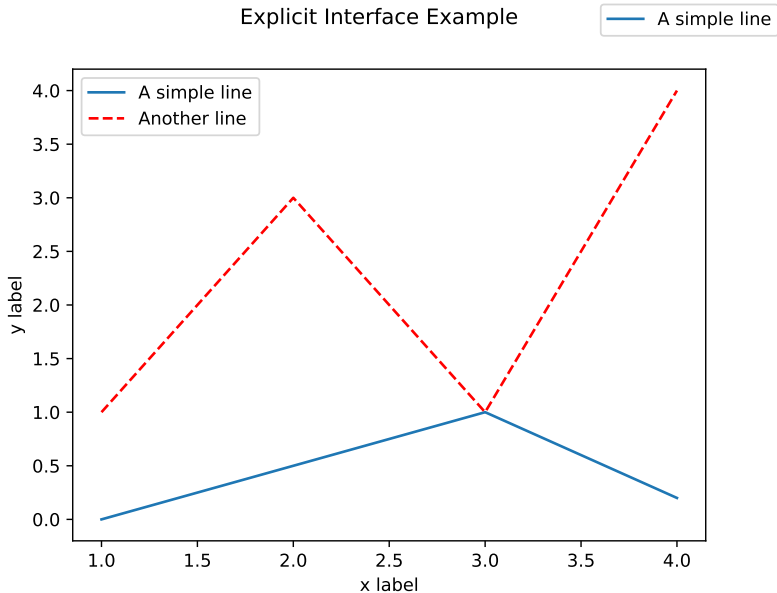

Matplotlib - Example



Matplotlib - Example

```
# Add another line and a second legend  
ax.plot([1, 2, 3, 4], [1, 3, 1, 4], 'r--')  
ax.legend(['A_simple_line', 'Another_line'])  
# And save the figure  
fig.savefig("/workspaces/python_course/slides/five/figures/myplot.  
pdf")
```

Matplotlib - Example



Debugging

- Debugging is the process of finding and fixing errors in your code

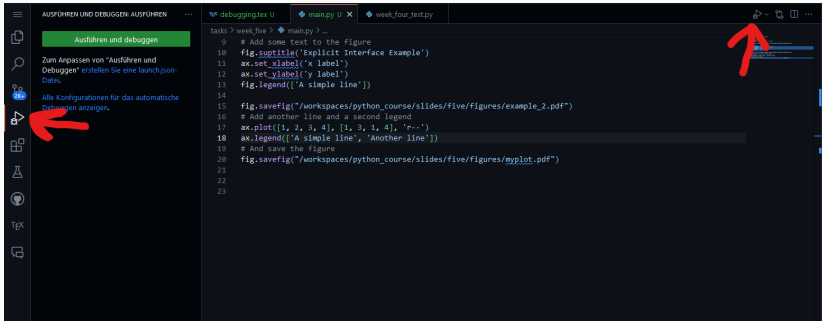
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- Debugging is the process of finding and fixing errors in your code
- Special program attached to the running program
- Allows you to inspect the program at runtime

Usecases:

- catch errors and show you the code and the state of the code
- set breakpoints and hold the program at a certain point

Debugging - HowTo



Debugging - HowTo

The screenshot shows the VS Code Python IDE interface with several panels and annotations. The main editor displays a Python script with a breakpoint at line 13. The left sidebar contains the 'VARIABLEN' (Variables) panel, the 'AUFRUFLISTE' (Call Stack) panel, and the 'HALTEPUNKTE' (Breakpoints) panel. The bottom panel shows the 'TERMINAL' output.

Annotations (red arrows and numbers) point to the following elements:

- 1) Controls the Debugger: Points to the top toolbar icons for running and debugging.
- 2) Breakpoint and next line: Points to the breakpoint icon and the next line of code in the editor.
- 3) vars at the moment of the stop: Points to the 'VARIABLEN' (Variables) panel.
- 4) vars to watch: Points to the 'AUFRUFLISTE' (Call Stack) panel.
- 5) all breakpoints: Points to the 'HALTEPUNKTE' (Breakpoints) panel.

The Python code in the editor is as follows:

```
tasks > week_five > main.py > ...
9 # Add some text to the figure
10 fig.suptitle('Explicit Interface Example')
11 ax.set_xlabel('x label')
12 ax.set_ylabel('y label')
13 fig.legend(['A simple line'])
14
15 fig.savefig("/workspaces/python_course/slides/five/figures/example_2.pdf")
16 # Add another line and a second legend
17 ax.plot([1, 2, 3, 4], [1, 3, 1, 4], 'r--')
18 ax.legend(['A simple line', 'Another line'])
19 # And save the figure
20 fig.savefig("/workspaces/python_course/slides/five/figures/myplot.pdf")
21
22
23
```

The terminal output shows the following commands and results:

```
source /workspaces/python_course/tasks/week_five/venv/bin/activate
@lannusch → /workspaces/python_course (dev) $ source /workspaces/python_course/tasks/week_five/venv/bin/activate
(venv) @lannusch → /workspaces/python_course (dev) $ /usr/bin/env /workspaces/python_course/tasks/week_five/venv/bin/python /home/vscode
599 -- /workspaces/python_course/tasks/week_five/main.py
[]
```

Debugging - Example

Task
