

Rapid prototyping camera applications

Interactive programming with IDS peak and uEye+ cameras

Python is a very common programming language in the Internet of Things (IoT). It allows writing and testing short code snippets without the time-consuming setup of a complete development environment. The possibility of interactive programming makes it the ideal interface for the testing and trial phase. Especially in combination with embedded systems, Python is a winner, as no time-consuming cross-compiling is necessary.

With IDS peak 1.2 you can also use the advantages of Python for programming your uEye+ camera applications. The numerous camera features of IDS industrial cameras can be tested quickly, analysed and prepared for later use in a larger software project. With this tech tip, we would therefore like to explain the programming of uEye+ cameras via the IDS peak python interface in more detail.

The Python source code examples used illustrate the basic handling of the cameras and the interface. They are designed as "Jupyter notebooks". This allows them to be tested and reproduced live in the [open source web application](#) with your uEye+ cameras.



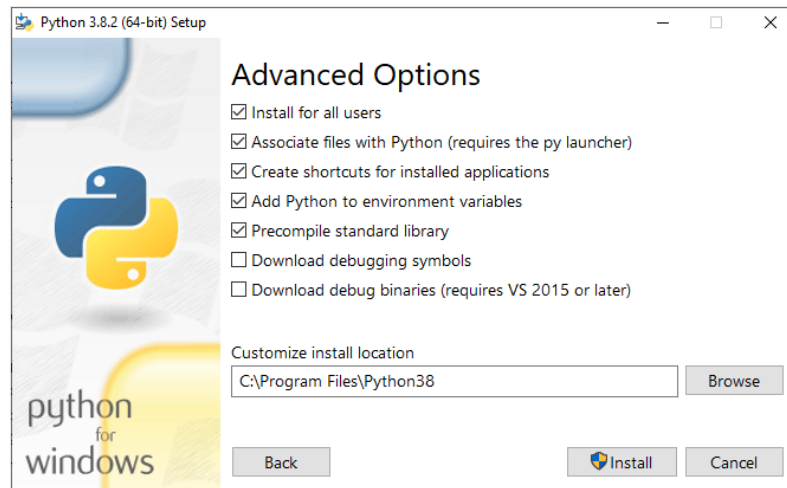
We describe the installation and use of the Jupyter notebooks as an example for a Windows 10 PC. Since Python is available for several platforms and Jupyter Notebooks is a platform-independent web application, you can of course also run and test the source code examples under Linux.

Requirements

Python

Python is a prerequisite (Python 3.5 or higher) for installing Jupyter Notebook and for our IDS peak programming examples.

[Download and install Python](#)



Python installation dialogue - Advanced options

! Make sure that Python is installed for "all users" and that Python is added to the "path" variable. Then you can also use Python via the command prompt.

Additional Python libraries

In the source code examples we use additional Python libraries for image processing and data visualisation. You still have to install this as well.

- [PIL](#) - The Python Imaging Library extends your Python interpreter with image processing functions.
- [matplotlib](#) - Matplotlib is a comprehensive library for creating static, animated and interactive visualisations in Python.
- [OpenCV](#) - Computer Vision Library
- [pyTorch](#) - Deep Learning Framework

Also install the libraries via:

```
pip install Pillow
pip install matplotlib
pip install opencv-python
pip install torch
```

IDS peak

For operation and programming of uEye+ cameras, install the IDS peak SDK (Software Development Kit). It includes all the libraries and software tools that are necessary.

↓ [IDS peak Software Development Kit](#)

Then install the IDS peak API and IPL Python bindings in the version that matches your Python version. The easiest way is via "pip", the package management programme for Python packages, using PowerShell (as administrator):

```
python -m pip install --upgrade pip
pip install "C:\Program Files\IDS\ids_peak\sdk\api\binding\python\wheel\x86_64\ids_peak-1.2.0.5-cp38-cp38-win_amd64.whl"
pip install "C:\Program Files\IDS\ids_peak\sdk\ipl\binding\python\wheel\x86_64\ids_peak_ipl-1.2.2.1-cp38-cp38-win_amd64.whl"
```

Jupyter Notebook

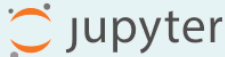
The installation of the open source web application is also very simple with pip:

```
pip install notebook
```

If you need more info about Jupyter Notebook:



First steps with Jupyter Notebook



[Install Jupyter Notebook](#)

[Jupyter Documentation](#)

Run Jupyter Notebooks



Next, unpack the source code example in a folder on your PC.

The package contains only one file. The Jupyter sample notebook.

[ids-peak-python-sample-jupyter.zip](#)

Notebook Server

Open a **Powershell window** (user rights are sufficient) and start the **Jupyter Notebook Server**.



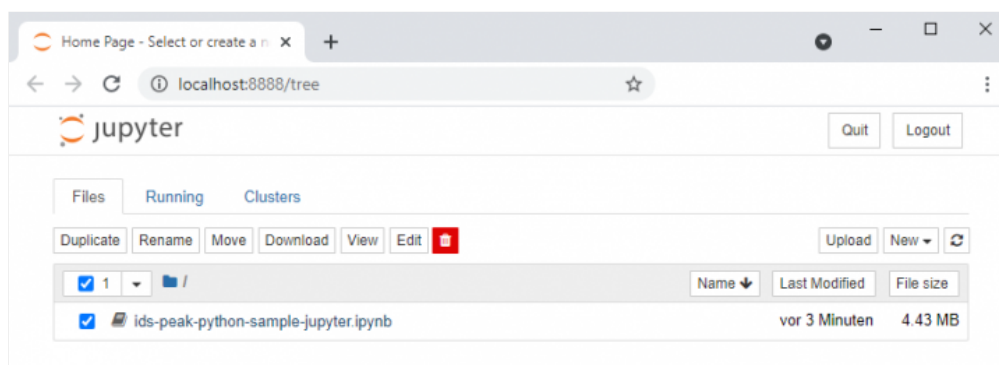
Open Powershell in folder

Start the server directly in the installation folder of the sample notebook, then the notebooks are directly available to you.

To open a PowerShell window directly in a specific folder, first navigate to this directory in the Explorer, type "powershell" in the path bar at the top and confirm with "Enter".

```
PS C:\Users\ids\ids-peak-jupyter-notebooks> jupyter notebook
[I 12:12:45.115 NotebookApp] Serving notebooks from local directory: C:\Users\ids\ids-peak-jupyter-notebooks
[I 12:12:45.115 NotebookApp] The Jupyter Notebook is running at:
[I 12:12:45.115 NotebookApp] http://localhost:8888/?token=f8baad4df16a4b1436c59723cfba540c4b5a923b3352120
[I 12:12:45.115 NotebookApp] or http://127.0.0.1:8888/?token=f8baad4df16a4b1436c59723cfba540c4b5a923b3352120
[I 12:12:45.115 NotebookApp] Use Control-C to stop this server and shut down all kernels (twice to skip confirmation).
```

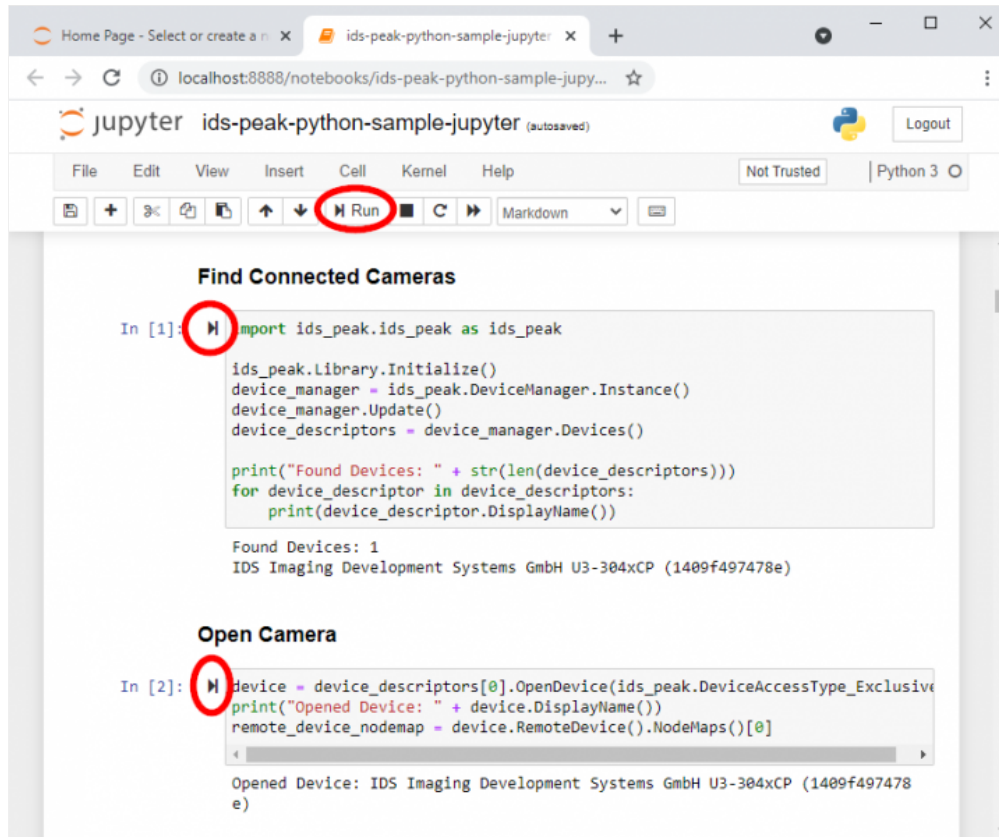
The Notebook server opens in your default web browser at start-up and outputs a bit of information in the shell, including the **URL of the web application** (<http://localhost:8888> by default). When the server is opened in your browser, you will see the **Notebook dashboard**, which displays a list of notebooks, files and subdirectories in the directory where the Notebook server was started.



Jupyter Notebook Dashboard

Use Notebook

Now simply open the notebook "ids-peak-python-sample-jupyter.jpynb" in the server.



IDS peak Python Sourcecode Sample

The notebook is annotated and self-explanatory. You can run it and also customise it for your requirements and save it again. The IDS peak Jupyter Notebook guides you through the basic handling of uEye+ cameras using Python, such as finding and opening the devices, adjusting camera settings and taking pictures. Furthermore, we demonstrate how image data can be converted with the IDS peak IPL (Image Processing Library) into different data formats for image processing processes of OpenCV. Further processing in OpenCV is also shown with some standard functions. Finally, you will see how quickly a deep learning framework such as pyTorch can be involved to realise simple object recognition in the camera images.

For more information about IDS uEye+ cameras or their programming with IDS peak, visit the [Knowledge Base](#) of our website or contact our [system consultants](#).



Tip: uEye+ webinar-video

Our webinar video "[Rapid prototyping camera applications](#)" demonstrates programming with the IDS peak Python interface using this Jupyter notebook.