The REST interface also allows the programmatic integration of IDS NXT cameras into a factory automation system. The use of REST or HTTP connections is possible in most programming languages without additional software from the manufacturer. Since Python is a very common programming language in IoT, we would like to explain the integration of IDS NXT cameras in more detail. The Python code snippets show the basic handling of IDS NXT cameras and their interfaces. They are designed as "Jupyter notebooks". This allows them to be tested and reproduced live in an open source web application with IDS NXT cameras. In the following we explain how to install and use the Jupyter environment.

The following examples are included in the package:

**1. Log-in and image transfer (connect_and_get_image.ipynb)**

The first example shows how to use the GET command to authorize and retrieve an image from your IDS NXT camera.

**2. Change exposure time (change_exposure.ipynb)**

The second example shows how to request and modify camera parameters. To do this, we change the exposure value using the PATCH command.

**3. Trigger image acquisition (trigger_image_acquisition.ipynb)**

Using the POST command, we will show in the third example how to trigger an image capture to retrieve the image content of a modified scene.

**4. Configure the IO Gateway (set_gpio_gateway.ipynb)**

In the fourth example we will show you how to toggle the cameras digital outputs depending on the results of the CNN manager vision app.

> We explain how to use the Jupyter notebooks for a Windows 10 PC as an example. Since Python is available for several platforms and Jupyter Notebooks is a platform-independent web application, you can also run and test the source code examples on Linux.

# Requirements

## Python

Python is required (Python 3.3 or higher) for the installation of Jupyter Notebook and for our programming examples to control an IDS NXT camera via REST

⤓ Download and install Python 🐍
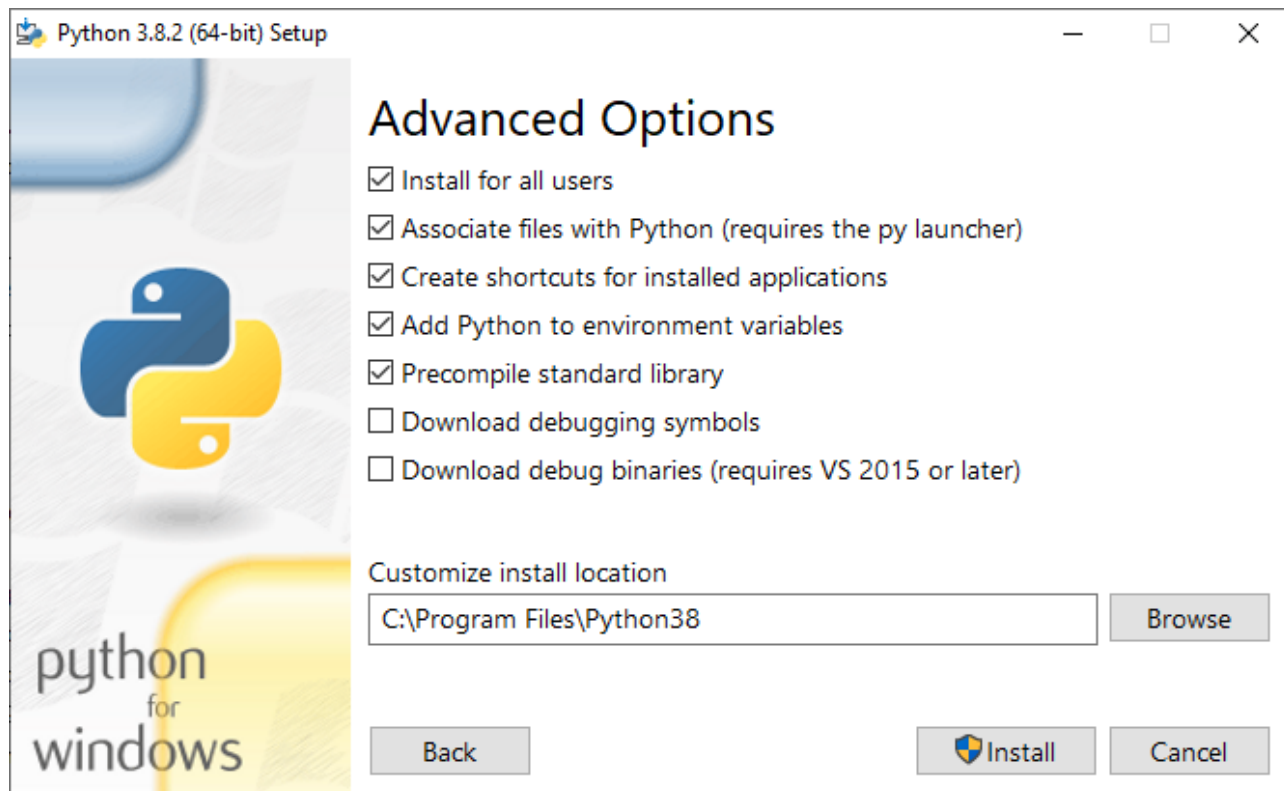


⚠ Make sure that Python is installed for "**all users**" and that it is added to the "**path**" variable. Then you can also use Python from the command line.

## Additional Python libraries

In the examples we use additional Python libraries for image processing and data visualization, which you have to install.

- 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 visualizations in Python.

Install Pillow and Matplotlib most easily via pip in the PowerShell (as administrator):

```
python -m pip install --upgrade pip
pip install Pillow
pip install matplotlib
```
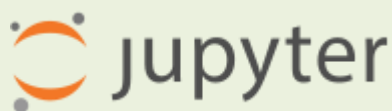
## Jupyter Notebook

The installation is also very easy with pip:

```
pip install notebook
```

If you need more information about Jupyter Notebook:

> ✅ **First steps with Jupyter Notebook**
>
> Jupyter
>
> → Install Jupyter Notebook
> → Jupyter Documentation 4.1

# Run IDS NXT Jupyter notebooks

Next, unpack the software package "talking_to_the_nxt.zip" in a folder.

## Package contents

- These installation and use instructions
- connect_and_get_image.ipynb
- change_exposure.ipynb
- trigger_image_acquisition.ipynb
- set_gpio_gateway.ipynb

# Jupyter Notebook Server

Open a **powershell window** as user and start the Jupyter Notebook **Server.**

> ⊘ **OPEN POWERSHELL IN CURRENT FOLDER**
>
> If you start the server directly in the installation folder of the example notebooks, you can access them directly via the servers Dashboard.
>
> To open a PowerShell window directly in a specific folder, navigate to this folder in the explorer, type "powershell" in the path bar at the top and confirm with Enter.

Start the server:

```
PS C:\Users\ids\ids-nxt-jupyter-notebooks> jupyter notebook
[I 12:12:45.115 NotebookApp] Serving notebooks from local directory:
C:\Users\ids\ids-nxt-jupyter-notebooks
[I 12:12:45.115 NotebookApp] The Jupyter Notebook is running at:
[I 12:12:45.115 NotebookApp]
http://localhost:8888/?token=f8baad4df16a4b1436c59723cfcba540c4b5a923b3352120
[I 12:12:45.115 NotebookApp]  or
http://127.0.0.1:8888/?token=f8baad4df16a4b1436c59723cfcba540c4b5a923b3352120
[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 startup and displays some information in the shell, including the URL of the web application

(by default *http://localhost:8888*).

When the server opens in your browser, you will see its **Dashboard**, which displays a list of notebooks, files, and subdirectories in the directory where the Notebook Server was started.
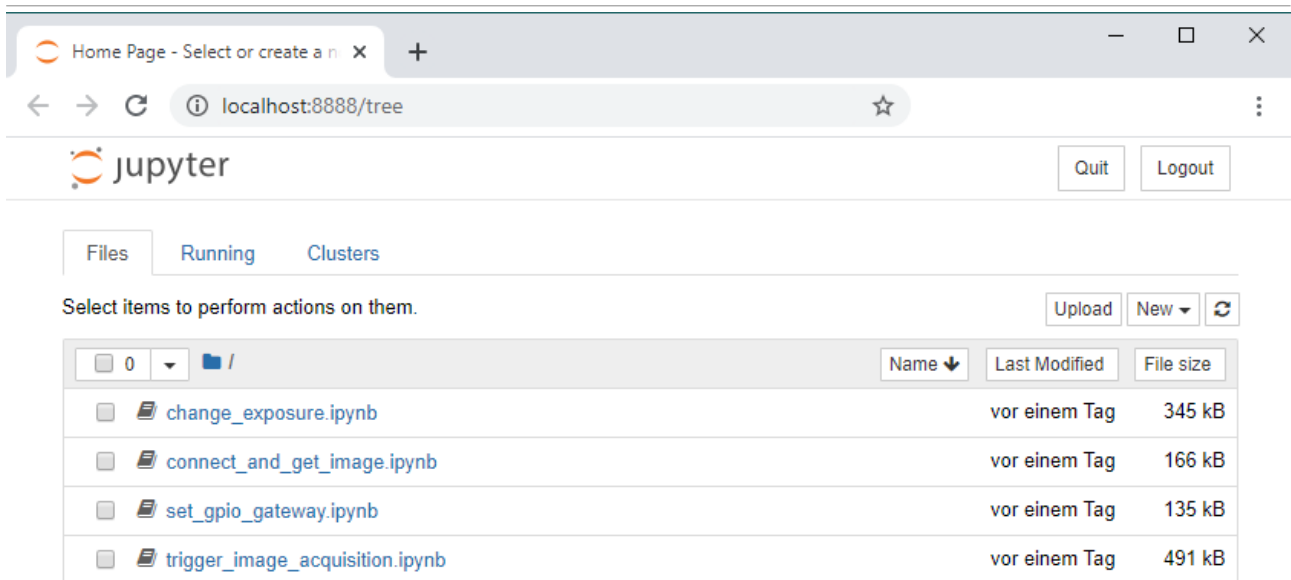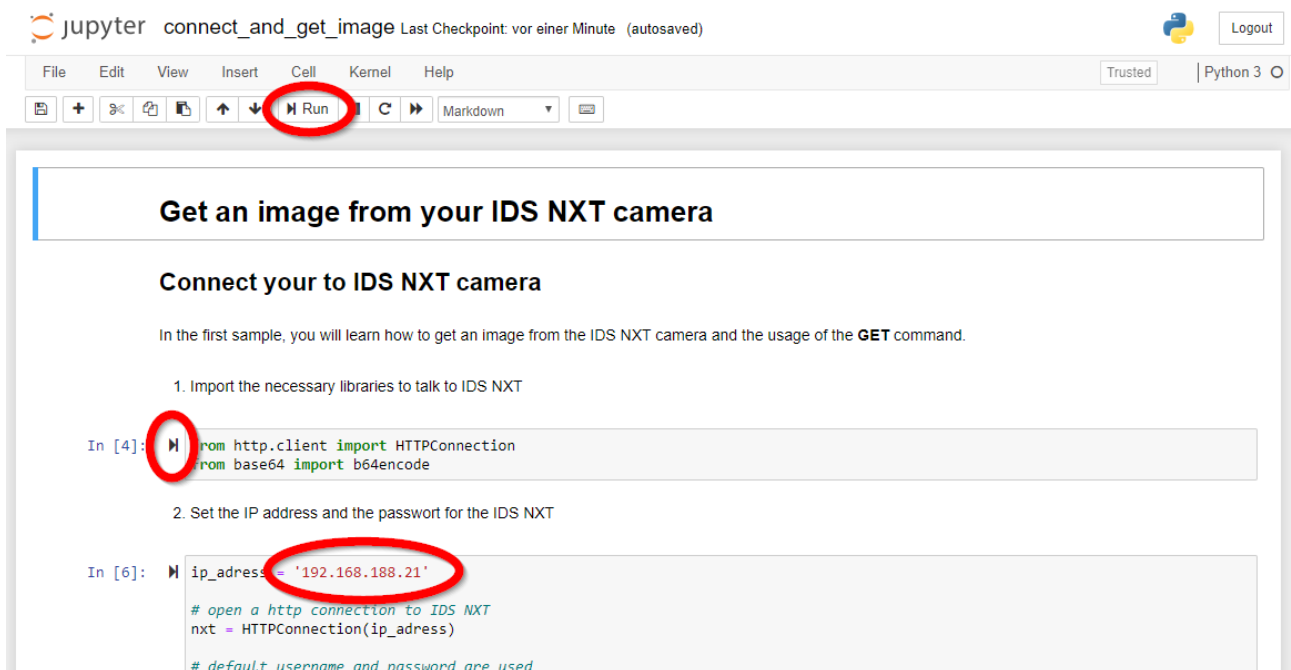
*Figure 1 Jupyter Dashboard*

## Usage of Notebooks

Now simply open the individual IDS NXT notebooks in the server.



The notebooks are commented and self-explanatory. You can run the notebooks and also customize and save them for your needs. For example, first change the IP for your camera.

This should enable you to retrieve an image from your camera with the first notebook code.

![IDS logo - It's so easy!]

> ✓ **Tip: IDS NXT Webinar**
>
> Our webinar video "**Integration of IDS NXT in factory automation**" demonstrates communication via the IDS NXT camera interfaces using Python sample codes and Jupiter notebooks

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