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Working with file paths in Python

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With material from

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Use relative paths whenever possible

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- Read images by providing a path to skimage.io.imread (or a similar reader function)
- The path can be a relative path

```
from skimage.io import imread

image = imread('../../data/blobs.tif')
```

Relative path to image

- or an absolute path.

```
from skimage.io import imread

image = imread('C:\data\blobs.tif')
```

Absolute path to image

- If you keep your script in a subfolder, the relative path also works on your collaborator's computer
- That is why we use relative paths throughout the teaching material

Backslashes often cause problems on Windows

- Backslash (‘\’) is a special character in python strings
- When pasting Windows paths, this may lead to errors

```
from skimage.io import imread

image = imread(‘C:\data\blobs.tif')
```

OSError: [Errno 22] Invalid argument:

- Add a lowercase ‘r’ before path to fix that

```
from skimage.io import imread

image = imread(r‘C:\data\blobs.tif')
```

This ’r’ tells python to interpret the string as “raw string literal”
No characters with special meaning are interpreted here

Reading Proprietary File Formats with Python

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- Sometimes images may be stored in specific proprietary file formats, like '.czi', '.lif', '.nd2', '.ims', etc
- In Fiji, Bioformats usually takes care of opening many different proprietary file formats
- Currently in python, there are a couple solutions to open them:
  - Install a python package capable of opening a specific file format. Example (look for specific package in PyPI, https://pypi.org/):

    conda install –c conda-forge czifile

  - Use AICSImageIO package or its equivalent napari plugin to open them in napari:
    - https://github.com/AllenCellModeling/aicsimageio#aicsimageio
    - https://github.com/AllenCellModeling/napari-aicsimageio#napari-aicsimageio

Reading Multidimentional Images in Python

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- 2D images

```
image.shape
```

```
(254, 256)
```

- 3D images

```
image.shape
```

```
(36, 254, 256)
```

- Multichannel images

```
image.shape
```

```
(36, 254, 256)
```

```
channel1 = image[:,:,0]
channel2 = image[:,:,1]
channel3 = image[:,:,2]
```

- Some libraries return an array in a standardized fashion

```
image.shape
```

```
(1, 1, 1, 80, 520, 692, 1)
```

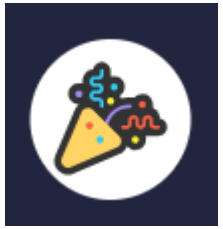
What dimension is this?

?

Tile

I don't know

Time



Slice

Check image metadata to know which dimension corresponds to what.

Check library documentation.

Use `pathlib` to work with paths

```
from pathlib import Path

data_path = Path('../../data/Folder_Structures/Project1_Car_Trunk’)
data_path
```

```
PosixPath('../../data/Folder_Structures/Project1_Car_Trunk')
```

- `data_path` is now an object that lets you do all kinds of useful stuff

```
data_path.name
```

```
‘Project1_Car_Trunk’
```

```
data_path.parent
```

```
PosixPath('../../data/Folder_Structures')
```

```
data_path / 'subdirectory/file.txt'
```

```
PosixPath('../../data/Folder_Structures/Project1_Car_Trunk/subdirectory/file.txt')
```

```
data_path.exists()
```

```
True
```


https://docs.python.org/3/library/pathlib.html

Pathlib also lets you loop over files


```
for path in data_path.iterdir():
    print(path.name)
```

```
0acd2c223d300ea55d0546797713851e818e5c697d073b7f4091b96ce0f3d2fe.png
0bf33d3db4282d918ec3da7112d0bf0427d4eafe74b3ee0bb419770eefe8d7d6.png
.DS_store.txt
```

```
for path in data_path.glob('*.png'):
    print(path.name)
```

```
0acd2c223d300ea55d0546797713851e818e5c697d073b7f4091b96ce0f3d2fe.png
0bf33d3db4282d918ec3da7112d0bf0427d4eafe74b3ee0bb419770eefe8d7d6.png
```

- If you need the list of files multiple times, store it in a list

```
list(data_path.iterdir())
```

```
[PosixPath('../../data/Folder_Structures/Project1_Car_Trunk/0acd2c223d300ea55d.png'),
PosixPath('../../data/Folder_Structures/Project1_Car_Trunk/0bf33d3db4282d918ec.png'),
PosixPath('../../data/Folder_Structures/Project1_Car_Trunk/.DS_store.txt']
```

```
list(data_path.glob('*.png')
```

```
[PosixPath('../../data/Folder_Structures/Project1_Car_Trunk/0acd2c223d300ea55d.png'),
PosixPath('../../data/Folder_Structures/Project1_Car_Trunk/0bf33d3db4282d918ec.png'),
```

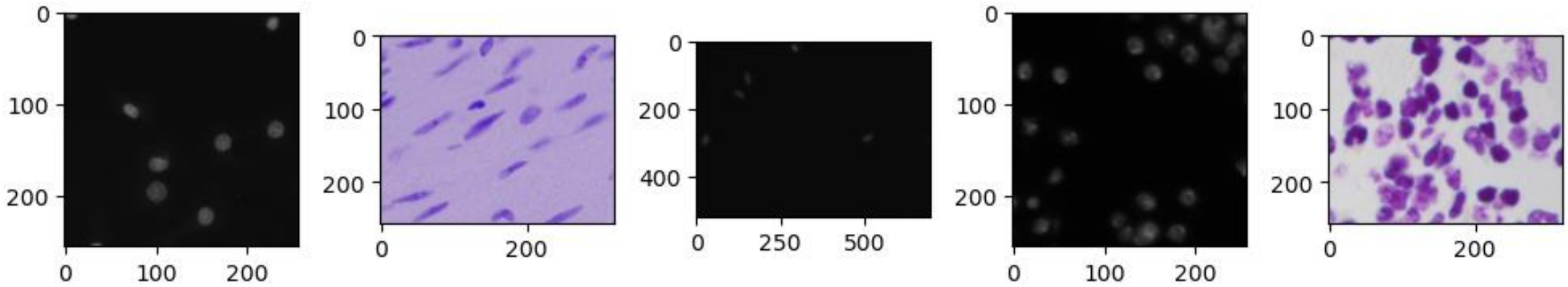
For example, we plot all images in a folder:

```
#create a list of all png image paths
image_path_list = list(data_path.glob('*.png'))

# first we use the list to determine the number of files with len(image_path_list),
so that we can create a figure with the appropriate number of subplots
fig, ax = plt.subplots(1, len(image_path_list), figsize=(10,3))

# Now we loop over the list to plot each image
for count, image_path in enumerate(image_path_list):
    image = imread(image_path)
    ax[count].imshow(image)

plt.tight_layout()
```



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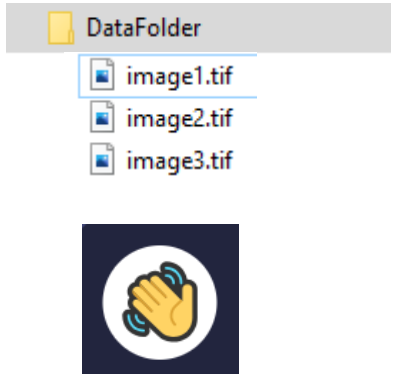
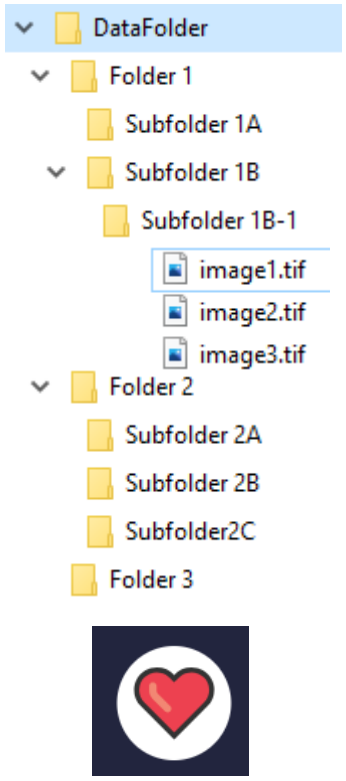
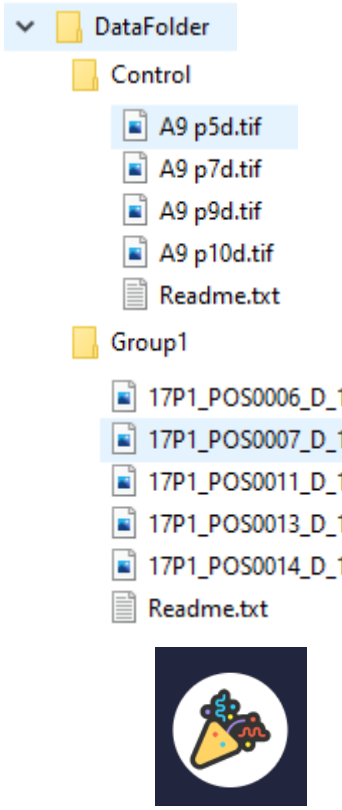
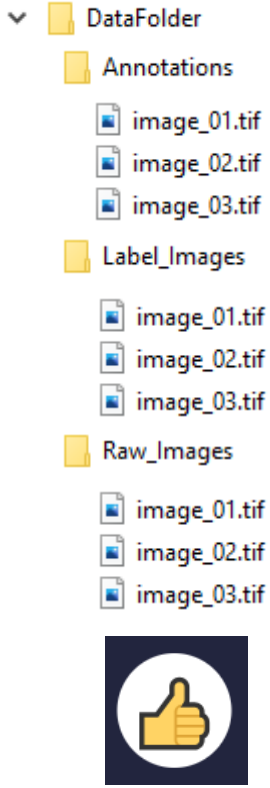
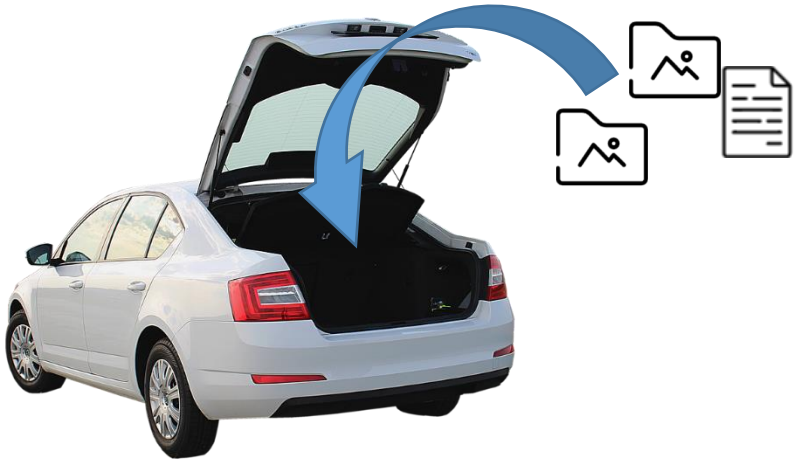
Folder Structures











A few general advice:

- Avoid too many levels
- Add “Readme” files as soon as you create a folder (you will forget later)
- Consider using a data management platform
- Talk to a data management experts to find the best structure to your needs

Image by eikira from Pixabay (https://pixabay.com/photos/trunk-automobile-vehicle-luggage-1478832/)

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