PoL
Physics of Life
TU Dresden

CENTER FOR
SYSTEMS BIOLOGY
DRESDEN

Plotting Data with Seaborn

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With material from

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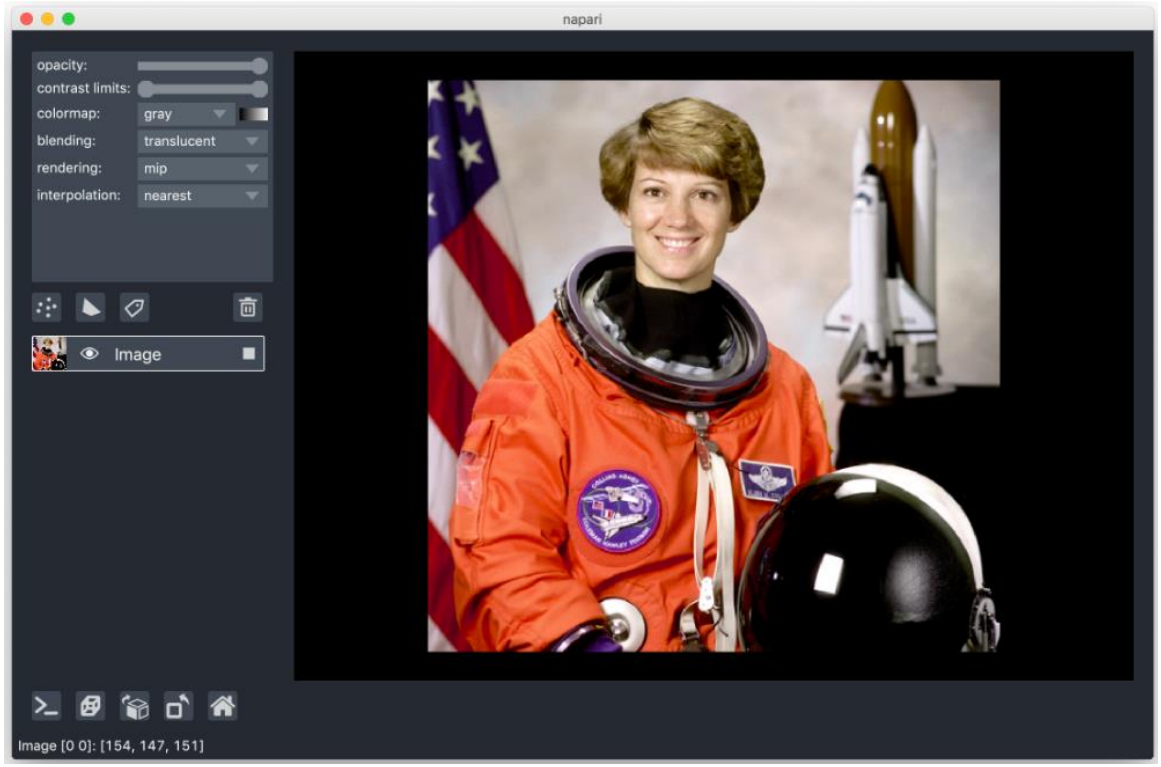
@zoccolermarcelo

Plotting Data with Python

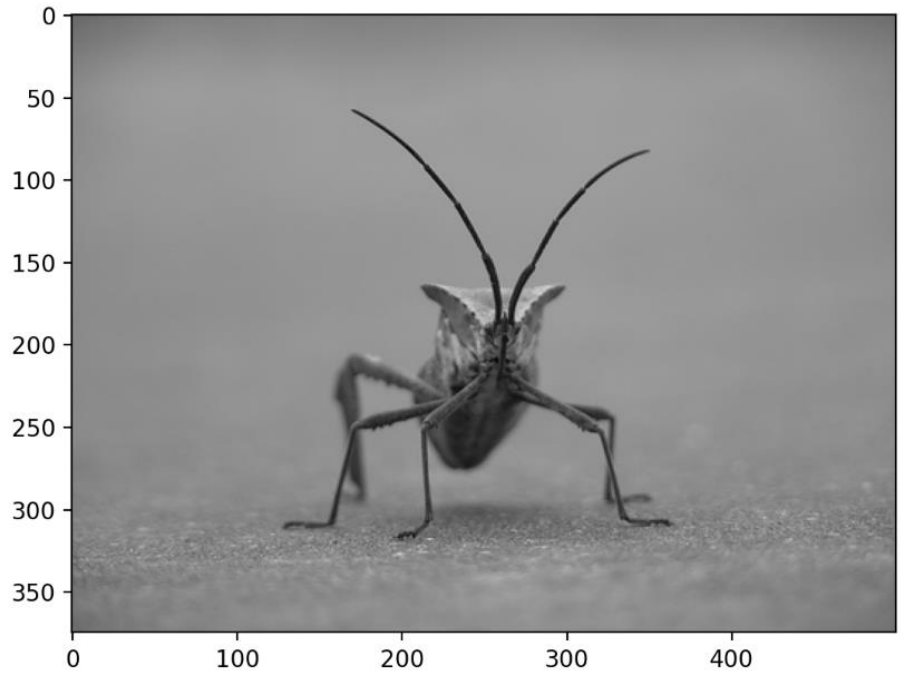
- Displaying images

napari



matplotlib

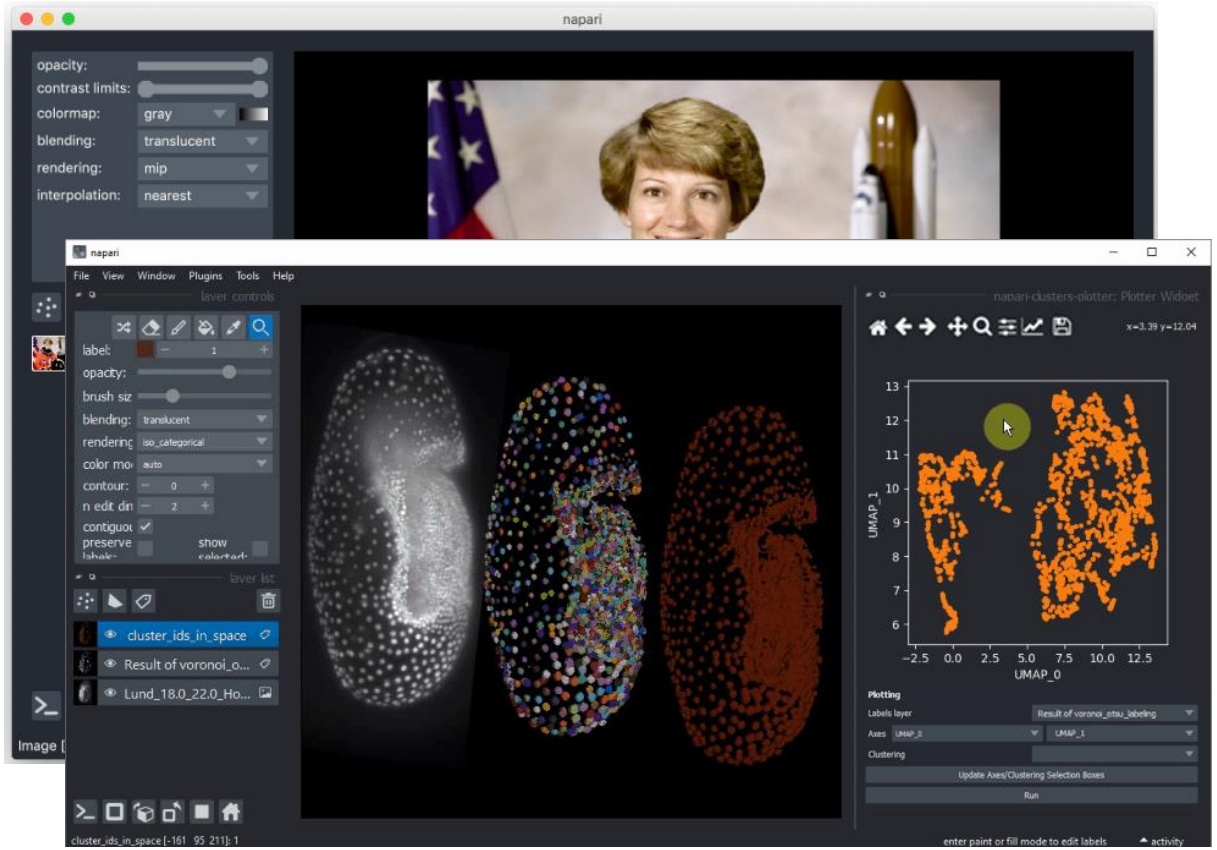
```
imgplot = plt.imshow(img)
```



Plotting Data with Python

- Displaying graphs

napari



https://github.com/BiAPoL/napari-clusters-plotter

matplotlib

Plotting Data with Matplotlib

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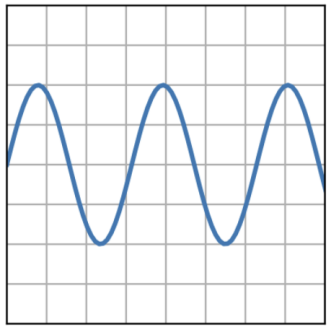
Basic Plot Types

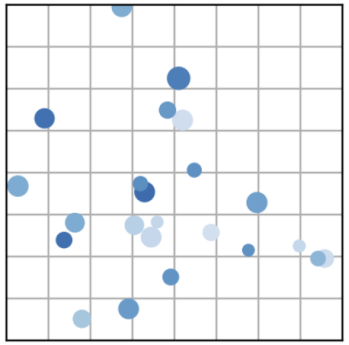
plot(x, y)

See `plot`.



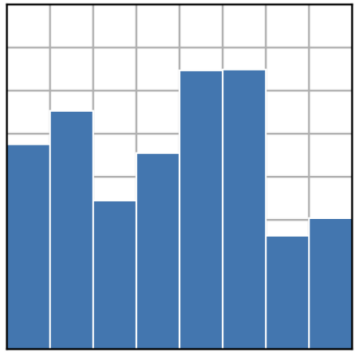
scatter(x, y)

See `scatter`.



bar(x, height)

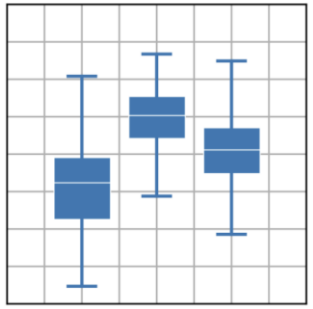
See `bar`.



Statistical Plots

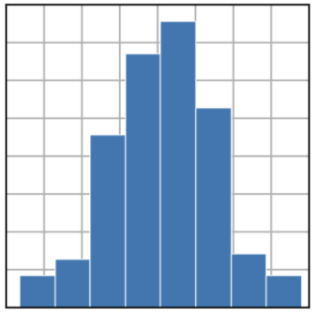
boxplot(X)

See `boxplot`.



hist(x)

See `hist`.



Plotting Data with Matplotlib

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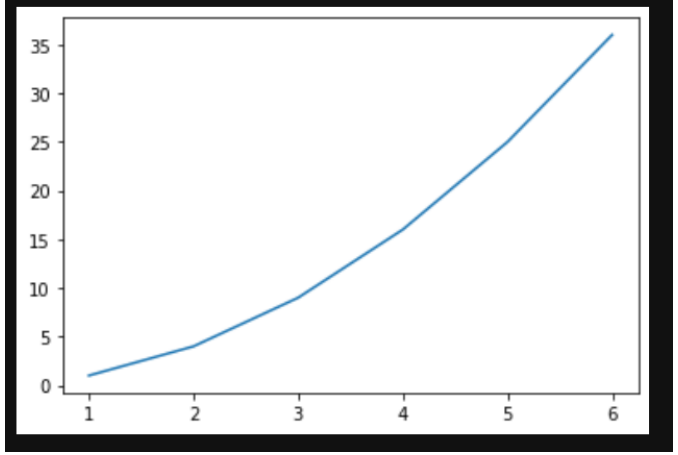
Individual plots:

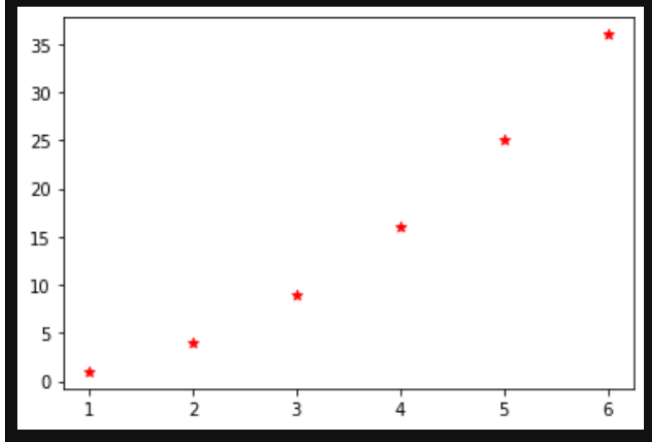
```
import matplotlib.pyplot as plt
import numpy as np

x = np.array([1, 2, 3, 4, 5, 6])
y = x**2

plt.plot(x, y)
```

```
[<matplotlib.lines.Line2D at 0x1d01c6c8370>]
```




```
plt.scatter(x, y, marker = '*', color = 'red')
```

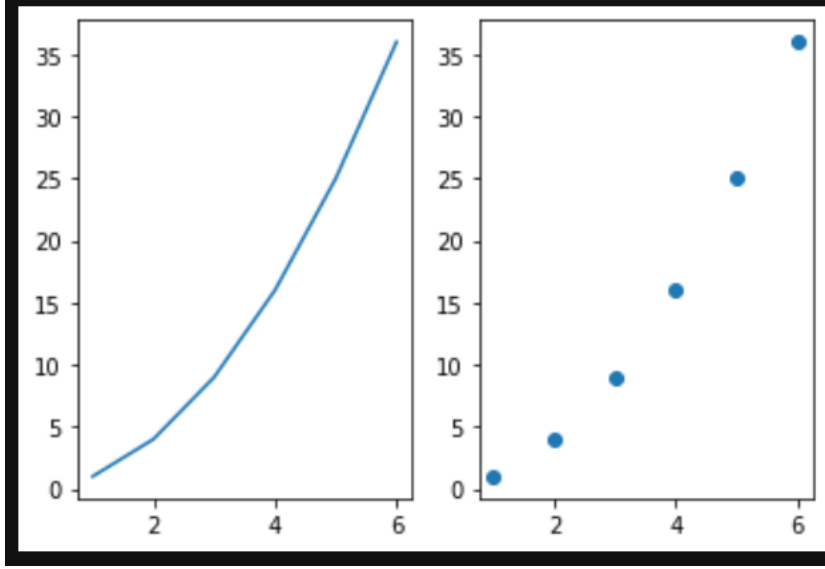
```
<matplotlib.collections.PathCollection at 0x1d01d039730>
```



Plots with subplots:

```
fig, ax = plt.subplots(1,2)
ax[0].plot(x, y)
ax[1].scatter(x, y)
```

```
<matplotlib.collections.PathCollection at 0x1d01cf0c1c0>
```



Plotting Data with Matplotlib

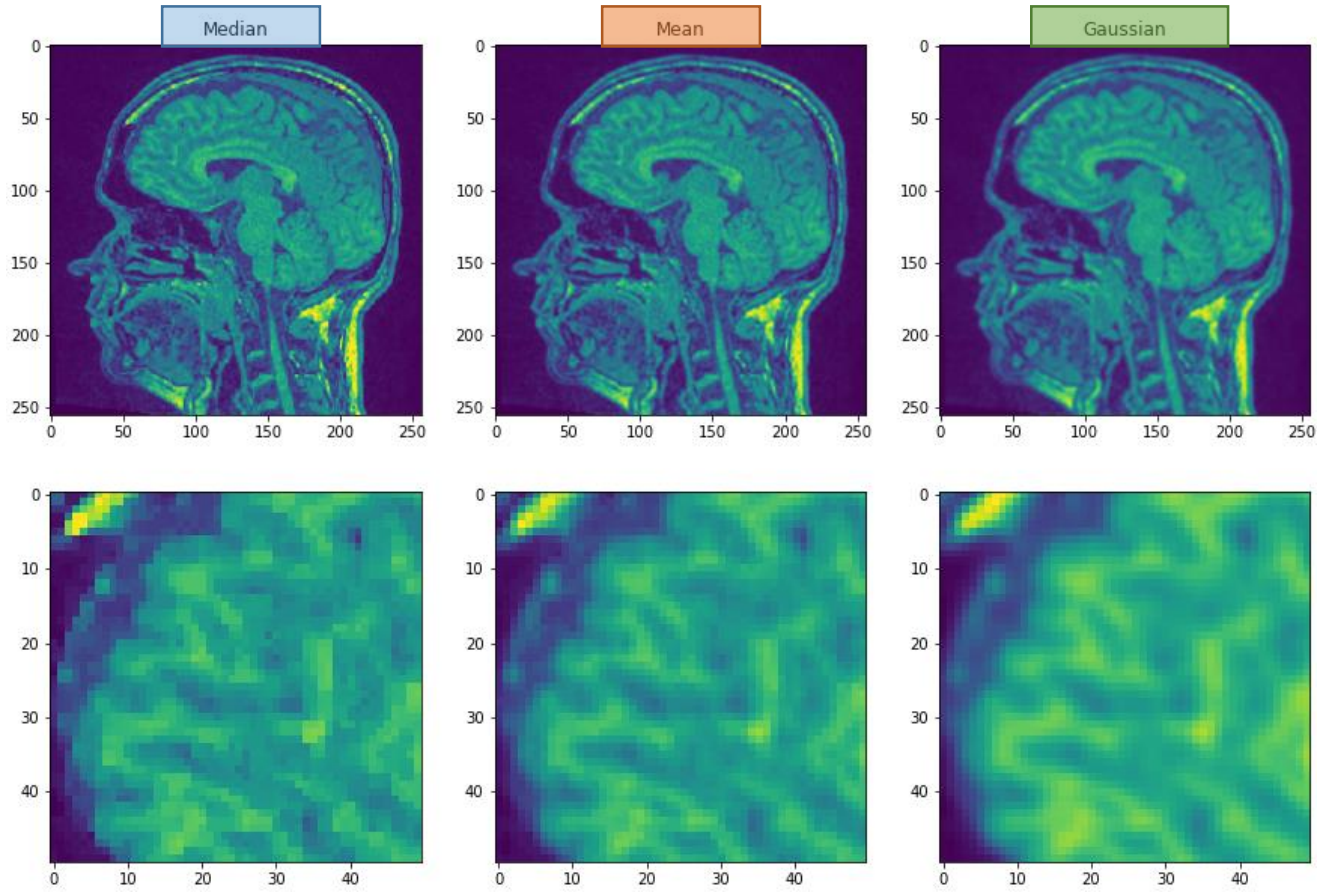
```
median_filtered = filters.median(noisy_mri, disk(1))
mean_filtered = filters.rank.mean(noisy_mri, disk(1))
gaussian_filtered = filters.gaussian(noisy_mri, sigma=1)

fig, axs = plt.subplots(2, 3, figsize=(15,10))

# first row
axs[0, 0].imshow(median_filtered)
axs[0, 0].set_title("Median")
axs[0, 1].imshow(mean_filtered)
axs[0, 1].set_title("Mean")
axs[0, 2].imshow(gaussian_filtered)
axs[0, 2].set_title("Gaussian")

# second row
axs[1, 0].imshow(median_filtered[50:100, 50:100])
axs[1, 1].imshow(mean_filtered[50:100, 50:100])
axs[1, 2].imshow(gaussian_filtered[50:100, 50:100])
```

rows

columns

row

column



https://matplotlib.org/stable/api/_as_gen/matplotlib.pyplot.subplots.html

Plotting Data with Matplotlib

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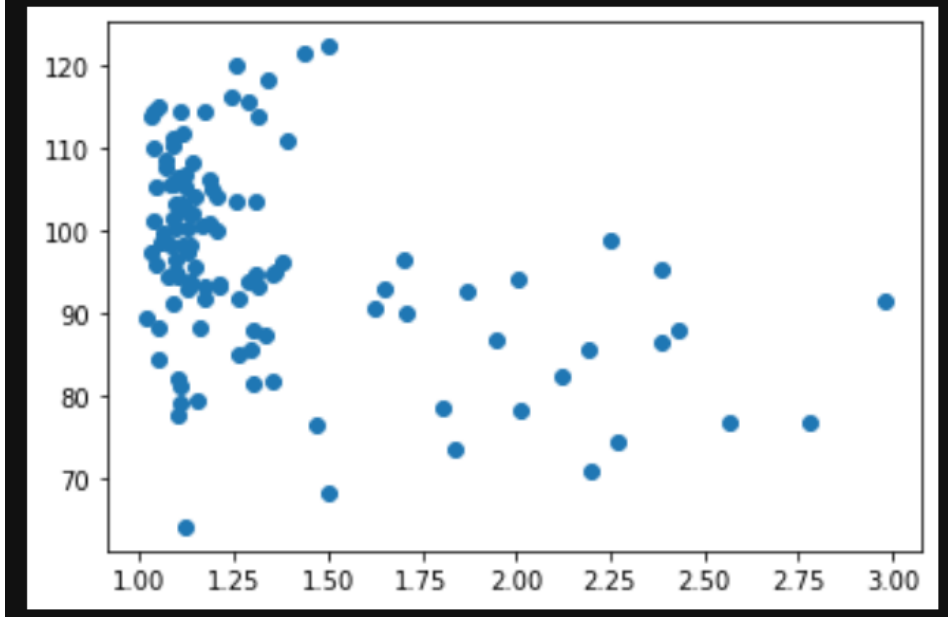
Plotting tabular data:

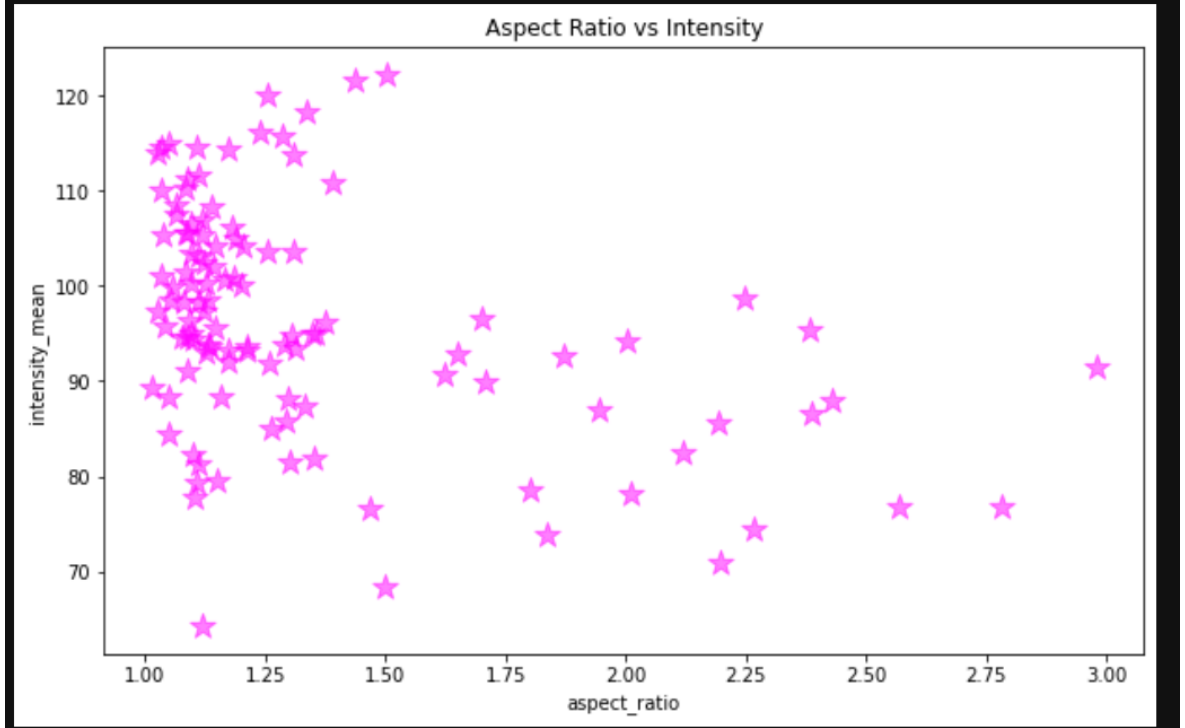
```
x = df['aspect_ratio']
y = df['intensity_mean']

plt.scatter(x, y)
```

```
<matplotlib.collections.PathCollection at 0x190e2bd1790>
```




```
fig, ax = plt.subplots(figsize = [10,6])
ax.scatter(x, y, color = 'magenta', marker = '*', s = 200, alpha = 0.5)
ax.set_xlabel('aspect_ratio')
ax.set_ylabel('intensity_mean')
ax.set_title('Aspect Ratio vs Intensity')
```

```
Text(0.5, 1.0, 'Aspect Ratio vs Intensity')
```

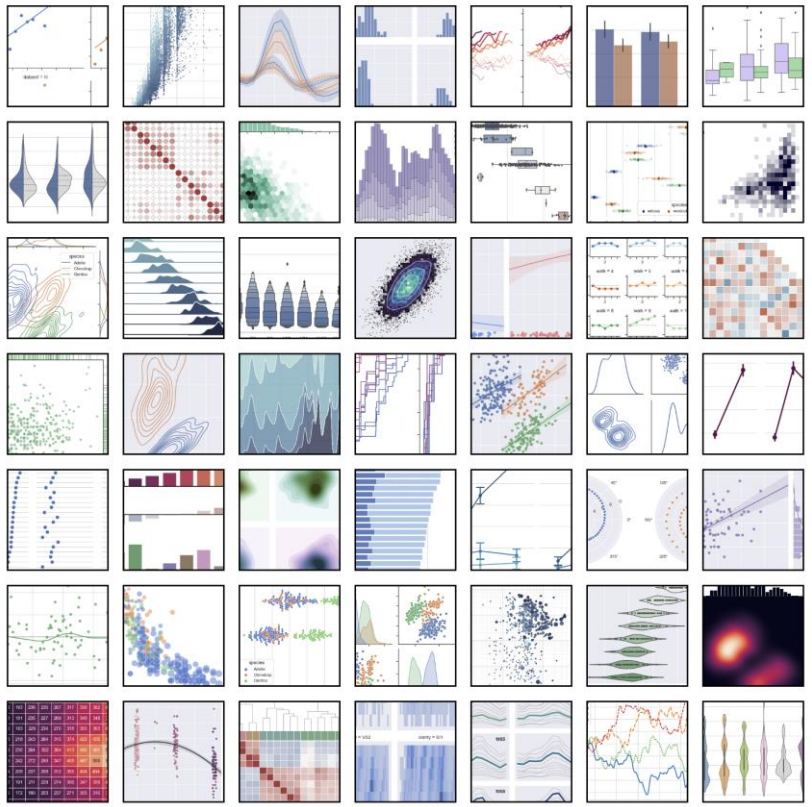


https://seaborn.pydata.org/tutorial/introduction.html

An introduction to seaborn

Seaborn is a library for making statistical graphics in Python. It builds on top of matplotlib and integrates closely with pandas data structures.

Example gallery



https://seaborn.pydata.org/examples/index.html

Plotting Data with Seaborn

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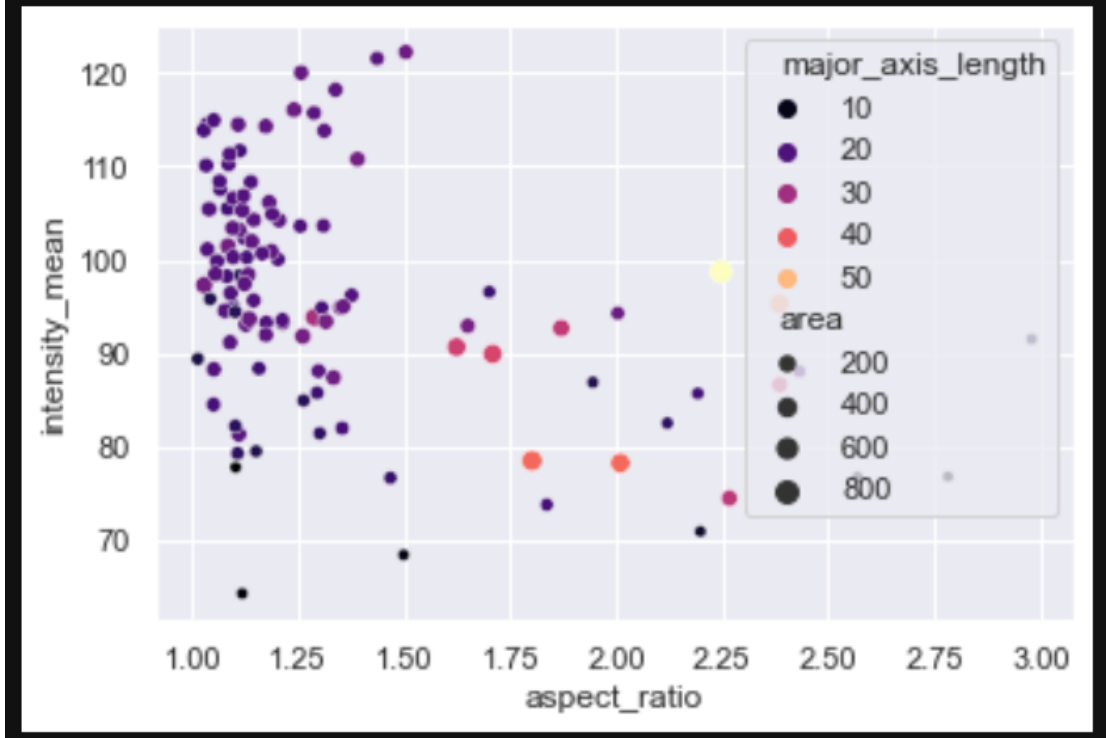
Plotting tabular data: scatterplots

```
df = pd.read_csv("../../data/BBBC007_analysis.csv")
df.head()
```

	area	intensity_mean	major_axis_length	minor_axis_length	aspect_ratio	file_name
0	139	96.546763	17.504104	10.292770	1.700621	20P1_POS0010_D_1UL
1	360	86.613889	35.746808	14.983124	2.385805	20P1_POS0010_D_1UL
2	43	91.488372	12.967884	4.351573	2.980045	20P1_POS0010_D_1UL
3	140	73.742857	18.940508	10.314404	1.836316	20P1_POS0010_D_1UL
4	144	89.375000	13.639308	13.458532	1.013432	20P1_POS0010_D_1UL

```
sns.scatterplot(data=df,
                x = "aspect_ratio",
                y = "intensity_mean",
                size = "area",
                hue = "major_axis_length",
                palette = 'magma')
```

```
<AxesSubplot:xlabel='aspect_ratio', ylabel='intensity_mean'>
```



Plotting Data with Seaborn

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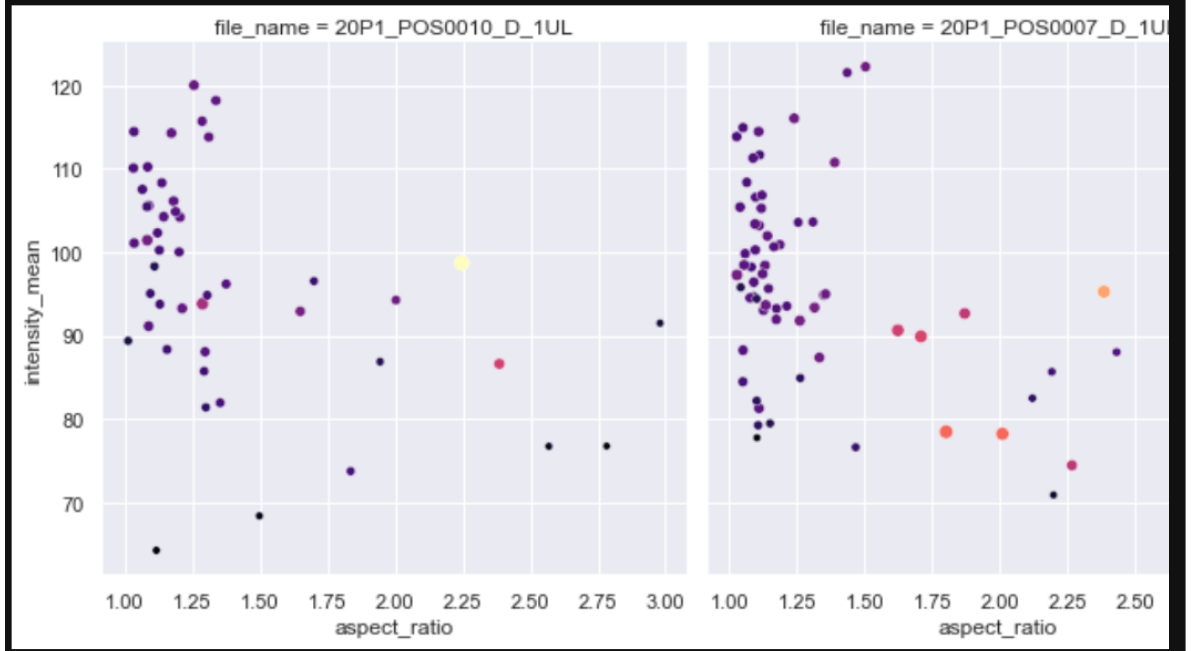
Plotting categorical variables splitted:

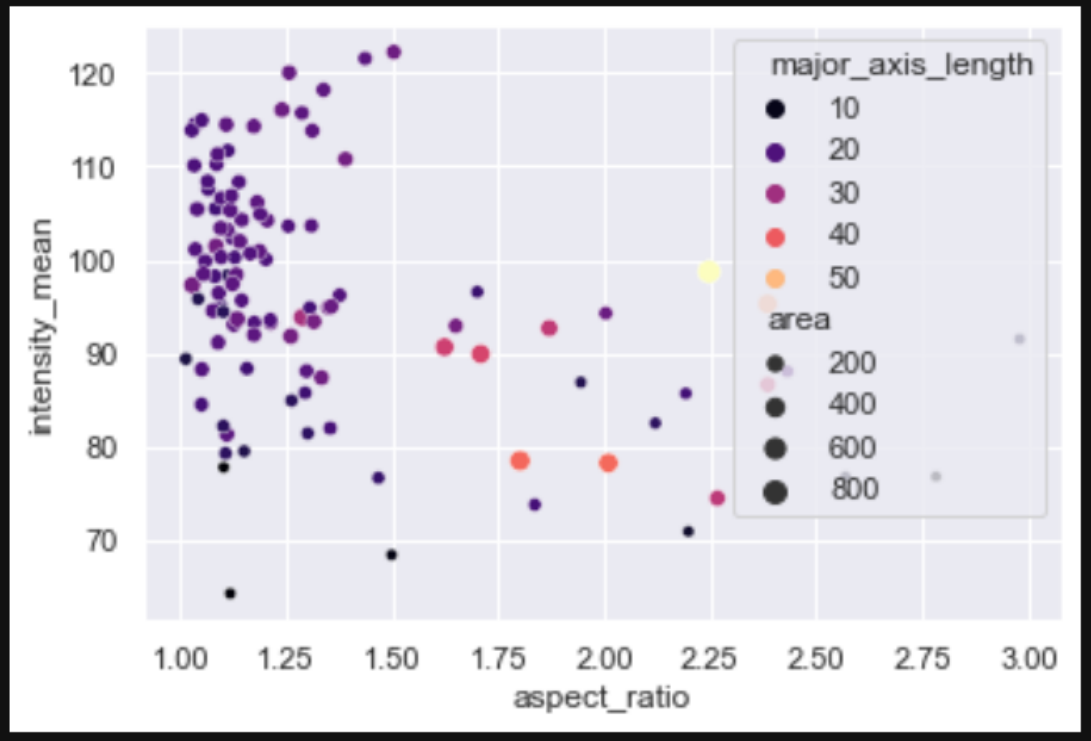
```
sns.relplot(data=df,
            x = "aspect_ratio",
            y = "intensity_mean",
            size = "area",
            hue = "major_axis_length",
            col = "file_name",
            palette = 'magma')
```

```
<seaborn.axisgrid.FacetGrid at 0x1b97a2c8d30>
```




```
sns.scatterplot(data=df,
                x = "aspect_ratio",
                y = "intensity_mean",
                size = "area",
                hue = "major_axis_length",
                palette = 'magma')
```

```
<AxesSubplot:xlabel='aspect_ratio', ylabel='intensity_mean'>
```

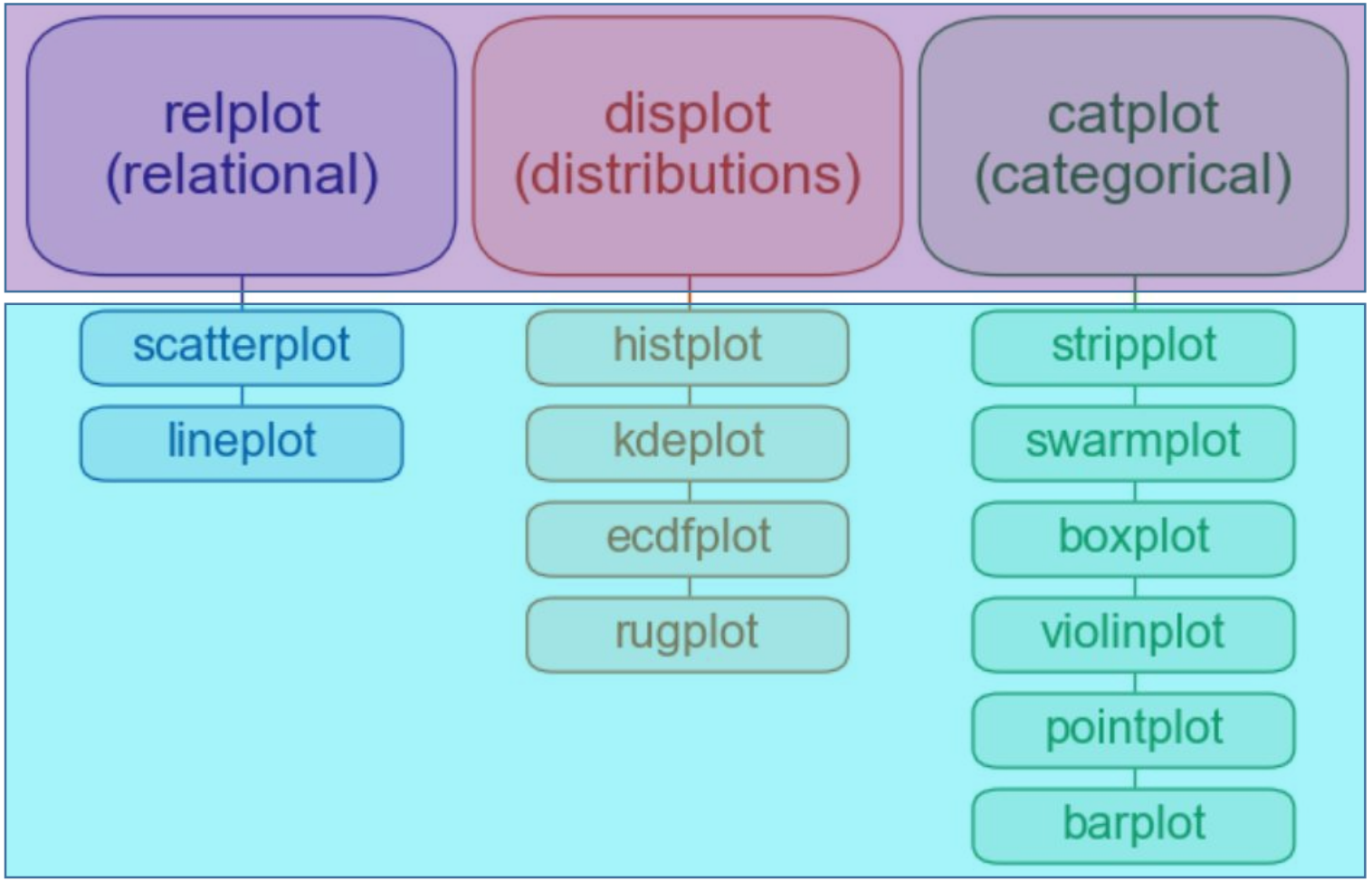


Plotting Data with Seaborn

Figure-level functions vs axes-level functions

Figure-level

Axes-level



NOTE:
Relplot generate the sub-figures automatocally.

The scatterplot will not.

kde:
Kernel Density Estimation

Plotting Data with Seaborn

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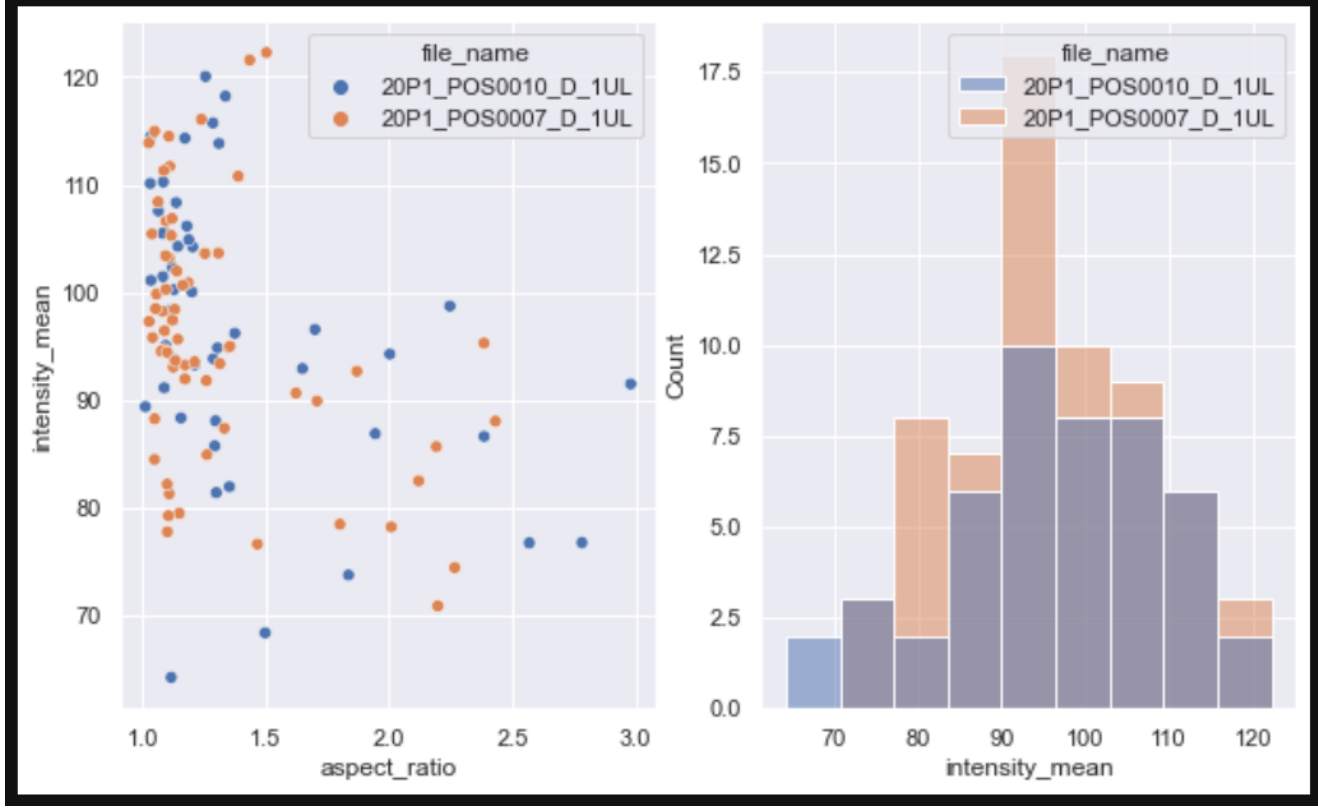
Figure-level functions vs axes-level functions

```
fig, ax = plt.subplots(1,2, figsize=(10,6))
sns.scatterplot(data=df, x="aspect_ratio", y="intensity_mean", hue = 'file_name', ax=ax[0])
sns.histplot(data = df, x="intensity_mean", hue="file_name", ax=ax[1])
```

```
<AxesSubplot:xlabel='intensity_mean', ylabel='Count'>
```



Plotting Data with Seaborn

Adding a line regression to a scatter plot

Axes-level

```
sns.regplot(data = df, x = "aspect_ratio", y = "intensity_mean")
```

```
<AxesSubplot:xlabel='aspect_ratio', ylabel='intensity_mean'>
```

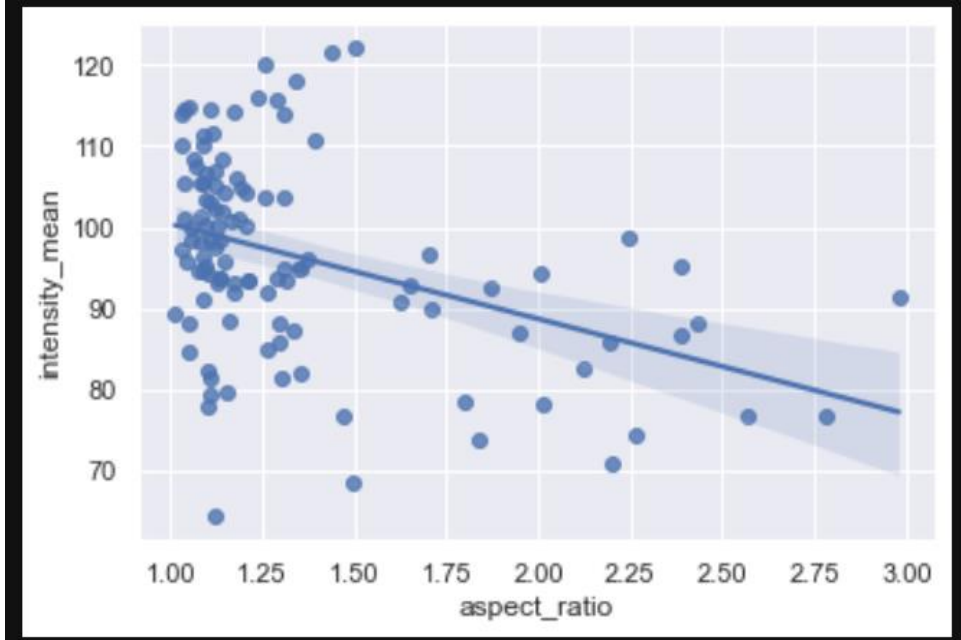
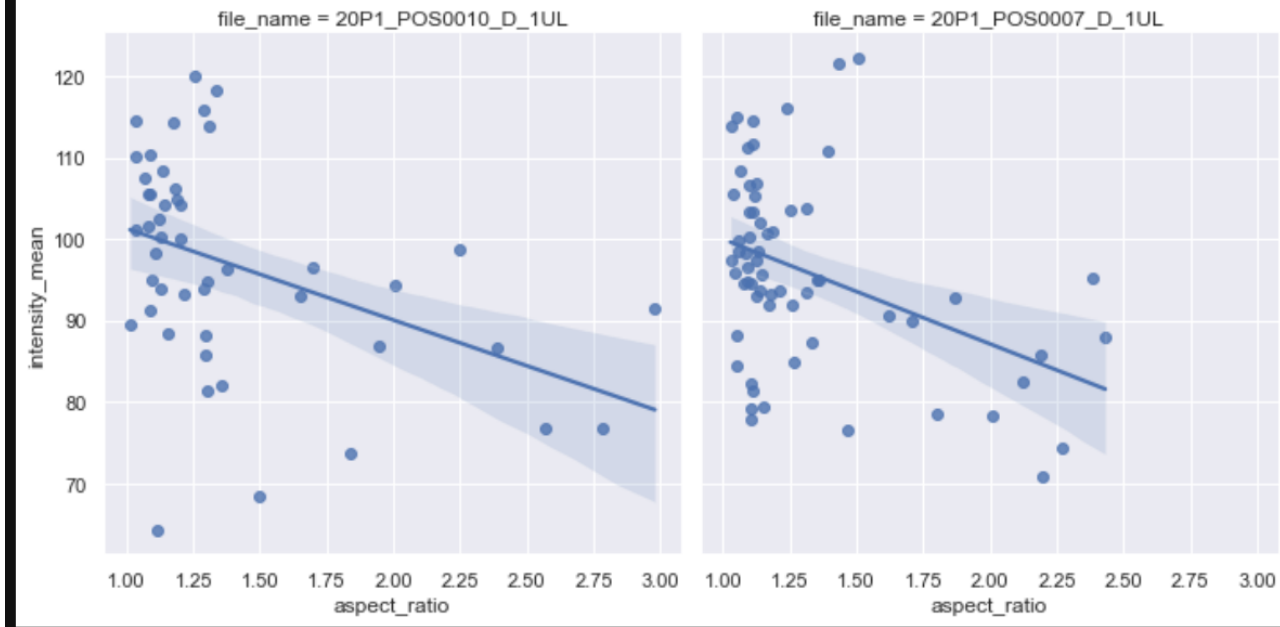


Figure-level

```
sns.lmplot(data = df,
           x = "aspect_ratio",
           y = "intensity_mean",
           col = "file_name")
```

```
<seaborn.axisgrid.FacetGrid at 0x1b97a479970>
```



Plotting Data with Seaborn

Boxplots

Axes-level

```
sns.boxplot(data=df, x="intensity_mean", y="file_name")
```

```
<AxesSubplot:xlabel='intensity_mean', ylabel='file_name'>
```

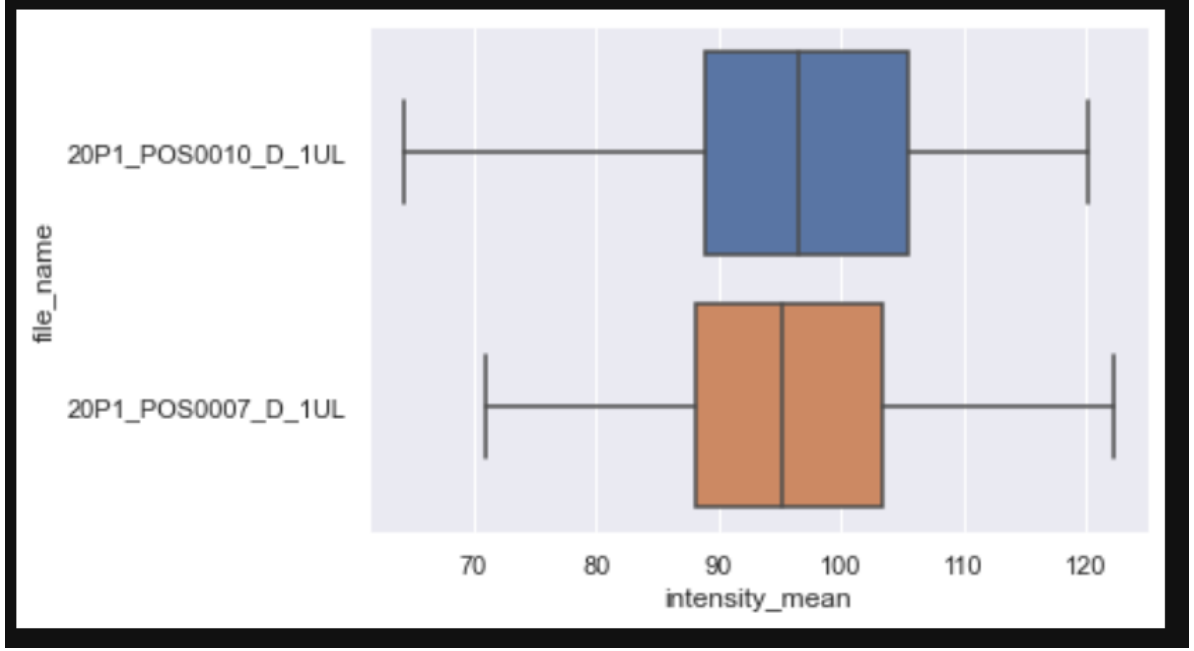
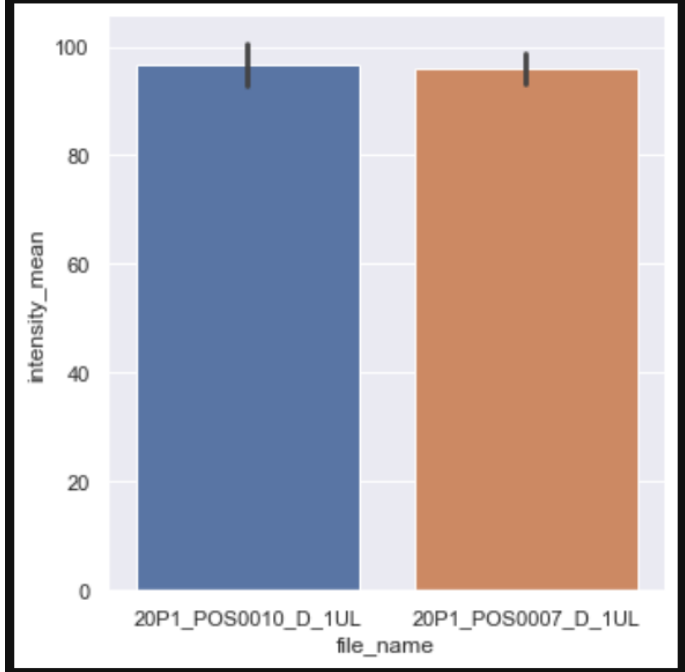


Figure-level

```
sns.catplot(data=df, x="file_name", y="intensity_mean", kind="bar")
```

```
<seaborn.axisgrid.FacetGrid at 0x14fcb408fd0>
```



Plotting Data with Seaborn

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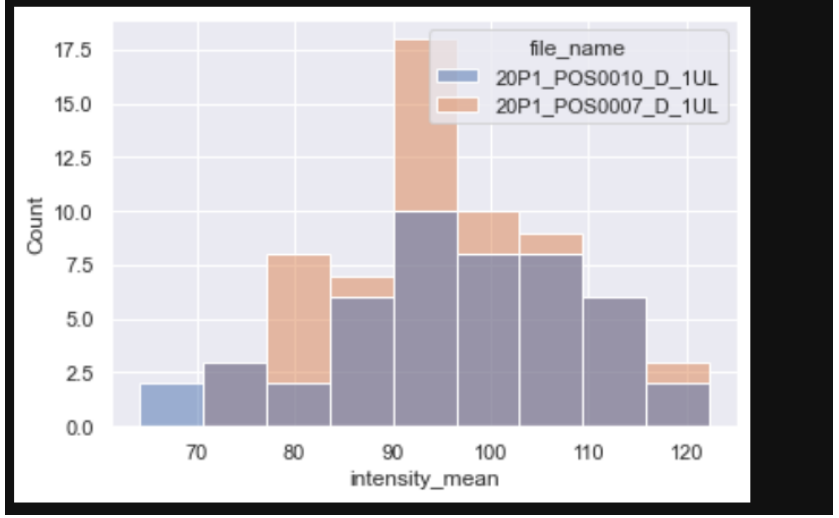
Histograms

Axes-level

```
sns.histplot(data = df, x="intensity_mean", hue="file_name")
```

```
<AxesSubplot:xlabel='intensity_mean', ylabel='Count'>
```




```
sns.kdeplot(data=df, x="intensity_mean", hue="file_name")
```

```
<AxesSubplot:xlabel='intensity_mean', ylabel='Density'>
```

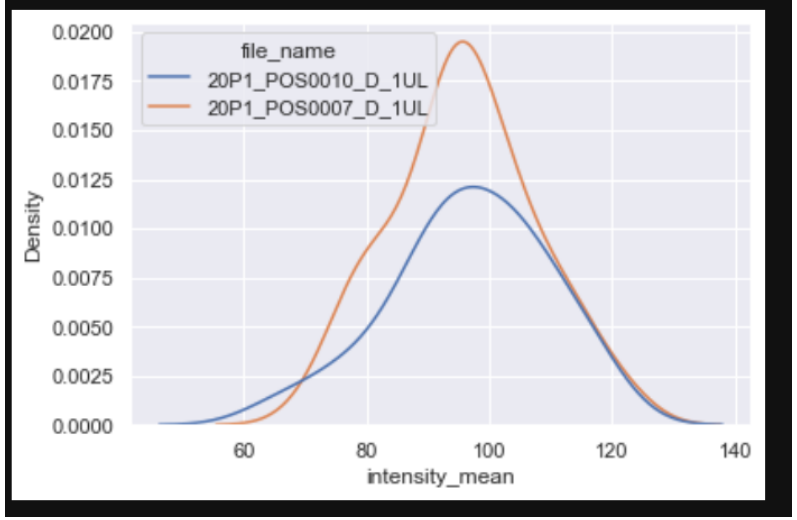
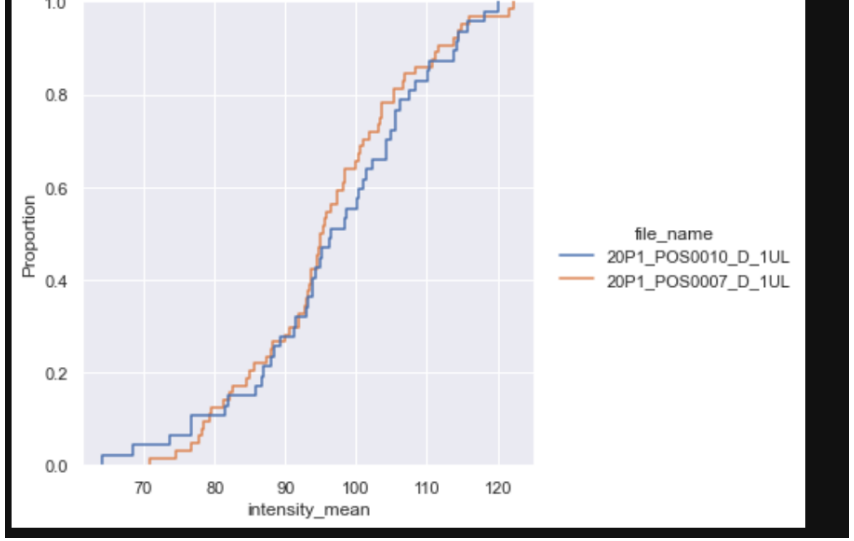


Figure-level

```
sns.displot(data = df, x="intensity_mean", hue="file_name", kind = 'ecdf')
```

```
<seaborn.axisgrid.FacetGrid at 0x21f0955d070>
```



Plotting Data with Seaborn

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Joint distributions and pair-plotting multiple properties

Figure-level

```
sns.jointplot(data=df, x="aspect_ratio", y="area", hue = 'file_name')
```

```
<seaborn.axisgrid.JointGrid at 0x12edd860970>
```

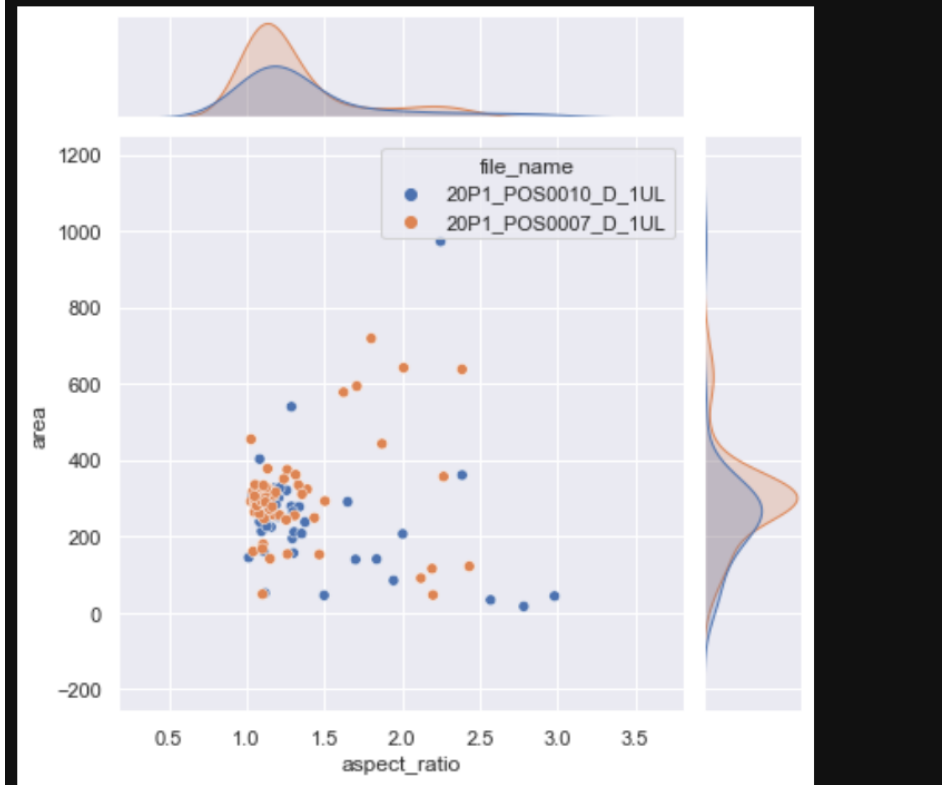
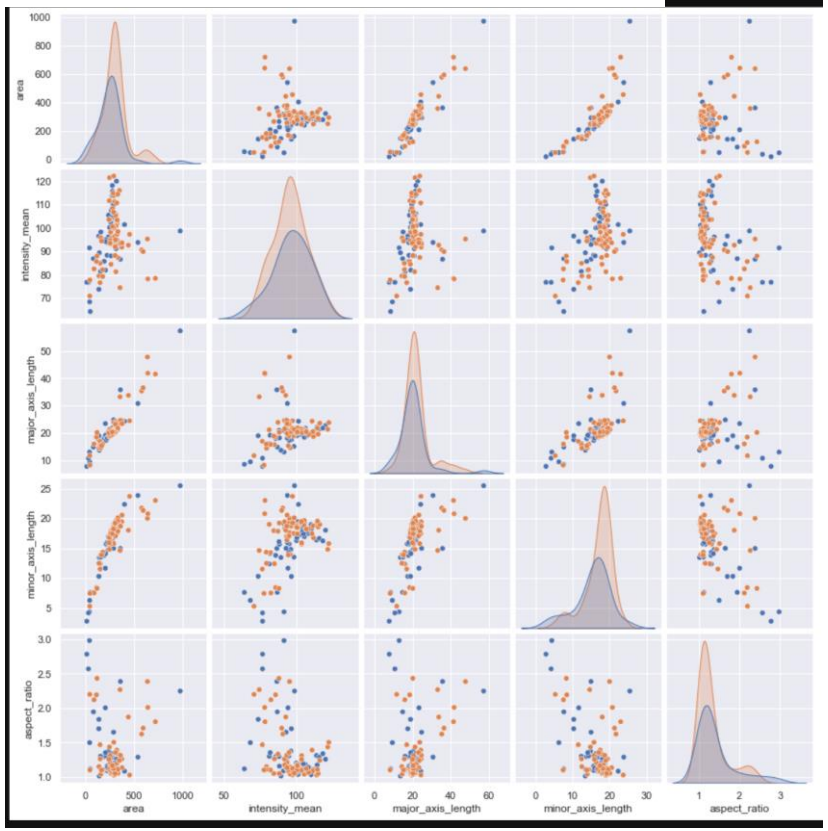


Figure-level

```
sns.pairplot(data=df, hue="file_name")
```



Plotting Data with Seaborn

Pros and cons of Figure-level functions:

Advantages	Drawbacks
Easy faceting by data variables	Many parameters not in function signature
Legend outside of plot by default	Cannot be part of a larger matplotlib figure
Easy figure-level customization	Different API from matplotlib
Different figure size parameterization	Different figure size parameterization