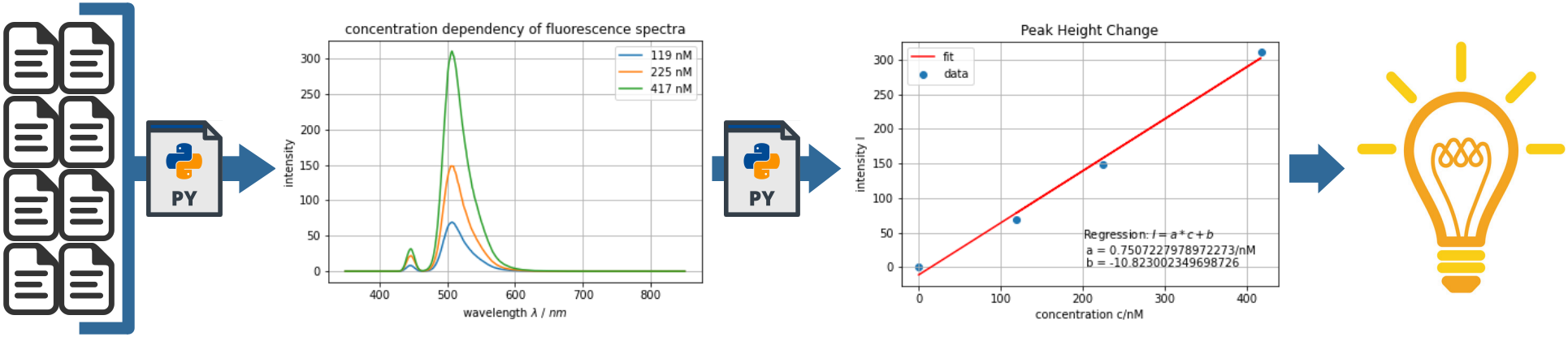
Computing Regressions

Common Workflow



Linear Regression

```
# Import scikit-learn
from sklearn.linear_model import LinearRegression

# Create a linear regression model
linearModel = LinearRegression()
# Fit testing data
linearFit   = linearModel.fit(xvalues, yvalues)
# Extract the fitting parameters
coefficient = linearFit.coef_
intercept   = linearFit.intercept_
```

Machine Learning Module
https://sklearn.org/

Formating Training Data
for Linear Regression

$$\hat{y}_j = b_1 \cdot x_j + b_0$$

```
xvalues = [x0, x1, …, xn]
```

xvalues.reshape(-1,1)

```
xvalues = [ [x0],
            [x1],
             …
            [xn] ]
```

```
yvalues = [ y0, y1, …, yn ]
```

Formating Training Data
for Multiple Linear Regression

$$\hat{y}_j = \sum_{i=1}^{n} b_i \cdot x_{ij} + b_0$$

```
xvalues = [ [x00, x01, …, x0m],
            [x10, x11, …, x1m],
                  …
            [xn0, xn1, …, xnm] ]
```

xvalues.T

```
xvalues = [ [x00, x10, …, xm0],
            [x01, x11, …, xm1],
                  …
            [x0n, x1n, …, xmn] ]
```

```
yvalues = [ y0, y1, …, yn ]
```

Extracting Fitting Parameters

```
# Fit testing data
linearFit = LinearRegressions().fit(xvalues, yvalues)
# Extracting fitting parameter
linearFit.intercept_ # → b0
linearFit.coef_      # → [ b1, b2, …, bn ]
# Predict new data
newY = [ linearFit.coef_[0] * x + linearFit.intercept_ for x in newX ]
newY = linearFit.predict(newX)
```

Exponential Regression

```
# Import modules
from scipy.optimize import curve_fit
import numpy as np

# Define a regression formula
model = lambda x, A, b : A * np.exp(b*x)
# Fit testing data
fit = curve_fit( f      = model,
                 xdata = xvalues,
                 ydata = yvalues,
                 p0    = [initial_A, intial_b] )
# Extract fitting parameters
parameters = fit[0] # → [ A, b ]
```

Exerise 12: Regression

Do a linear regression on some data of your choice.

Try a second kind of regression if you want
(e.g. polynominal, exponential, …).

Create a plot with the training data
and your regression models.