

# Linear Regression Activity

SYDE 599 Deep Learning F23

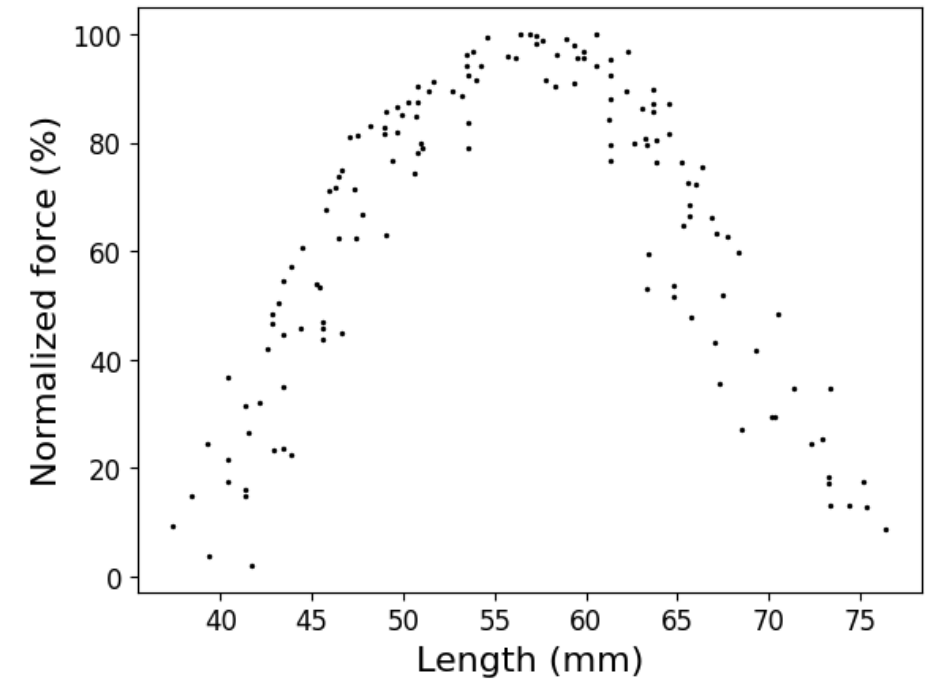
September 14, 2023



# Linear regression activity

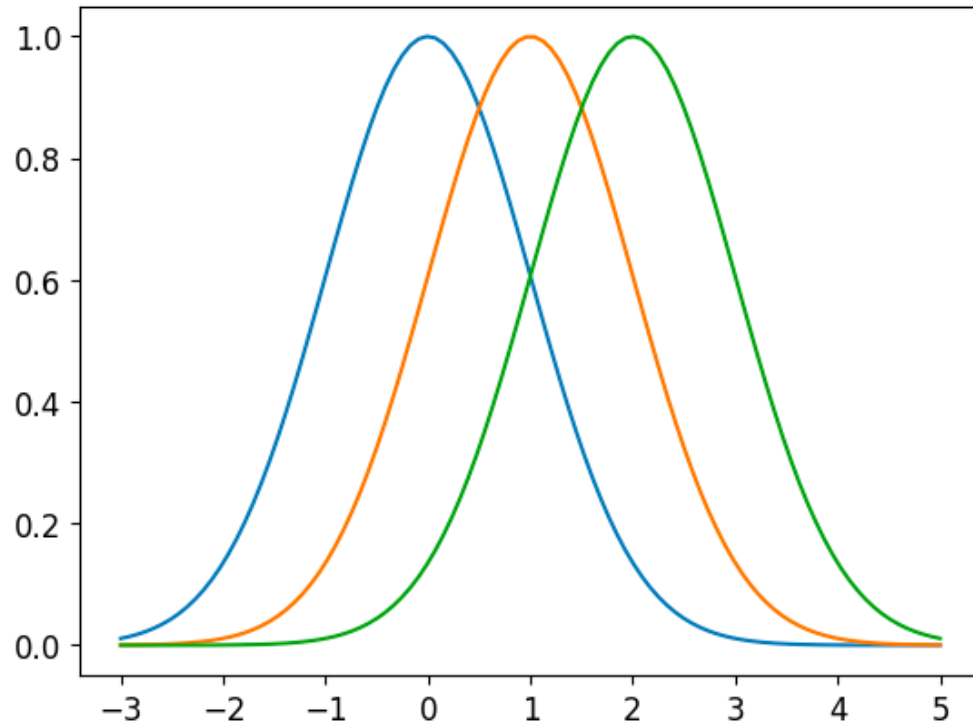
- These are measurements of muscle force as a function of muscle length
- Use linear regression to fit the training set defined in the notebook
- Use the dataset in the repo and `sklearn.linear_model.Ridge`

Data



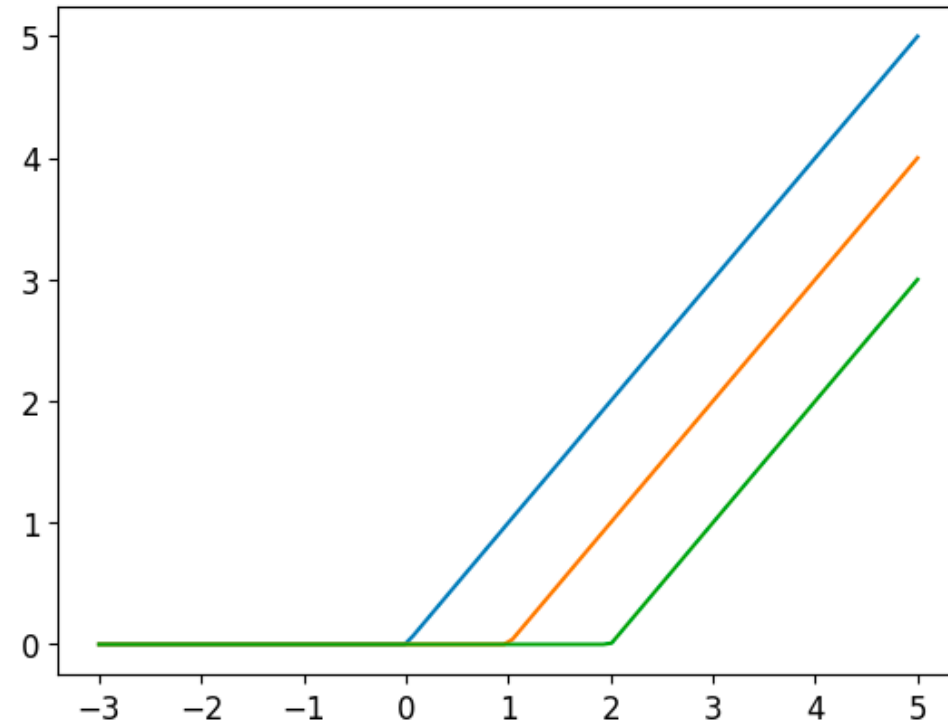
# Linear regression activity

Gaussian basis functions



$$\phi(x | \mu, \sigma) = e^{-\frac{1(x-\mu)^2}{2\sigma^2}}$$

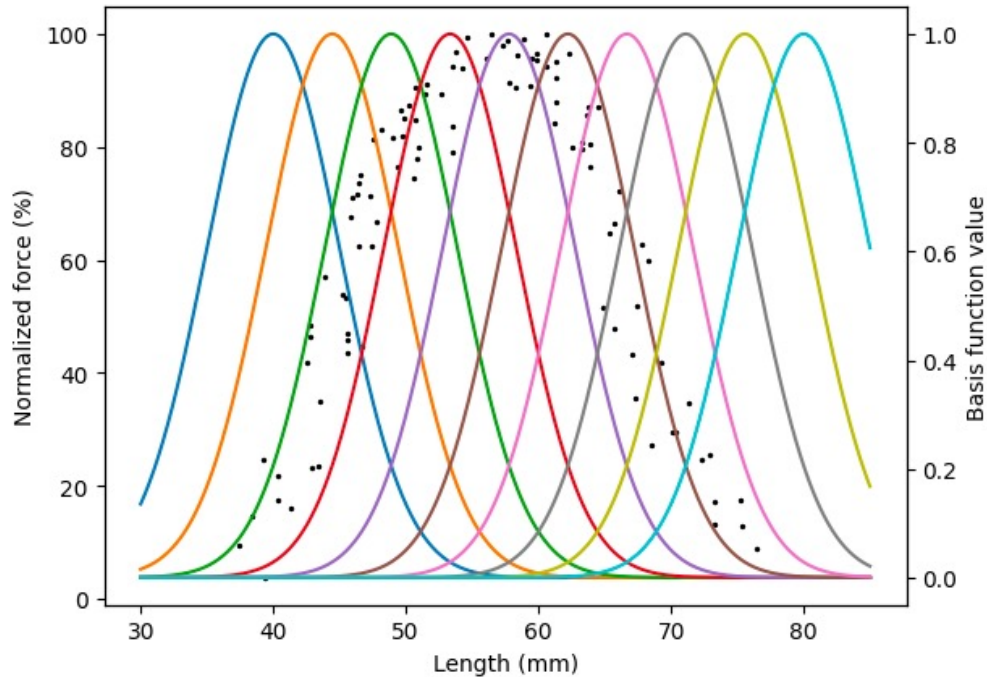
ReLU basis functions



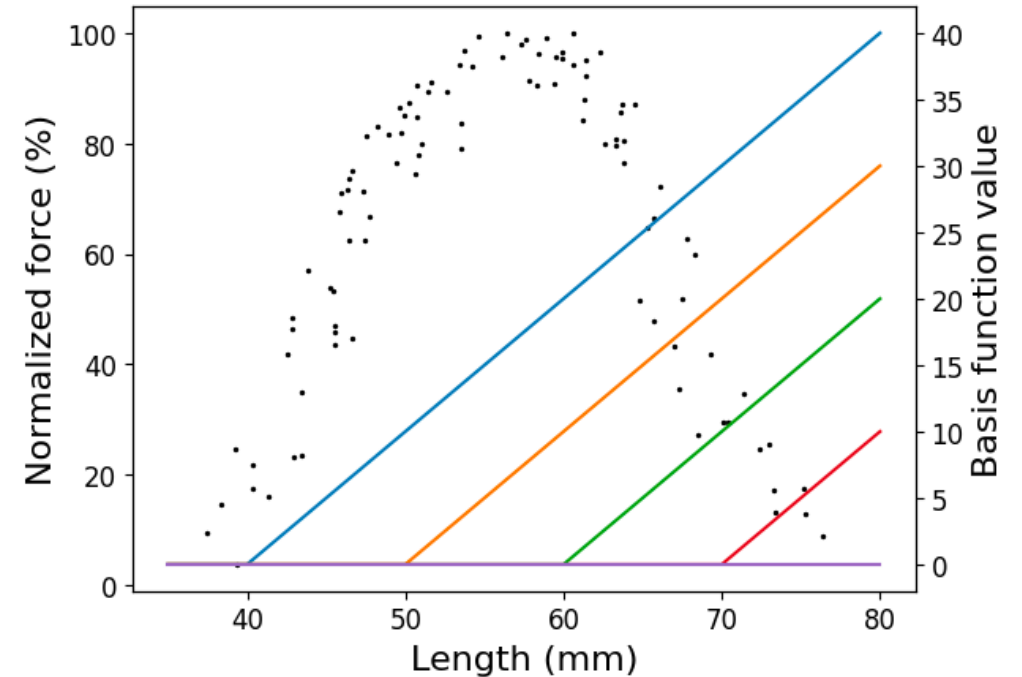
$$f(x | c) = \begin{cases} 0 & \text{if } x < c \\ x - c & \text{if } x \geq c \end{cases}$$

# Linear regression activity

- Gaussian basis functions



- ReLU basis functions



# Discussion

## Section 1:

- Why should we not apply this regression model to a muscle length of 80 mm?

## Section 2:

- What is the optimal number of basis functions? When is it over/under-fitting?
- What do you observe about the plots of the model that overfits?

## Section 3:

- Explain why a linear combination of shifted ReLU features is able to replicate this peaked shape.
- Which number of ReLU basis functions would you choose and why?
- What is one drawback of applying this approach of parameterized basis functions to arbitrary problems?