# CHE 4230

# Homework 4

**Due Sunday March 2, midnight**

1. Explain the difference between **classification** and **regression** in supervised learning.
2. Provide an example of a **real-world application** for each.
3. **Neural network basic concepts:** A single perceptron (neuron) can represent many Boolean functions (True or False decisions). Assume Boolean values of 1 (true) and -1 (false).

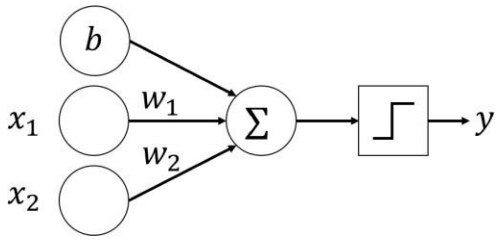


**Figure 1**. A perceptron.

**Where the activation function returns 1 if $f_\Sigma > 0$, and -1 if $f_\Sigma < 0$**

a) If $w_1 = 0.8,\ w_2 = 1.0,\ b = -0.5$, calculate the output $y$ for the input vector [1, 0].

b) What could be a set of possible values of $[w_1, w_2, b]$, and the input $[x_1,\ x_2]$, where $x_i$ can be 1 or 0 if the perceptron is to represent the **AND** function that returns $y = 1$ **if and only if** $[x_1,\ x_2] = [1,1]$?

4. **Practice with ANN parameters and inheritance:**

Your goal is to set up a python package that includes at least one parent class and one child class (see **Figure 2**). Your package should contain methods for: loading datasets, preprocessing data, creating an artificial neural network model, training the model, testing the model performance (see part 2.b.) and visualizing the results.

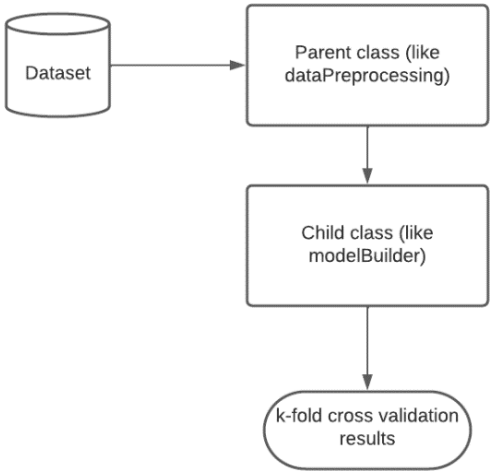


**Figure 2.** Example of the structure of a Python package.

a) Start by *forking* the meters repository on GitHub (meter_Hw4). For this assignment you will use the dataset available in this repository.

b) For the following steps, create as many branches as you need, and remember to commit often.

c) Create a jupyter notebook to test out pieces of code, methods, classes, etc.

d) Make use of the methods/classes/structure already in the repository and add whatever is needed to complete the package.

e) Once you have tested your code in the jupyter notebook, integrate your code in the package structure (using classes and imports in .py files).

f) Create a new jupyter notebook to try different values for the hidden_layer_sizes, learning_rate_init, and max_iter hyperparameters (use at least 4 new combinations). Report the results and a brief explanation for your observations using markdown in the jupyter notebook.

5. **Submission:**

Submit a .pdf file showing your work for questions 1, 2 and 3 and a link to the repository in question 4.