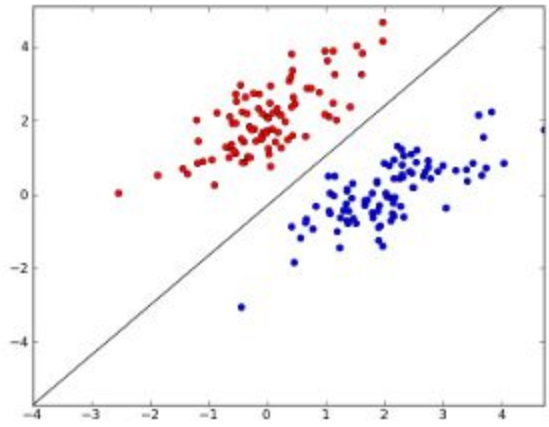
Lab 7: Classification using perceptron

A security researcher wanted to see if they could figure out the password entered in a smart-phone just by looking at the accelerometer data from the phone. They expect that pressing the phone in different positions (corresponding to pressing different numbers on the screen) would cause different signals on the accelerometer. The team gathered training data, where each data point is the x,y values sensed by the accelerometer and the label is the number pressed. Your job is to build a classifier using a perceptron that can classify the button pressed by looking at just the accelerometer data.

Please use python3 and dont import any extra files. Your each call of the student function must take under 60 seconds to execute. You may wish to limit the number of training loops to ensure this, especially for problem 2.

Problem 1:
To verify you can build a classifier, the researcher asked that you first build a binary classifier that can classify 2D data that is linearly separable. To complete this task you are to make a function that takes in some labeled training data (data is x,y values and each data is labeled as class 0 or 1), and your function is to classify the test data given. The team wants your classifier to be correct more than 95% of the time on the test data.



For this part you are to complete one function: def part_one_classifier(data_train,data_test):

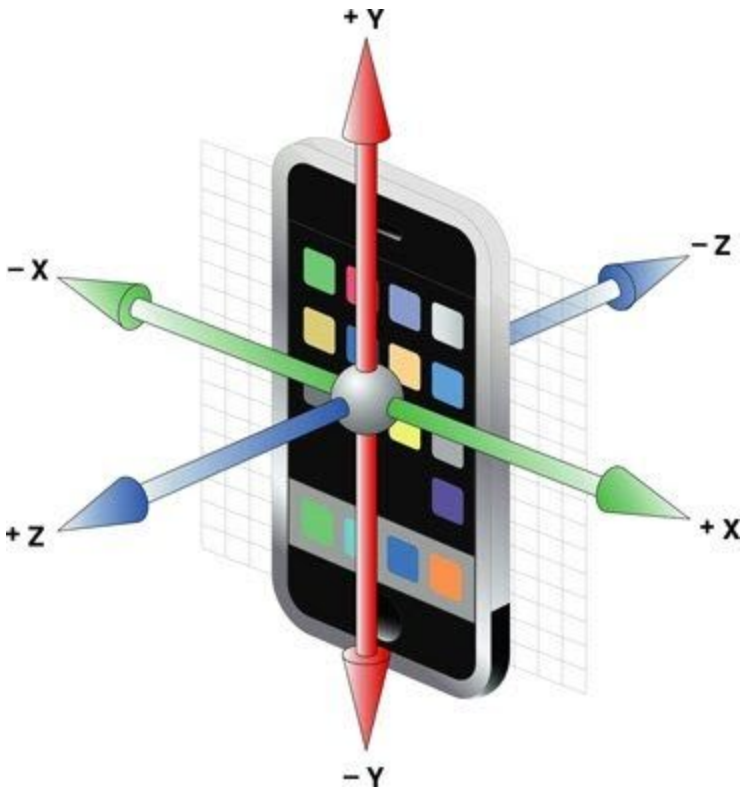
The function receives:

- bidimensional structure data_train of size TRAINING_SIZE x 3. Every row contains a value for X in position 0, a value for for Y in position 1 and a value for the class in position 2.
- bidimensional structure data_test of size TEST_SIZE x 3. Every row contains a value for X in position 0, a value for for Y in position 1 and an empty space for the class in position 2.

The function must modify:

-The third column of the “data_test ” structure, by entering the right class of each element. Valid values for classes are 0 or 1.

Problem 2:
Now the researcher give you the training data collected from the phone, which for each data point it is the x,y accelerometer values, and the button pressed (0-8). Next they give you test data, just the x,y accelerometer values sensed when a button was pressed. You are to write a function that takes in the training data and test data, and correctly classifies the test data. The researcher wants your classifier to be correct more than 90% of the time. The researcher suggests that when you train your perceptron that you use a small learning rate, like 0.01. This is the weight in which you add or subtract features from the weight vectors when updating the weights.



For this part you are to complete one function: def part_two_classifier(data_train,data_test):

The function receives:

- bidimensional structure data_train of size TRAINING_SIZE x 3. Every row contains a value for X in position 0, a value for for Y in position 1 and a value for the class in position 2.
- bidimensional structure data_test of size TEST_SIZE x 3. Every row contains a value for X in position 0, a value for for Y in position 1 and an empty space for the class in position 2.

The function must modify:

-The third column of the “data_test ” structure, by entering the right class of each element. Valid values for classes are 0 to 8.