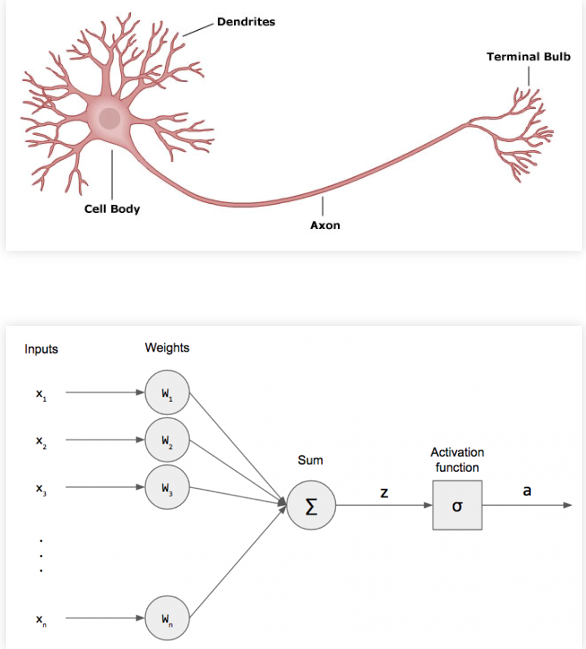
**A1**

**introdution;**

### MACHINE LEARNING

In this assignment you will write a program that can learn from its experience, in order to become better at accomplishing perceptual tasks (classifying objects). In order to make your program learn you will build a single neuron inspired by one type of nervous cell found in animal brains. Although your program will simulate the learning process of just a single simple neuron (not an entire brain with complex neural cells as it is done with modern deep learning systems), it is powerful enough to process various forms of perceptual input and capable of learning useful information from data.

You will then teach this neuron to become better at its task by training it on a dataset of examples. Afterwards, your neuron can clasiffy objects that it hasn't seen during training.



### ASSIGNMENT

You will use your neuron as a base for three programs. These programs will accomplish three different tasks involving decision making based on perceptual inputs:

* sonar sound waves bouncing of underwater objects → was the object a mine?
* images of various things → is there a cat in the image?
* handwritten digits → what digit is it?

### OOP APPROACH

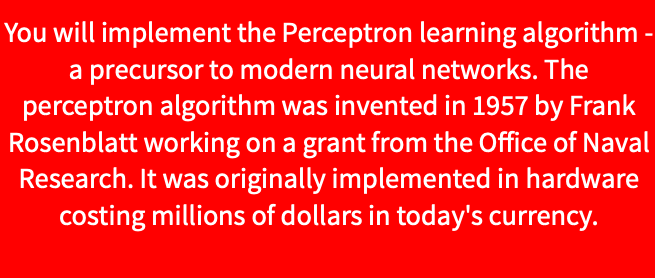
### Let's start by writing a class that models the behavior of a simple-cell neuron. We will need some properties and methods.

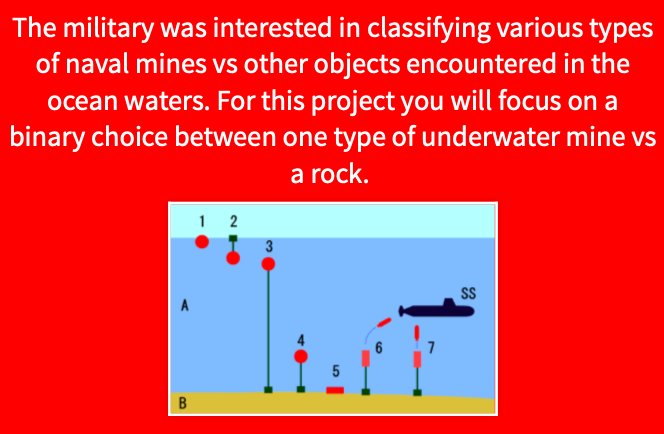
* constructor (activation function, input dimension)
* weights
* \_\_call\_\_

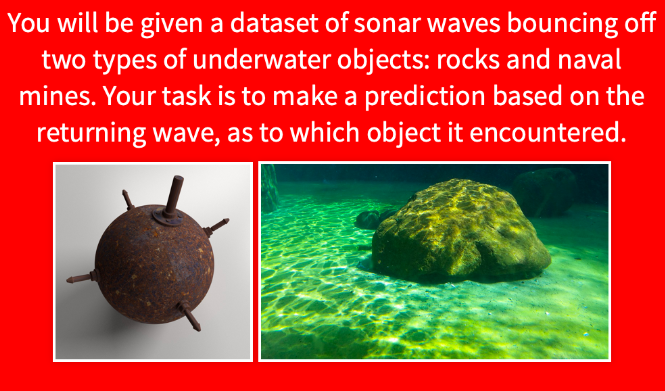
### YOUR TASK

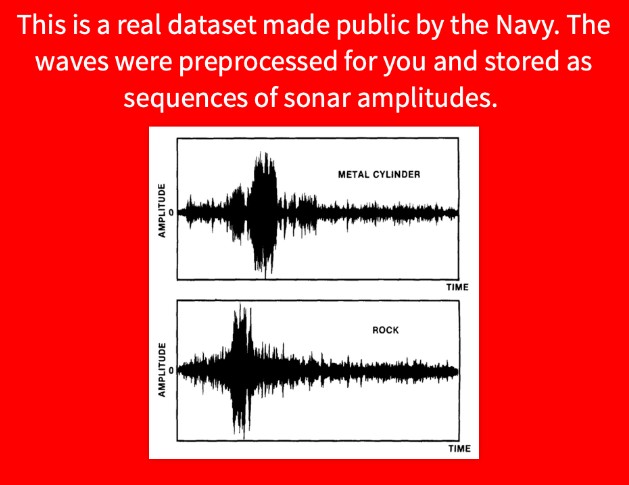
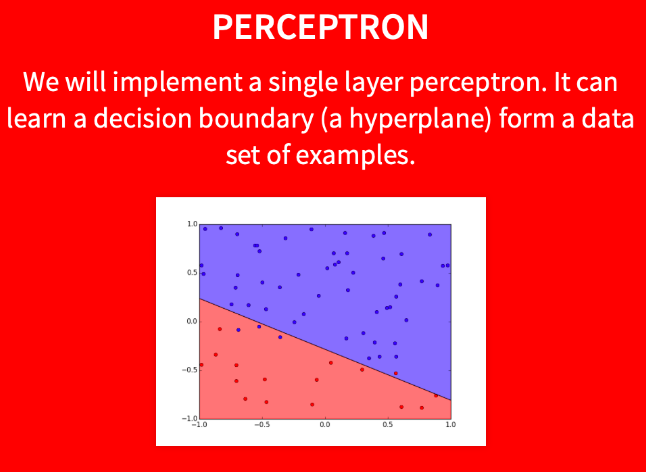
An artificial neuron we discussed in lecture, can only activate under a given set of weights. However, tuning those weights by hand to accomplish different tasks is an arduous process. In fact we wouldn't even know how to set them properly for most tasks (although it was basically done by hand in early implementations of perceptrons). Your task in this project is to implement a learning process, so the neurons can tune their weights automatically from datasets of examples.

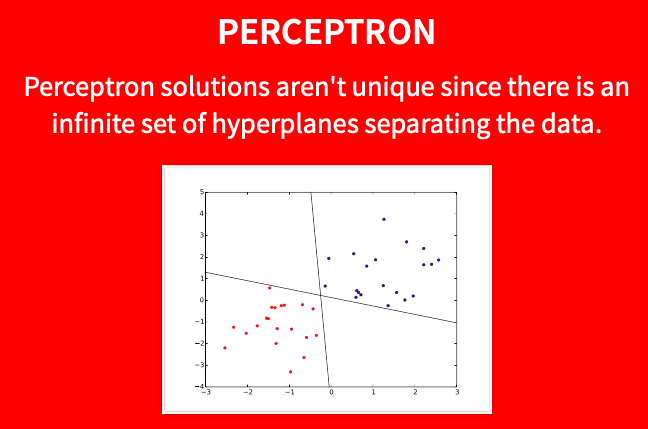
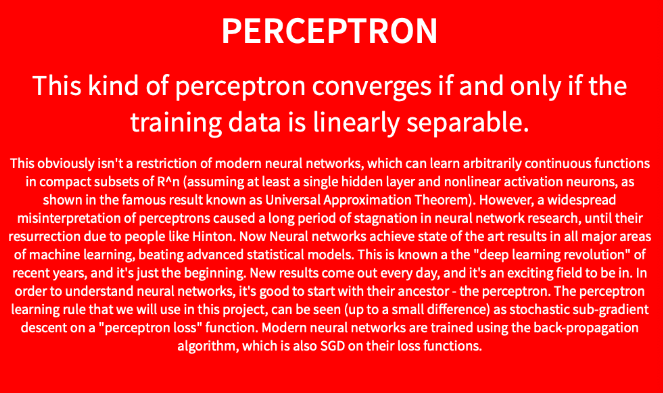
\***SONAR**

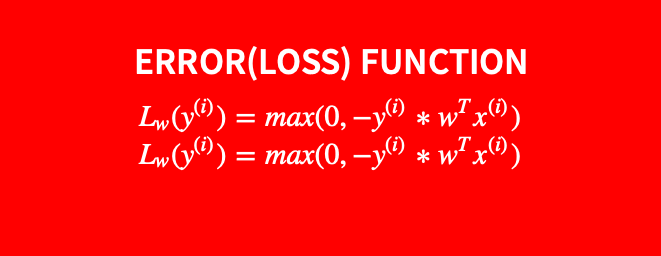
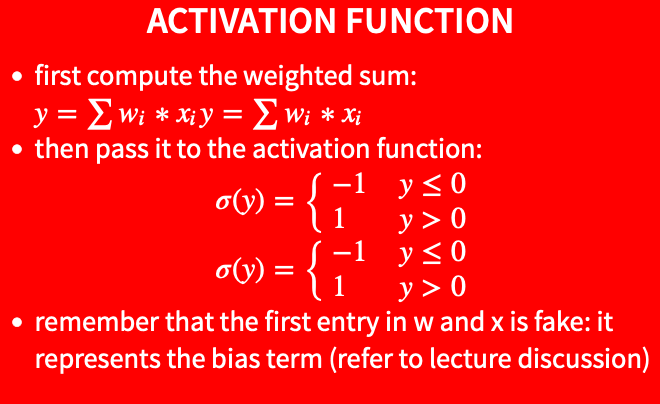
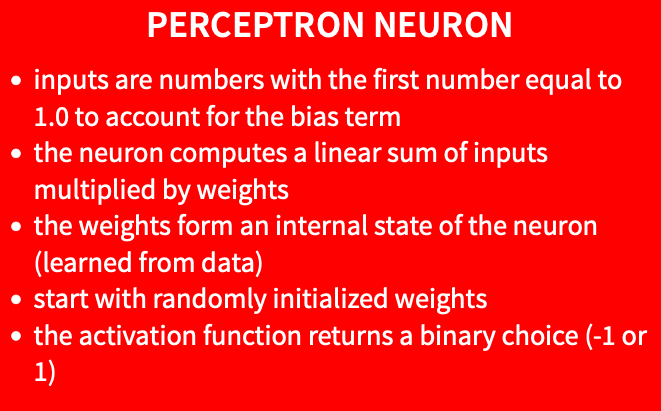
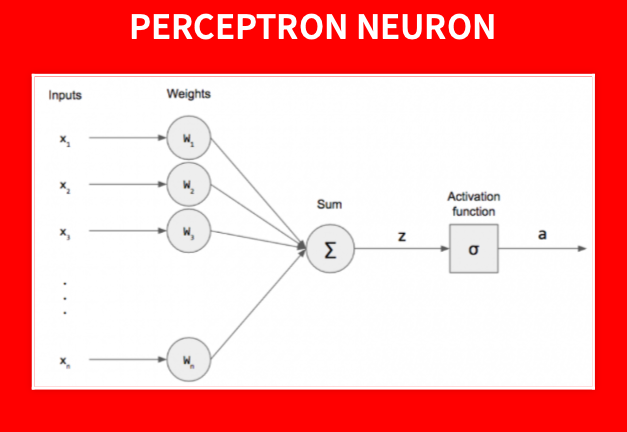
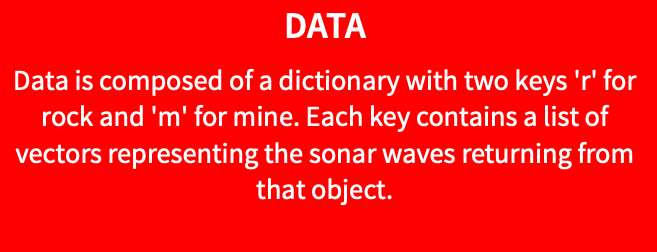
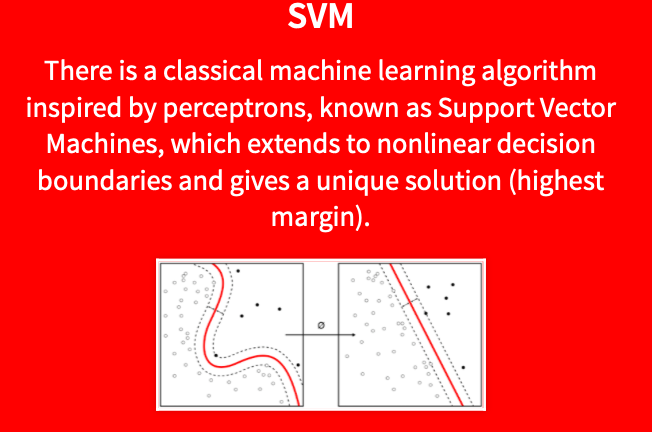


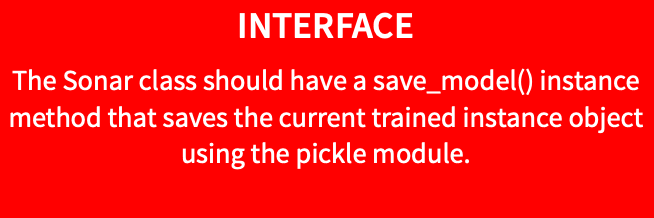
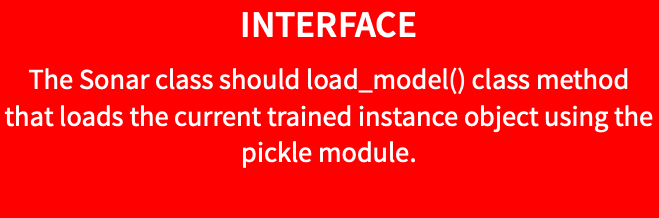
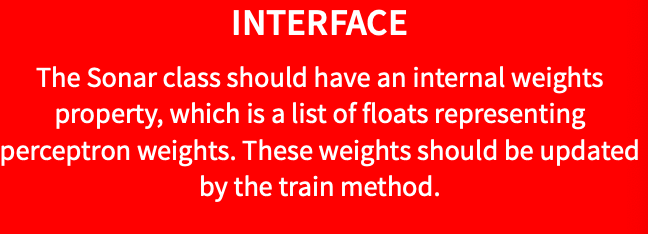
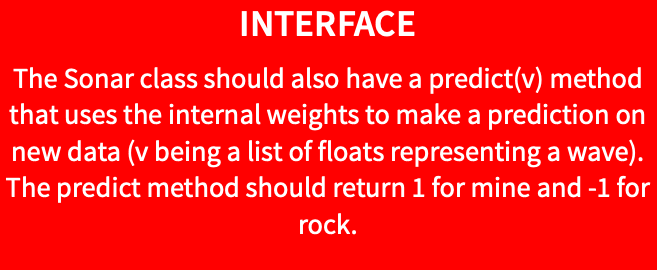
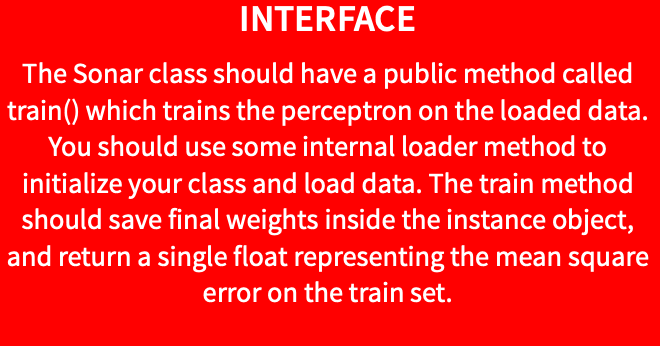
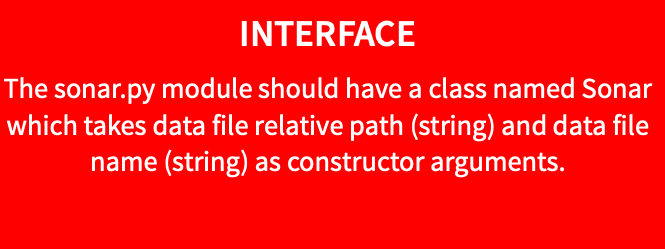
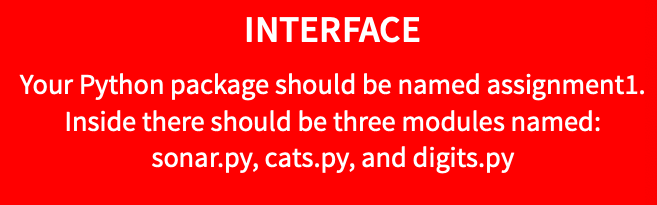
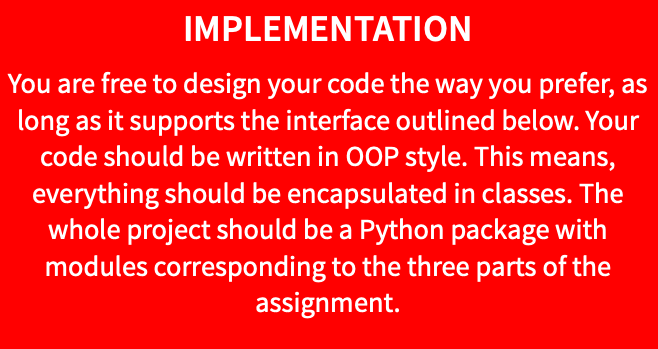
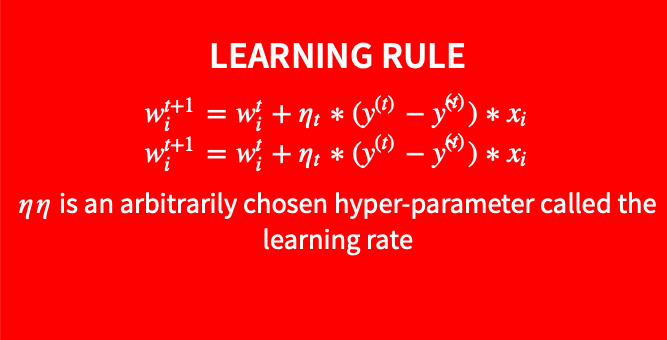
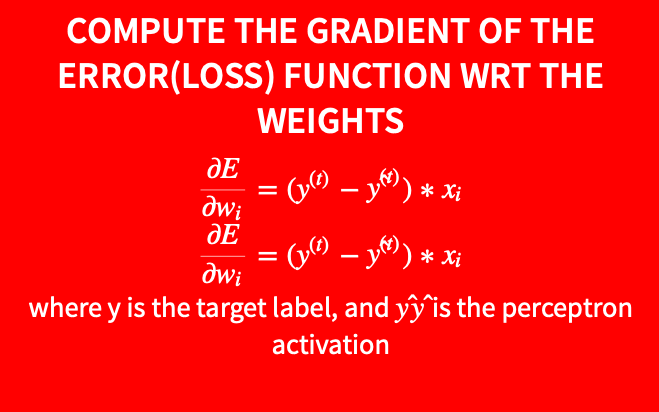
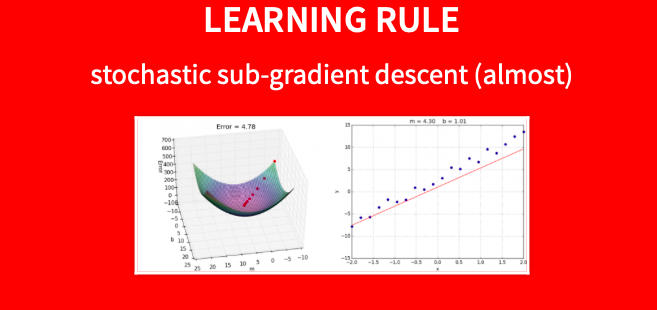




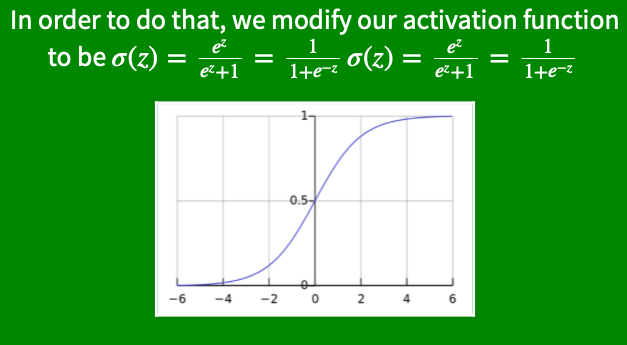
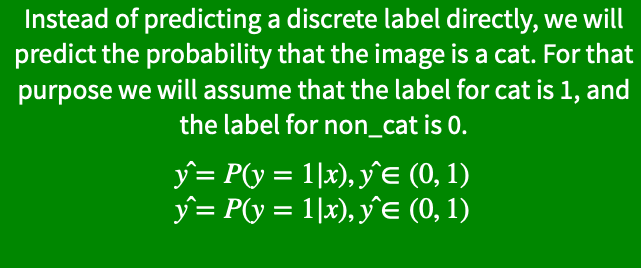
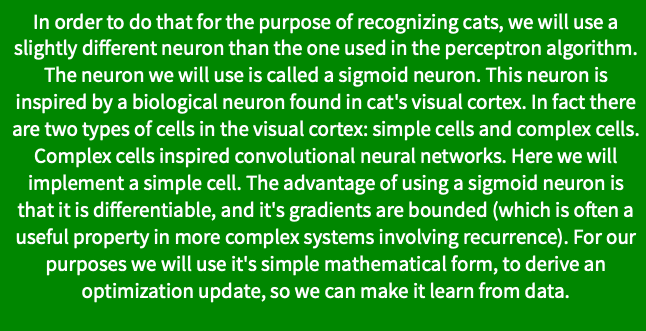
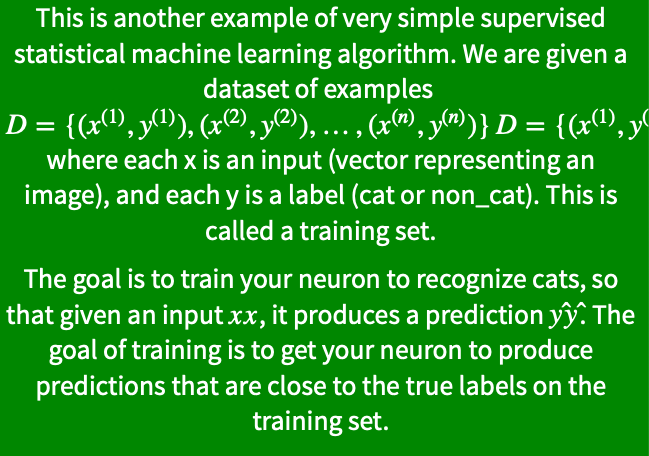
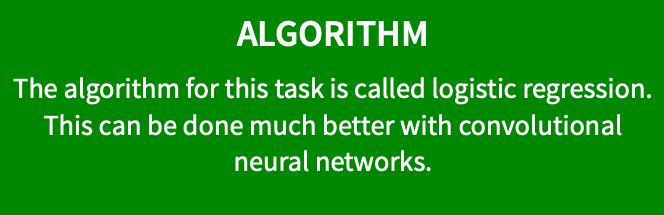
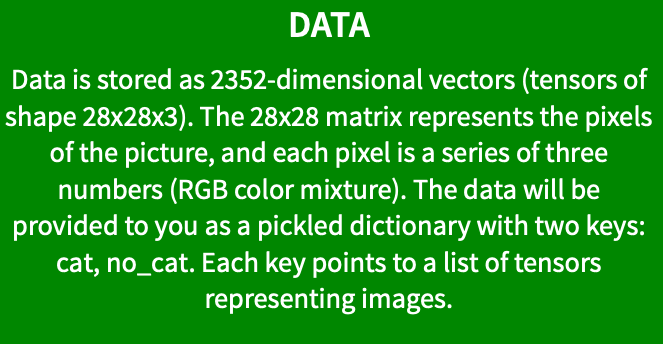
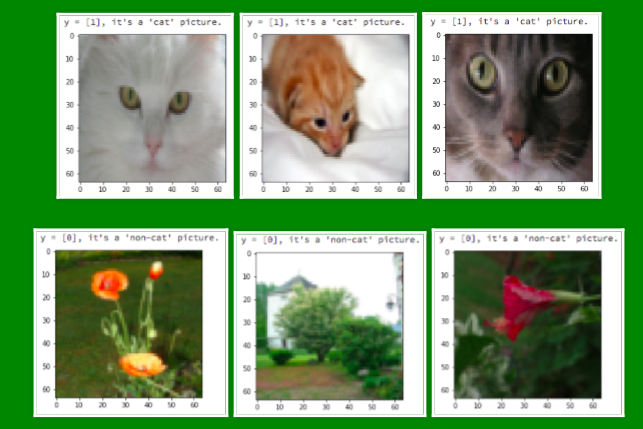
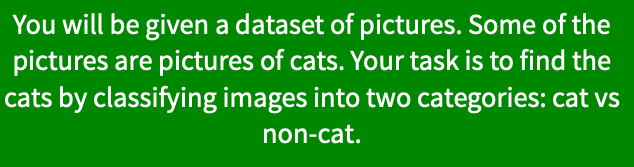
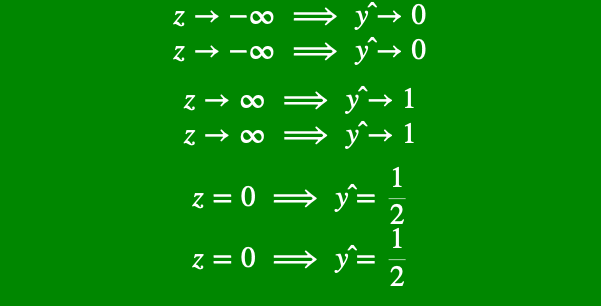
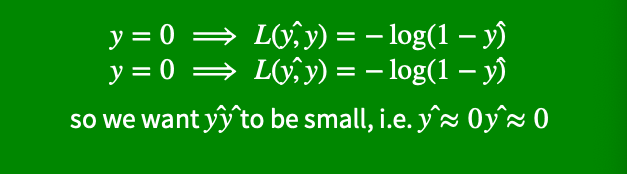
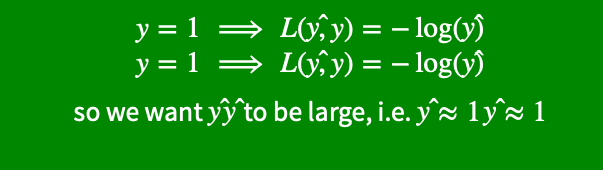
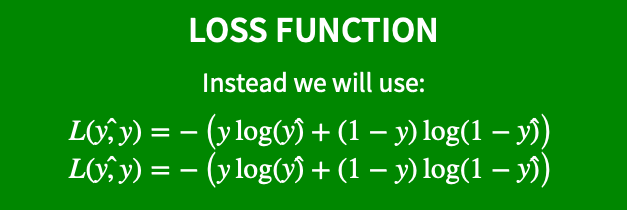
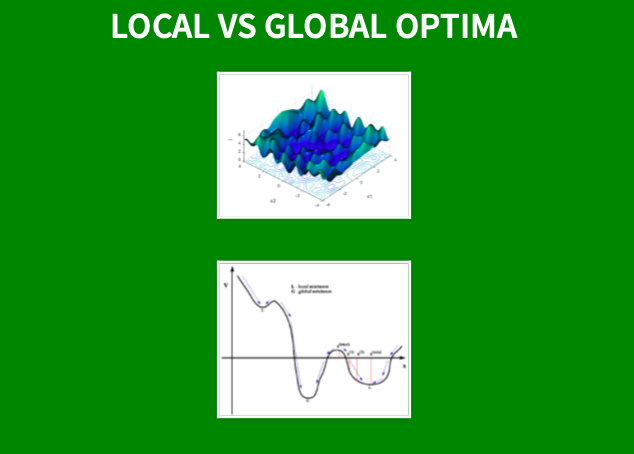
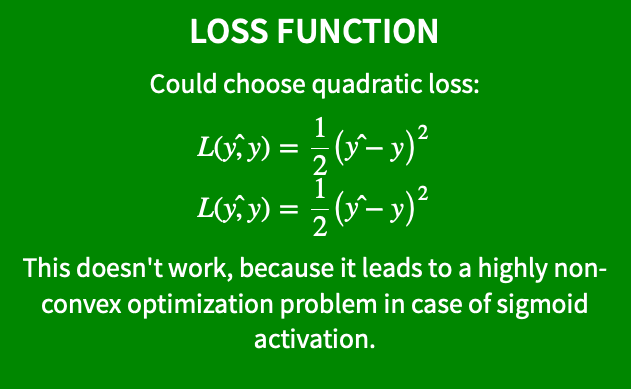
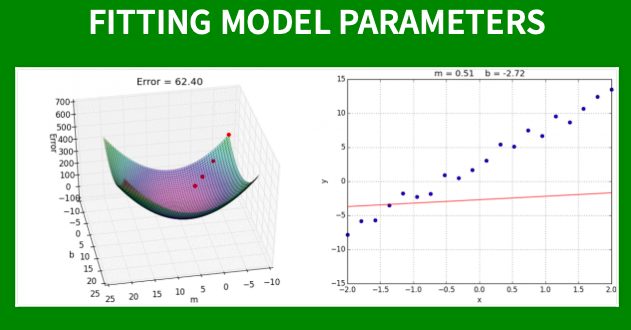
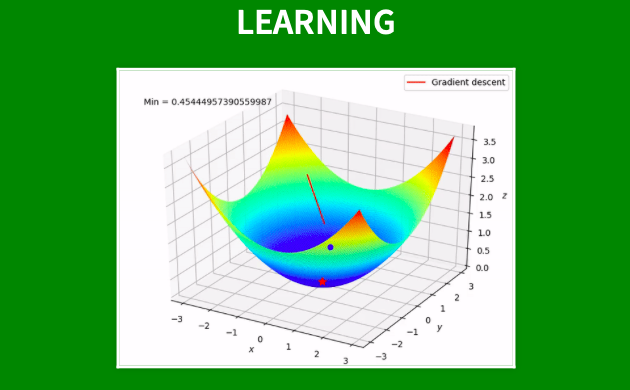
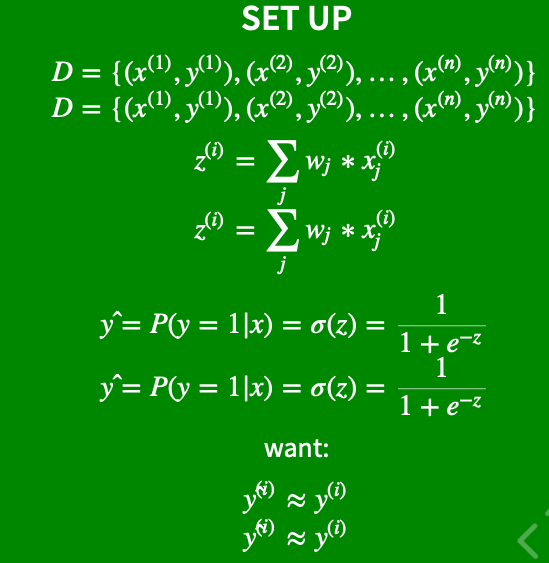
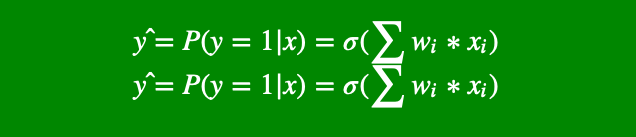
SONA

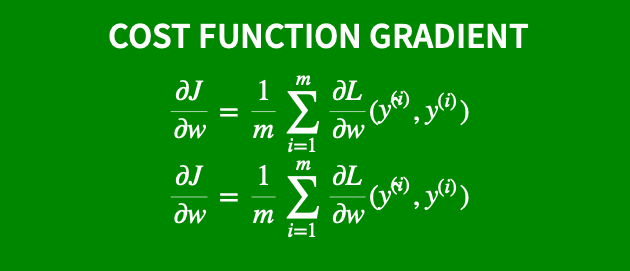
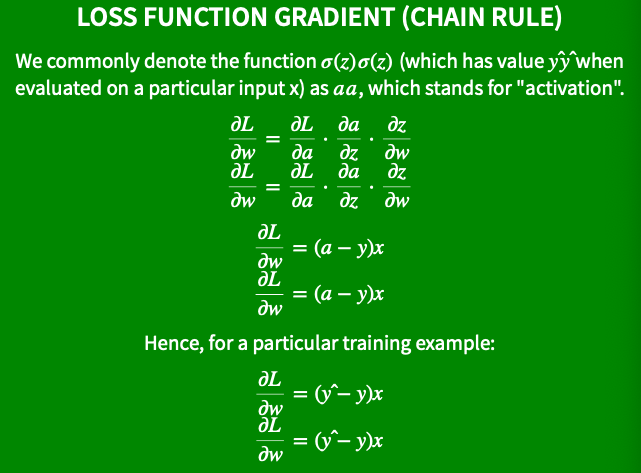
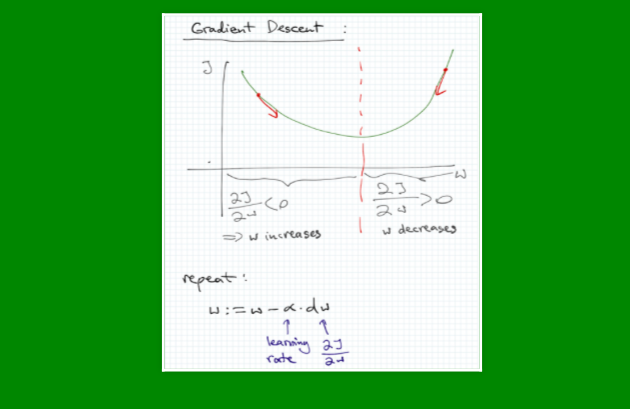
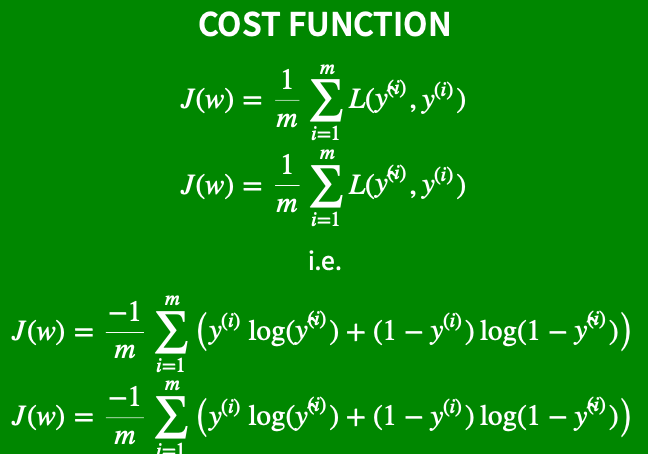


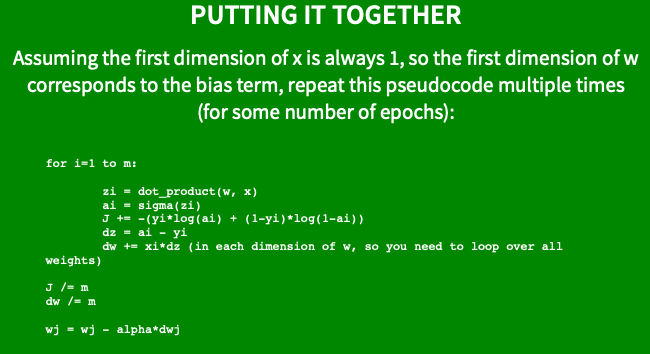
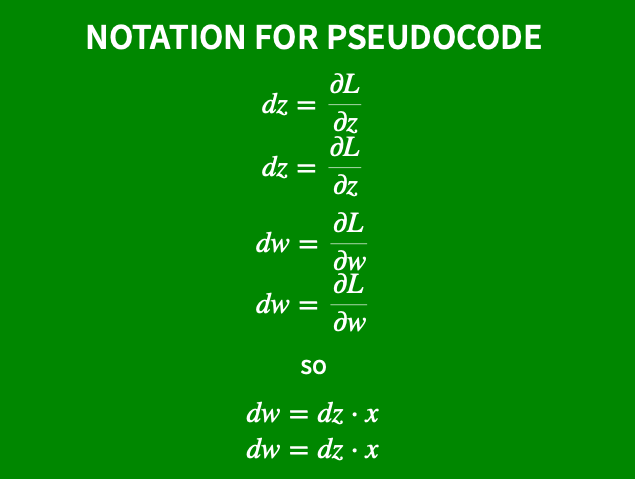




**\*CATS**

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**\*DIGITS**