Good morning. Everyone

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My final project is to implement a perceptron AI classifier which recognizes a given input image. Since perceptron has been covered in the lecture, I will not go too deep.

Such perceptron classifier can be seen mostly on optical character recognition (OCR), or on a tablet laptop. Or speech recognition.

My program primarily focus on character recognition. Which means my image only have two colors, black and white.

First a set of characters are to be imported to the program, and the program crop the character to be recognized. And save it as a datum object. As you can see here.

A datum object is just a dictionary. Its keys are locations of the pixel of original image. In this case, black color is assigned a value of 1 and white color is assigned a value of 0.

These values are called input vector. Input vector is x here with i number of data. This set of data is called a class. W is prototype weight of a class and each class has its own label. Input vector times its corresponding prototype weight and add them together, we get the score for that class. My perceptron model is little different. Instead of output a 1 when input score exceed the threshold, it picks the class with highest score and output its label.

However, if the label recognized is not the one given. Then we can train the perceptron to recognize it correctly.

For thewrong class which was picked by perceptron, we substrate all of its prototype weight by the input vector.

And for the class which was supposed to be picked, we add to all of its prototype weight by the input vector.

So here are two classes of prototype weights. The one to the left is the class which was supposed to be picked but not. The one to the right is the one which was not pi but should. They are initially 0, after training, the correct weight class is increment by one and the mis-reconized class is decrement by input vector.

So here is the demo, first I write down a digit six and save it to a bmp image, and load it to the program and converted it to a datum object. Now let the AI recognize it. I have a predefined label in the AI’s data base. However, the AI tells me that what I just enter is 1. Which means, the AI does not understand what I just enter. So I tell it what I just enter. It is 6. The program then save it as its legal label. After the program knows what I just enter, I can now train the AI. After training. And ask AI to recognize it again. It now tells me that, what I entered is 6. Below you can see the prototype weights of 1 and prototype weights of 6. With too much zeros it is very hard to see. So let’s take out the zeros . It will be easier to see the weight change.

Now you can see that prototype weight which correspond to non-zero input vector is one. The prototype weight for label 1 is decremented.

Now let’s input a one and see if the AI can distinguish between one and six. It can’t. since it hasn’t learned it yet.

Now give it a training. After training, you can see how the prototype weight is changed in class of both label. Some prototype weights in class of label 1 is incremented from zero to one

Now let’s give the AI a new handwritten 6 and see if it can recognize it.

If more time is allowed I would like to make the program identify a image with more colors other than black and white.