# Part A Report

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## Assignment 6: Perceptron Classification and Training

CSE 415 Introduction to Artificial Intelligence, Winter 2023, University of Washington

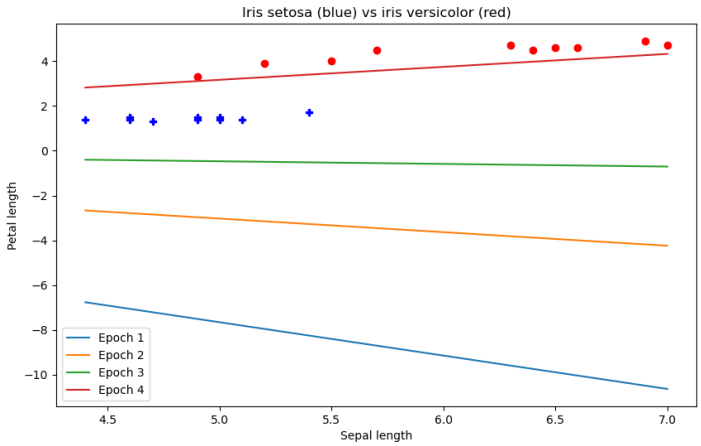
Please answer each question using text in Blue, so your answers stand out from the questions.

Note: If not otherwise specified, use the default parameters present in the starter code to answer the questions.

A1. How many epochs were required to train your perceptron on the 2-class Iris data having 2 features? What was the performance of your perceptron on the test data?

4 epochs were required. Lines move up to separate the points, and when there are 4 epochs, the line can separate the points correctly. 2 errors on the test data out of 80 items.

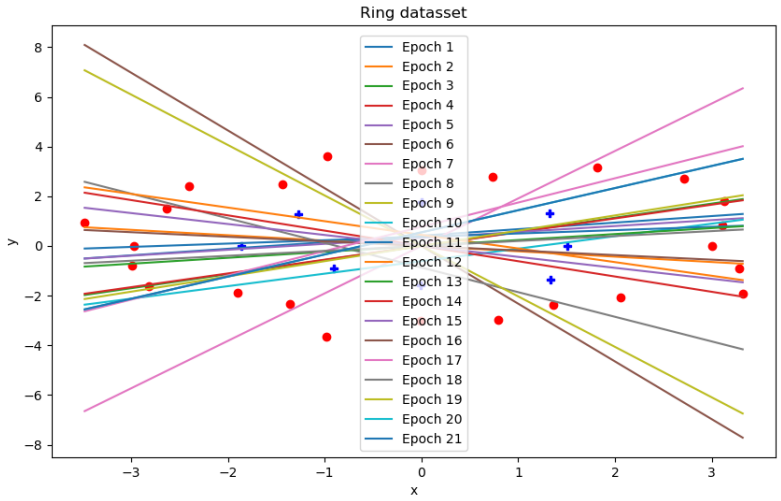
A2. Include a graphic produced using matplotlib that shows both the training data points (in separate colors) and the "separating" lines implied by the weights at the end of each training epoch." (Reduce the graphic as necessary to make it fit here without taking up more than half the page.)




A3. In the above plot, was there any thrashing (oscillation in the separator, such as flipping slope back and forth between positive and negative values, or having its y intercept jumping up and down as epochs proceed? How would you describe the progress of the learning, on the basis of the plot?

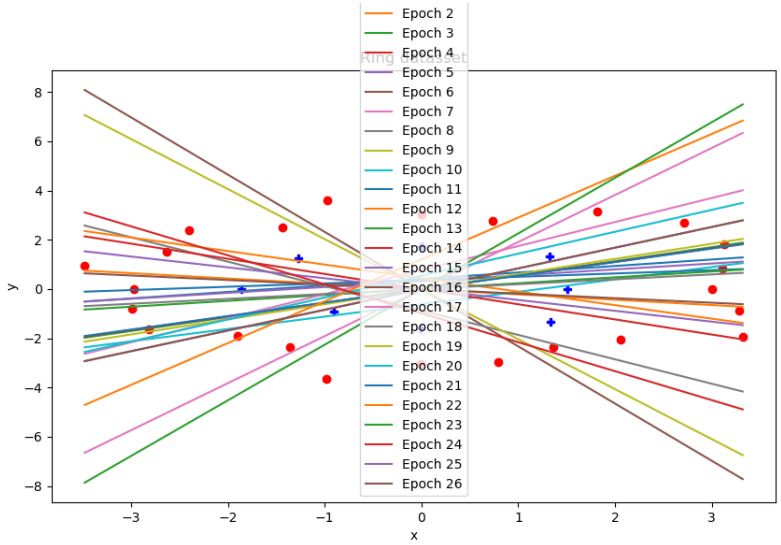
No thrashing occurs, and no y-intercept jumping up and down. The reason is that the points can be appropriately separated as epochs proceed.

A4. After plotting the ring data, describe its distribution in words.



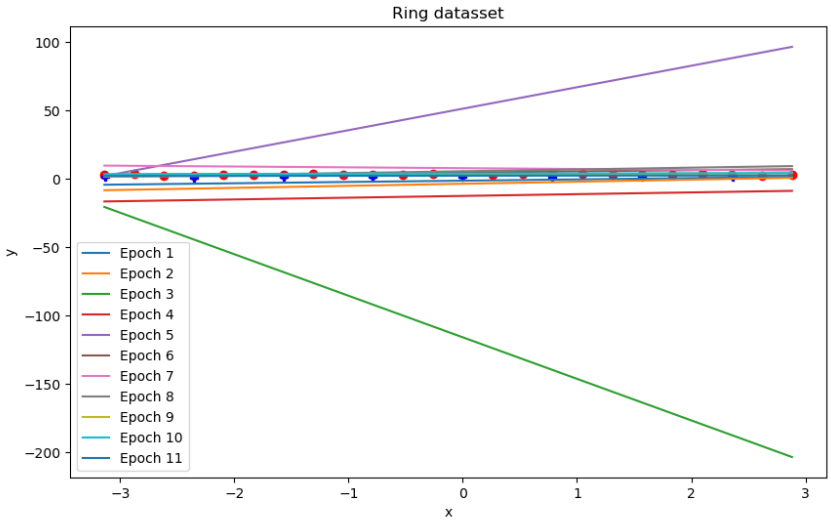

The points are scattered, so thrashing occurs, and the y-intercept jumps up and down in order to converge. But from the points distribution, we can see they can't be separated. Thus, training did not converge in 20 epochs.

A5. Describe the sequence of separators obtained when training your perceptron for 25 epochs using the ring data. Is there any thrashing? To what extent did it achieve convergence? And finally, do you think if the model is run for more epochs it will eventually fully converge?




Thrashing also occurs, and it still doesn't converge after 25 epochs. As mentioned above, the points are scattered. Thus no linear lines will separate them. It will not converge no matter how many epochs are used. Points need to be remapped.

A6. After you have re-mapped the ring data with the provided non-linear mapping function, plot the data and describe the distribution.




After remapping the data, we can see that the points can be separated with a linear line.

A7. After training your perceptron on the re-mapped ring data, did it achieve convergence, and if so, how many epochs were used?

It achieved convergence, and 11 epochs were used to make convergence.

A8. What do these results suggest about the power of perceptrons to classify data that may consist of clusters that cannot be separated by a linear manifold (such as a line or plane)?

We need some method to preprocess the data to make the points able to be separated by a linear line.