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Machine Learning with Python-From Linear Models to Deep Learning

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3. Perceptron Algorithm

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Project due Oct 7, 2020 05:29 IST *Completed*

Now you will implement the Perceptron algorithm

Perceptron Single Step Update

1.0/1 point (graded)

Now you will implement the single step update for the perceptron algorithm (implemented with $0 - 1$ loss). You will be given the feature vector as an array of numbers, the current θ and θ_0 parameters, and the correct label of the feature vector. The function should return a tuple in which the first element is the correctly updated value of θ and the second element is the correctly updated value of θ_0 .

Available Functions: You have access to the NumPy python library as `np`.

Tip:: Because of numerical instabilities, it is preferable to identify 0 with a small range $[-\epsilon, \epsilon]$. That is, when x is a float, " $x = 0$ " should be checked with $|x| < \epsilon$.

```
1 def perceptron_single_step_update(  
2     feature_vector,  
3     label,  
4     current_theta,  
5     current_theta_0):  
6     """  
7     Properly updates the classification parameter, theta and theta_0, on a  
8     single step of the perceptron algorithm.  
9  
10    Args:  
11        feature_vector - A numpy array describing a single data point.  
12        label - The correct classification of the feature vector.  
13        current_theta - The current theta being used by the perceptron  
14                      algorithm before this update.  
15        current_theta_0 - The current theta_0 being used by the perceptron  
16                        algorithm before this update.
```

Press ESC then TAB or click outside of the code editor to exit

Correct

Test results

CORRECT

[See full output](#)

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You have used 2 of 25 attempts

Full Perceptron Algorithm

1.0/1 point (graded)

In this step you will implement the full perceptron algorithm. You will be given the same feature matrix and labels array as you were given in **The Complete Hinge Loss**. You will also be given T , the maximum number of times that you should iterate through the feature matrix before terminating the algorithm. Initialize θ and θ_0 to zero. This function should return a tuple in which the first element is the final value of θ and the second element is the value of θ_0 .

Tip: Call the function `perceptron_single_step_update` directly without coding it again.

Hint: Make sure you initialize `theta` to a 1D array of shape `(n,)` and **not** a 2D array of shape `(1, n)`.

Note: Please call `get_order(feature_matrix.shape[0])` and use the ordering to iterate the feature matrix in each

Note: Please call `get_order(feature_matrix.shape[0])`, and use the ordering to iterate the feature matrix in each iteration. The ordering is specified due to grading purpose. In practice, people typically just randomly shuffle indices to do stochastic optimization.

Available Functions: You have access to the NumPy python library as `np` and `perceptron_single_step_update` which you have already implemented.

```
1 def perceptron(feature_matrix, labels, T):
2     """
3     Runs the full perceptron algorithm on a given set of data. Runs T
4     iterations through the data set, there is no need to worry about
5     stopping early.
6
7     NOTE: Please use the previously implemented functions when applicable.
8     Do not copy paste code from previous parts.
9
10    NOTE: Iterate the data matrix by the orders returned by get_order(feature_matrix.shape[0])
11
12    Args:
13        feature_matrix - A numpy matrix describing the given data. Each row
14                        represents a single data point.
15        labels - A numpy array where the kth element of the array is the
16                correct classification of the kth row of the feature matrix
```

Press ESC then TAB or click outside of the code editor to exit

Correct

Test results

CORRECT

[See full output](#)

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You have used 4 of 25 attempts

Average Perceptron Algorithm

1.0/1 point (graded)

The average perceptron will add a modification to the original perceptron algorithm: since the basic algorithm continues updating as the algorithm runs, nudging parameters in possibly conflicting directions, it is better to take an average of those parameters as the final answer. Every update of the algorithm is the same as before. The returned parameters θ , however, are an average of the θ s across the nT steps:

$$\theta_{final} = \frac{1}{nT}(\theta^{(1)} + \theta^{(2)} + \dots + \theta^{(nT)})$$

You will now implement the average perceptron algorithm. This function should be constructed similarly to the Full Perceptron Algorithm above, except that it should return the average values of θ and θ_0

Tip: Tracking a moving average through loops is difficult, but tracking a sum through loops is simple.

Note: Please call `get_order(feature_matrix.shape[0])`, and use the ordering to iterate the feature matrix in each iteration. The ordering is specified due to grading purpose. In practice, people typically just randomly shuffle indices to do stochastic optimization.

Available Functions: You have access to the NumPy python library as `np` and `perceptron_single_step_update` which you have already implemented.

```
1 def average_perceptron(feature_matrix, labels, T):
2     """
3     Runs the average perceptron algorithm on a given set of data. Runs T
4     iterations through the data set, there is no need to worry about
5     stopping early.
6
7     NOTE: Please use the previously implemented functions when applicable.
8     Do not copy paste code from previous parts.
9
10    NOTE: Iterate the data matrix by the orders returned by get_order(feature_matrix.shape[0])
```

```

11
12
13     Args:
14         feature_matrix - A numpy matrix describing the given data. Each row
15             represents a single data point.
16         labels - A numpy array where the kth element of the array is the

```

Press ESC then TAB or click outside of the code editor to exit

Correct

Test results

CORRECT

[See full output](#)

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You have used 2 of 25 attempts

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✓ [Full Perceptron Algorithm - Why should we "make sure initialize theta to a 1D array of shape \(n,\) and not a 2D array of shape \(1, n\)"?](#)

3

I've used two pieces of code, one using a 1D array and the other using a 2D array, but the grader accepted both ways. So why shoul...

? [when x is a float, "x=0" should be checked with |x| < ε?](#)

15

I'm struggling with the epsilon thing, if anyone can help :D If x is a float, it should be checked with epsilon? That means we're checki...

💬 [Average Perceptron issue with local test](#)

2

Hi is there any error in the local test case for the average perceptron. I am getting test failed in my local machine using the test.py, b...

? ["The truth value of an array with more than one element is ambiguous. Use a.any\(\) or a.all\(\)"](#)

4

any help please for this "The truth value of an array with more than one element is ambiguous. Use a.any() or a.all()"? for question t...

💬 [MemoryError: Unable to allocate 404. MiB for an array with shape \(4000, 13234\) and data type float64](#)

1

I'm getting this error when I run main.py.

💬 [Wrong Values for Average Perceptron Algorithm](#)

3

I got correct answers for all algorithms except for the last one. I'm not getting any errors, and the output of my result in a numpy arr...

? [Error "Test high dimension"](#)

2

Hello, I have a problem with the code "Full Perceptron Algorithm". I compile the code in my computer and its work well, but in grade...

? [What is the size of theta and feature vector in feature_matrix?](#)

3

How can I find it? It seems that I can't multiply theta and the feature vector, because of the wrong size, but I don't know what size th...

? [Need help for question 2 - get error](#)

10

Hello, I keep getting the same error and would like to get some hints; for this one i start by initializing theta and theta_0 as 0 outside ...

? [Trouble with average case of high times and dimensions](#)

2

I have troubles with average case. I got 1 and 2. My error is high dimension and high number of times. My initialization is zero. I am ...

✓ [Very lost on Full Perceptron](#)

3

I keep trying to get the hang of this and it seems like my theta0 works, I do not seem to get theta adjusted properly.... Here is what I...

? [Grader Problem](#)

1

The grader is not correctly counting the problem score. The score-breakup and the question is marked as correct but the progress b...

? [Does the grader use my previous code or correct code pre-programmed in grader?](#)

4

If I get errors in one function but then the following functions make function call to that function, does the grader use built-in tested ...

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