1. Perceptron Mistakes

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Homework due Feb 22, 2023 08:59 -03 Past due

In this problem, we will investigate the perceptron algorithm with different iteration ord

Consider applying the perceptron algorithm **through the origin** based on a small trainin points:

$$x^{(1)} = [-1,-1],$$

$$x^{(2)} = [1,0],$$

$$x^{(3)} = [-1, 1.5],$$

Given that the algorithm starts with $\theta^{(0)} = 0$, the first point that the algorithm sees is a mistake. The algorithm starts with some data point and then cycles through the data (i further mistakes.

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1. (a)

1/4 points (graded)

How many mistakes does the algorithm make until convergence if the algorithm starts How many mistakes does the algorithm make if it starts with data point $x^{(2)}$?

Also provide the progression of the separating plane as the algorithm cycles in the follo $[[\theta_1^{(1)}, \theta_2^{(1)}], \ldots, [\theta_1^{(N)}, \theta_2^{(N)}]]$, where the superscript denotes different θ as the separ For example, if θ progress from $[0, 0]$ (initialization) to $[1, 2]$ to $[3, -2]$, you should ente

Please enter the **number of mistakes** of Perceptron algorithm if the algorithm starts wi

1 ✖

Please enter the **progression of the separating hyperplane (θ, in the list format descr** Perceptron algorithm if the algorithm starts with $x^{(1)}$.

()

✖

Please enter the **number of mistakes** of Perceptron algorithm if the algorithm starts wi

Note: Only choose factors that were changed in part (a), **not** all factors that can affect

(Choose all that apply.)

- [x] Iteration order
- [ ] Maximum margin between positive and negative data points
- [x] Maximum norm of data points

✖

Submit You have used 3 of 3 attempts

1. (c)

4 points possible (graded)

Now assume that . How many mistakes does the algorithm make until starts with data point ?

Also provide the progression of the separating plane as the algorithm cycles in the follo , where the superscript denotes different as the separa For example, if progress from (initialization) to to , you should ente

Please enter the **number of mistakes** of Perceptron algorithm if the algorithm starts wi

Please enter the **progression of the separating hyperplane (, in a list format describ** algorithm if the algorithm starts with .

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Please enter the **progression of the separating hyperplane (, in the list format descr** Perceptron algorithm if the algorithm starts with .

number of mistakes

(Choose all that apply.)

- [ ] Iteration order
- [ ] Maximum margin between positive and negative data points
- [ ] Maximum norm of data points

Submit You have used 0 of 3 attempts

1. (e) (Optional)

0 points possible (ungraded)
In 1962, Novikoff has proven the following theorem.

Assume:

- There exists such that for all and some
- All the examples are bounded

Then the number of updates made by the perceptron algorithm is bounded by .

(Note that the first condition implies that the data is linearly separable)

For proof, refer to theorem 1 of this paper. Based on this theorem, what are the factors bound on the number of mistakes made by the algorithm?

(Choose all that apply.)

- [ ] Iteration order
- [ ] Maximum margin between positive and negative data points
- [ ] Maximum norm of data points
- [ ]

- [ ] Dynamic Programming the worst ordering
- [ ] Greedily select the data point with the maximum norm

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