5. The Perceptron Algorithm

Bookmark this page

Exercises due Sep 23, 2020 05:29 IST *Completed*

The Perceptron Algorithm

0:00 / 0:00 1.25x

Start of transcript. Skip to the end.

All right.

We defined earlier, training error

for any classifier as a fraction of training samples

that are misclassified--

so in terms of whether or not the classifier

applied to their training example,

whether it disagrees with a given label

Video
Download video file

Transcripts
Download SubRip (.srt) file
Download Text (.txt) file

Perceptron Concept Questions 1

0/1 point (graded)
Remember that the Perceptron Algorithm (without offset) is stated as the following:

Perceptron $\left(\left\{\left(x^{(i)}, y^{(i)}\right), i = 1, \ldots, n\right\}, T\right)$:
initialize $\theta = 0$(vector);
for $t = 1, \ldots, T$ do
for $i = 1, \ldots, n$ do
if $y^{(i)}\left(\theta \cdot x^{(i)}\right) \leq 0$ then
update $\theta = \theta + y^{(i)} x^{(i)}$

What does the Perceptron algorithm take as inputs among the following? Choose all those apply.

- [x] Training set
- [ ] T - the number of times the algorithm iterates through the whole training set
- [ ] Test set
- [x] θ
- [ ] θ_0

✖

Submit You have used 2 of 2 attempts

Perceptron Update 1

1/1 point (graded)

Now consider the Perceptron algorithm with Offset. Whenever there is a "mistake" (or equivalently, whenever $y^{(i)}\left(\theta \cdot x^{(i)}+\theta_0\right) \leq 0$ i.e. when the label y^i and $h\left(x\right)$ do not match), perceptron updates

$$\theta \text{ with } \theta + y^{(i)}x^{(i)}$$

and

$$\theta_0 \text{ with } \theta_0 + y^{(i)}.$$

More formally, the Perceptron Algorithm with Offset is defined as follows:

Perceptron $\left(\left\{\left(x^{(i)}, y^{(i)}\right), i=1, \ldots, n\right\}, T\right)$:

initialize $\theta = 0$(vector); $\theta_0 = 0$(scalar)
  for $t = 1, \ldots, T$ do
    for $i = 1, \ldots, n$ do
      if $y^{(i)}\left(\theta \cdot x^{(i)}+\theta_0\right) \leq 0$ then
      update $\theta = \theta + y^{(i)}x^{(i)}$
      update $\theta_0 = \theta_0 + y^{(i)}$

In the next set of problems, we will try to understand why such an update is a reasonable one.

When a mistake is spotted, do the updated values of θ and θ_0 provide a better prediction? In other words, is

$$y^{(i)}\left(\left(\theta + y^{(i)}x^{(i)}\right) \cdot x^{(i)} + \theta_0 + y^{(i)}\right)$$

always greater than or equal to

$$y^{(i)}\left(\theta \cdot x^{(i)} + \theta_0\right)$$

- ◯ Yes, because $\theta + y^{(i)}x^{(i)}$ is always larger than θ
- ◉ Yes, because $\left(y^{(i)}\right)^2\left\|x^{(i)}\right\|^2 + \left(y^{(i)}\right)^2 \geq 0$
- ◯ No, because $\left(y^{(i)}\right)^2\left\|x^{(i)}\right\|^2 - \left(y^{i}\right)^2 \leq 0$
- ◯ No, because $\theta + y^{(i)}x^{(i)}$ is always larger than θ

✔

Submit You have used 2 of 2 attempts

Perceptron Update 2

0 points possible (ungraded)

For a given example i, we defined the training error as 1 if $y^{(i)}\left(\theta \cdot x^{(i)}+\theta_0\right) \leq 0$, and 0 otherwise:

$$\varepsilon_i\left(\theta, \theta_0\right)=\left[\left[y^{(i)}\left(\theta \cdot x^{(i)}+\theta_0\right) \leq 0\right]\right]$$

Say we have a linear classifier given by θ, θ_0. After the perceptron update using example i, the training error $\varepsilon_i\left(\theta, \theta_0\right)$ for that example can (select all those apply):

- [ ] Increase
- [x] Stay the same
- [x] Decrease

✔

Submit You have used 1 of 2 attempts

Discussion

Hide Discussion

Topic: Unit 1 Linear Classifiers and Generalizations (2 weeks):Lecture 2. Linear Classifier and Perceptron / 5. The Perceptron Algorithm

Add a Post

Show all posts by recent activity

💬	I think the name PERCEPTRON is a very cool name!! It reminds me of the Decepticons from transformers ACTIVATE THE PERCEPTRON How cool!	4
💬	Visualization of the Perceptron Algorithm in action	5
💬	Good tutorial Here's a good article on the perceptron algorithm: https://towardsdatascience.com/perceptron-learning-algorithm-d5db0deab975	2
💬	Perceptron Update 1 Hi all, The correction here states: "Considering that our goal is to minimize the training error, the update always makes the training e...	3
?	Question on the example professor showed at the end Why the point on quadrant II is called "negative"? I understand vectors also have positive/negative vectors, like negative means the d...	2
?	Question on proof part In the professor's proof process, why it's not y_(i+1) * (y_(i)*x_(i)*x_(i+1)) where y_(i)*x_(i) is the updated theta with initial theta 0? inst...	1
💬	Decision boundary If the decision boundary is of the form theta.x+theta_0 = 0 and theta is the normal vector. Isn't the decision boundary a line and thet...	3
💬	Is it possible that the training errors was decreased after updated? I mean, Maybe it's because I haven't notice the lecture, but, after we update the theta, which could add one more points to the corre...	3
💬	Grading error - is grading important to pass? Hi, for Perceptron update 1, I originally had the right answer but it said I was wrong. I went for another answer for the second attem...	2
?	Quenstion for Perceptron Update 2: why the training error would stay the same after the update? As far as I know, after the update, $y(i)(\theta \cdot x(i)+\theta\_0)$ must be greater. why the error doesn't change? I don't get it. Please help me! thanks	7
?	Perceptron Concept Questions 1 in this question inputs of the algorithm to start must first initialize value of parmeters theta to start algorithm ?? i can't able to begin ...	1
?	Perceptron Concept Questions 1 Hello, logic behind the answer of Perceptron Concept Question 1 may kindly be elaborated .	2
💬	[Staff] Transcript corrections 0:35 "primitive vectors" -> "parameter vectors"	2