edX

3. Decision Boundaries

In this problem, we will investigate the decision boundary of different classifiers.

3. (a)

2/2 points (graded)

Consider the function defined over three binary variables:

$f(x_1, x_2, x_3) = (\neg x_1 \wedge \neg x_2 \wedge \neg x_3)$.

We aim to find a θ such that, for any $x = [x_1, x_2, x_3]$, where $x_i \in \{0, 1\}$:

$$\theta \cdot x + \theta_0 > 0 \text{ when } f(x_1, x_2, x_3) = 1, \text{ and}$$

$$\theta \cdot x + \theta_0 < 0 \text{ when } f(x_1, x_2, x_3) = 0.$$

If $\theta_0 = 0$ (no offset), would it be possible to learn such a θ?

Yes

No

✔

Would it be possible to learn the pair θ and θ_0?

Yes

No

✔

Solution:

- Since $\theta \cdot 0 = 0$, it is impossible to obtain $\theta \cdot x + \theta_0 > 0$ for $f(0,0,0) = 1$.

- $\theta_1 = \theta_2 = \theta_3 = -1$ and $\theta_0 = 0.5$ is a valid solution.

Submit   You have used 1 of 3 attempts

ⓘ   Answers are displayed within the problem

3. (b-1)

1/1 point (graded)
You are given the following labeled data points:

- Positive examples: $[-1, 1]$ and $[1, -1]$,

- Negative examples: $[1, 1]$ and $[2, 2]$.

For each of the following parameterized families of classifiers, identify which parameterized family has a family member that can correctly classify the above data

and find the corresponding parameters of a family member that can correctly classify the above data.

Note: If there is no family member inside the parameterized family that can correctly classify the above data, just enter 0 for all the parameters.

Inside (positive) or outside (negative) of an origin-centered circle with radius r. Enter a scalar for r. If there is no such r, just enter 0.

| 0 |

✔ **Answer:** 0

Solution:

- Any circle that correctly classifies $[-1, 1]$ and $[1, -1]$ would incorrectly classify $[1, 1]$

Submit   You have used 1 of 3 attempts

ⓘ   Answers are displayed within the problem

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3. (b-2)

2/2 points (graded)
Inside (positive) or outside (negative) of an $[x, y]$-centered circle with radius r.

$[x, y]$:   [-1,-1]

✔ **Answer:** See solution

r: 2.01

✔ **Answer:** See solution

Solution:

- A valid solution is $[x, y] = [-1, -1], r = 2.1$

Submit   You have used 2 of 3 attempts

ℹ   Answers are displayed within the problem

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3. (b-3)

1.0/1 point (graded)
Strictly above (positive) or below (negative) a line through the origin with normal θ. Here we define "above" as $\theta \cdot x > 0$, and define "below" similarly. **Note:** Please enter a list for θ as $[\theta_1, \theta_2]$. If there is no solution, enter $[0, 0]$

[0,0]   ✔ **Answer:** [0, 0]

Solution:

- There is no line through the origin that can simultaneously be strictly below $[1, -1]$ and $[-1, 1]$

Submit   You have used 1 of 3 attempts

ℹ   Answers are displayed within the problem

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3. (b-4)

2/2 points (graded)
Strictly above (positive) or below (negative) a line with normal θ and offset θ_0. Here we define "above" as $\theta \cdot x + \theta_0 > 0$, and define "below" similarly. **Note:** If there is no solution, enter $\theta = [0, 0]$ and $\theta_0 = 0$.

$[\theta_1, \theta_2]$: [-1,-1]   ✔ **Answer:** See solution

θ_0: | 1 | ✔ **Answer:** See solution

Solution:

- A valid solution is $[\theta_1, \theta_2, \theta_0] = [-1, -1, 0.5]$

| Submit | You have used 2 of 3 attempts

ℹ   Answers are displayed within the problem

3. (b-5)

1/1 point (graded)
Which of the below are families of linear classifiers?

(Choose all that apply.)

☐ Inside or outside of an origin-centered circle with radius r.

☐ Inside or outside of an $[x, y]$-centered circle with radius r.

☑ Strictly above or below a line through the origin with normal θ.

☑ Strictly above or below a line with normal θ and offset θ_0.

✔

Solution:

- The first two families are nonlinear (circles), and the last two families are linear classifiers (lines).

| Submit | You have used 1 of 2 attempts

ℹ Answers are displayed within the problem

Discussion

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Topic: Unit 1 Linear Classifiers and Generalizations (2 weeks):Homework 1 / 3. Decision Boundaries

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☑ **The meaning of 3-a) Boolean notation**

It's not clear, so I wanted to confirm. The described function is supposed to be (NOT X1) AND ...   4

📌 Pinned

? **[STAFF] 3.(b-2) incomplete grading?**

I got 1/2 of answers correct, but the grader marked it as incorrect?   6

? **[Staff]Answer to first part of 3b-4 question is correct.............**

Dear staff, My answer to the first part of the subject question is correct while it's still marked ...   3

💬 **Help 3b1**

I don't understand the question. - What exactly need to be done? - How is the input need to l...   11

? **[STAFF] 3b5**

So When u say linear what does it make a difference if the circle is origin or cenetered [x,y] O...   2

? **Staff : I added correct values in B-4 but showing as wrong**

I added correct values in B-4 why it is showing as wrong pls staff check and correct it   2

☑ **b-2 and b-4**   4

? **[STAFF] 3. (b-4)**

STAFF, I drew a line with offset that separate the postive points from negative points. Howeve...   4

💬 **[STAFF] 3b-5**

I am struggling to understand 3b- 5 . How do know if the statement is a linear classifier or not...   4

? **Where is radius discussed?**

I've reviewed and reviewed the videos and don't see any reference to 'radius' mentioned. Not...   10

💬 **Tip for b2**   1

After being embarrassed for not being able to solve this right away, here is a tip: 1. I draw a ci...

? **3b4**   5

I tried to plot the positive points and negative points on the graph. The negative points are ar...

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