2. Feature Vectors Transformation

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Homework due Mar 8, 2023 08:59 -03

Consider a sequence of n-dimensional data points, $x^{(1)}, x^{(2)}, \ldots$, and a sequence of m-dimensional feature vectors, $z^{(1)}, z^{(2)}, \ldots$, extracted from the x's by a linear transformation, $z^{(i)} = Ax^{(i)}$. If m is much smaller than n, you might expect that it would be easier to learn in the lower dimensional feature space than in the original data space.

2. (a)

1 point possible (graded)

Suppose $n = 6$, $m = 2$, z_1 is the average of the elements of x, and z_2 is the average of the first three elements of x minus the average of fourth through sixth elements of x. Determine A.

Note: Enter A in a list format: $[[A_{11}, \ldots, A_{16}], [A_{21}, \ldots, A_{26}]]$

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2. (b)

1.0/1 point (graded)

Using the same relationship between z and x as defined above, suppose $h(z) = sign(\theta_z \cdot z)$ is a **linear** classifier for the feature vectors, and $g(x) = sign(\theta_x \cdot x)$ is a linear classifier for the original data vectors. Given a θ_z that produces good classifications of the feature vectors, determine a θ_x that will identically classify the associated x's.

Note: Use `trans(...)` for transpose operations, `theta_z` as θ_z and assume A is a fixed matrix (enter this as `A`).

Note: Expects θ_x (an $[n \times 1]$ vector), not $\theta_x^\top$.

$\theta_x =$ trans(A) * theta_z ✔

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2. (c)

1/1 point (graded)

Given the same classifiers as in (b), if there is a θ_x that produces good classifications of the data vectors, will there **always** be a θ_z that will identically classify the associated z's?

Note: A is a fixed matrix.

- ○ Yes
- ◉ No ✔

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2. (d)

1/1 point (graded)

Given the same classifiers as in (b), if there is a that produces good classifications of the data vectors, will there **always** be a that will identically classify the associated 's?

Note: Now assume that you can change the matrix .

- (•) Yes
- ( ) No

✔

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2. (e)

1/2 points (graded)

If , can we find a more accurate classifier by training in -space, as measured on the training data?

- ( ) Yes
- ( ) No
- (•) Depends

✖

How about on unseen data?

- ( ) Yes
- ( ) No
- (•) Depends

✔

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	For 2b, I am assuming my answer needs to be a matrix. In that case should my answer be in terms of elements of A and Z li...		
?	2b transpose I tried to enter trans(A), but the grader does not show A^T. Also, should I input A*B for matrix product of A and B?	2 new	4
	Probably good to come back later.... My feeling is that there is a lot to unroll from these questions. These are really important topics for linear regression, but it t... Community TA		4
	Hint on 2c and 2b Hi, considering that it has taken me pretty long to figure out the solution without just guessing them, I would like to share w...		2
	2(c) fixed matrix If A is fixed and the same as what we got in previous parts, it is invertible and should work. isn't it? what does a fixed A me...		4
?	2(d) Just to be clear regarding 2(d): are we allowed to change the shape of the matrix (m in this case), or just the entries within ...		2
?	How do i type A transposed in question 1b? I'm trying to type trans(A) as it is said in the note but it doesn't work for me What am I doing wrong?		5
	request Can the TAs ask the problem setter to be less ambiguous about the questions? It is really frustrating to spend time on the h...		10
?	Hint for 2(b)? No idea how to start. We have sign(theta_z*z) separating linearly in 2D z-space, meaning that all the transformed data poin...		3
	Part (e) is too ambiguous I feel like you can justify any answer depending on your interpretation of the questions. Does it mean "we can **always** fi...		6
	No view answer for those problems? I have several mistakes and I would like to see the answers and the explanations, so I can learn from my mistakes.		2
☑	Relating 2(c) and 2(d)		6

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