

Unit 1 Linear Classifiers and

Course > Generalizations (2 weeks)

> Homework 1 > 4. Feature Vectors

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### 4. Feature Vectors

**Ungrading Note:** The problems on this page should be placed after lecture 5. Hence, **all problems on this page are ungraded, and will reappear in Homework 3.** Feel free to work on these for fun now, especially parts (a) to (d).

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.

### 4. (a)

0 points possible (ungraded)

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:  $[[A_{11},\ldots,A_{16}]\,,[A_{21},\ldots,A_{26}]]$ 

[[1/6, 1/6, 1/6, 1/6, 1/6, 1/6],

Submit

You have used 1 of 5 attempts

### 4. (b)

0 points possible (ungraded)

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

Note: Use  ${\sf trans}(\ldots)$  for transpose operations, and assume A is a fixed matrix (enter this as A).

**Note:** Expects  $heta_x$  (an [n imes 1] vector), not  $heta_x^ op$  .

$$heta_x = \left| ext{ trans(theta_z)*A)} 
ight|$$

Submit

You have used 1 of 5 attempts

# 4. (c)

0 points possible (ungraded)

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

**Note:** A is a fixed matrix.

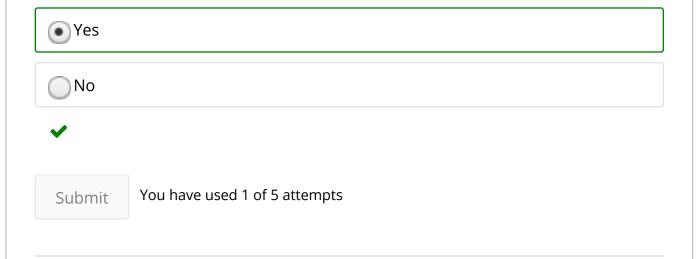


## 4. (d)

0 points possible (ungraded)

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

**Note:** Now assume that you can change the  $m \times n$  matrix A.



# 4. (e-1)

0 points possible (ungraded)

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

| ● No  |                             |
|---|-----------------------------|
| Depends   |                             |
| <b>✓</b>  |                             |
| Submit You have used 2 of 5 attempts  |                             |
| . (e-2)   |                             |
| points possible (ungraded)<br>ow about on unseen data?  |                             |
| Yes   |                             |
|   |                             |
| No  |                             |
| <ul><li>No</li><li>Depends</li></ul>  |                             |
| _   |                             |
| _   |                             |
| ● Depends  ✓  Submit You have used 1 of 5 attempts  |                             |
| ● Depends  ✓  Submit You have used 1 of 5 attempts  Fiscussion  pic: Unit 1 Linear Classifiers and Generalizations (2 | Hide Discussion             |
| ● Depends  ✓  | Hide Discussion  Add a Post |

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| ☑ Ungrading So if I understood correctly, these problems won't be graded as we need Lecture 5 to solve th   | 3 |
|---|---|
| [Staff] Ambiguous, Unclear Questions in H/W and Excercises Hi @Staff, I find that the questions asked in this and other homework sets tend to be simple   | 2 |
| ? 4.b  I can't understand this question, how to express theta_x ? i try trans(theta_z)*A, [[1],[n]], but t  | 1 |
| ? Dont understand question 4a Can you clarify this request. Thanks  | 1 |
| 4. (d) same as 4. (c) but different answer Both questions are identical. I think theta_x and theta_z should be swapped in (d).  | 2 |
| ? Missing definitions for e-1 and e-2? I understand these questions will reappear after lecture 5.<br><a href="https://www.br/&gt;br&gt;Meanwile how should we defi">br&gt;Meanwile how should we defi</a> ▲ Community TA | 5 |
| ? [Staff] Any articles or website for recommendation?  Hi can I ask are there any good reference articles for feature vectors as I am not very clear re   | 4 |
| ? What is the difference between a "data point" a "feature vector"  I would think that a data point and a feature vector are the same thingbut from the questio   | 2 |
| ■ [STAFF] Minor inaccuracy  | 1 |
| ? Question 4.(b): how to enter theta(subscipt z) in the answer?  hi Can you please let me know how to enter theta(subscipt z) in the answer? Thanks Amit  | 3 |

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