

Machine Learning Exercises 1 - Alternative Set

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Abstract

Two very different exercises. The first is to expose you to some mathematics. The second is more of a conceptual nature, and touches upon the fundamental problem in machine learning of how to represent your data in a machine learning task.

1 Vectors and Matrices

Exercise 1. *Compute the following:*

$$\text{a.) } \begin{pmatrix} 1 \\ 2 \\ 5 \end{pmatrix} + \begin{pmatrix} 9 \\ 0 \\ -2 \end{pmatrix}$$

$$\text{b.) } \begin{pmatrix} 5 \\ 6 \\ 9 \end{pmatrix} - 3 \begin{pmatrix} -1 \\ 2 \\ 2 \end{pmatrix}$$

$$\text{c.) } \begin{pmatrix} 8 & 3 & 4 & 5 \\ 9 & -4 & 6 & 6 \\ 5 & 1 & -1 & 3 \end{pmatrix} - \begin{pmatrix} -2 & 7 & 8 & 3 \\ 9 & -7 & -8 & 7 \\ 7 & 6 & 6 & 0 \end{pmatrix}$$

$$\text{d.) } \begin{pmatrix} -1 & 8 \\ 0 & 9 \end{pmatrix} + 2 \begin{pmatrix} 2 & -5 \\ 6 & 9 \end{pmatrix}$$

$$\text{e.) } \begin{pmatrix} 2 & 5 & 9 & -3 & -5 \\ 5 & 7 & 5 & 0 & 5 \end{pmatrix}^\top$$

$$\text{f.) } \left\langle \begin{pmatrix} 8 \\ 7 \\ 3 \\ 8 \end{pmatrix}, \begin{pmatrix} 3 \\ 7 \\ 1 \\ -16 \end{pmatrix} \right\rangle$$

$$\text{g.) } \begin{pmatrix} 3 & 4 \\ 9 & 4 \\ 2 & -5 \end{pmatrix} \begin{pmatrix} 5 & 3 & 9 \\ 5 & 1 & 1 \end{pmatrix}$$

$$\text{h.) } \left(\begin{pmatrix} 3 & 7 \\ 3 & -3 \\ -7 & 4 \end{pmatrix}^\top + \begin{pmatrix} 7 & 4 & 7 \\ 1 & 5 & -2 \end{pmatrix} \right) \begin{pmatrix} 2 \\ -1 \\ 7 \end{pmatrix}$$

2 Supervised Learning Problems

Exercise 2. *Give an example (not from class or from the book) of each of the following learning problems:*

- *prediction,*
- *classification,*
- *regression.*

How would you represent the labels and feature vectors (if applicable) mathematically? For either the classification or regression case (your choice), give at least two possible representations of your feature vectors.

Your examples do not need to be very realistic, but they do need to be about objects in the real world. For example, the answer “let \mathbb{R}^6 be the set of possible feature vectors” is not sufficient. You need to say what the feature vectors represent.

3 Comment on Sources

In general webresources do not meet scientific standards. Nevertheless, I've consulted the ones below during the preparation of these exercises.

References

- [1] J. Kolter. Linear algebra review and reference. Available online: <http://www.stanford.edu/class/cs229/section/cs229-linalg.pdf>, October 2006.