Intro To ML – HW4

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**Theory Questions**

**Question 1:**

**Question 2:**

**Question 3:**

**Question 4:**

Consider the following optimization problem:

Where is a matrix of the variables, is a column vector of size , and is a column vector of size of coefficients.

Consider the SVD of , we get the constraint:

We want now to recover , so from the recitation: . By multiplying both members with from left, we get: . Denote this solution by .

Assume is singular. Denote by a vector in the null space of . Namely a vector such that . Suppose other solution to the optimization problem: , so fulfills . Thus, we get: .

Hence any solution of the form contains all possible solutions to .

From the recitation, we know that the projection matrix, can be calculated by . We would like to project to the null space of so we can get the minimum distance vector from . Then the null space projection would be: , and for we get: .

Then, from the definition of projection, the closest vector to in this null space is **.**

We know that the null space is linear, hence as well.

Now we can solve the optimization problem:

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**Programming Questions**

**The code source files stay under /specific/a/home/cc/students/cs/avicaciularu/ML/HW4/:**

**Q5- Q5.py**

**Q6- Q6.py**

**Question 5:**

**Question 6:**