DSE 210

Homework 4

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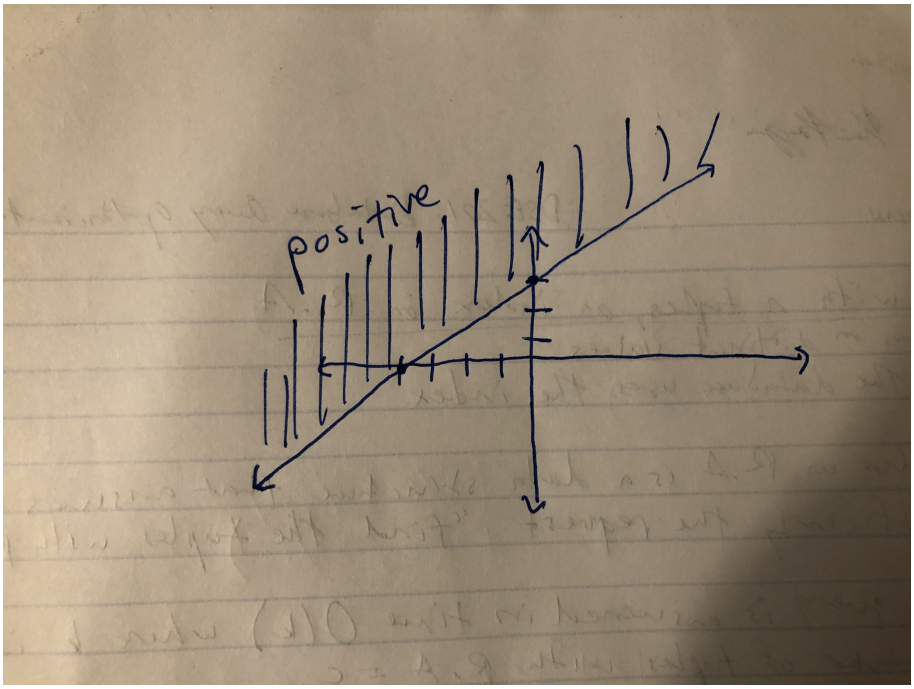
1 Generative models 3

1.1 Worksheet 8

1. $4y - 3x \geq 12$ in $\mathbb{R}^2$. Hence, $y \geq \frac{3}{4}x + 3$. Drawn below:



2. $2d$. There are d means and d variances for a diagonal Gaussian in $\mathbb{R}^d$ and no covariances.

3. Please refer to Jupyter notebook for Problem 3.

2 PCA and SVD

2.1 Worksheet 10

3. (a) $U = d \times 2$. $U^T = 2 \times d$. $UU^T = d \times d$. $u_1 u_1^T = d \times d$.

   (b) Not entirely sure how to phrase the answer for this question, yet I will do my best to explain. In the first case, we have mapped unit vectors onto x. In the second case, we have taken those projections and mapped them in the directions of our unit vectors, u_1, u_2. In the third case, we are effectively doing the same thing as we did in the first case, by transposing U and mapping onto x - may have formally

different dimensions but I believe they are more or less similar. The last case we are taking our $d \times d$ unit vector matrix and mapping that to x, which I believe is similar to the second case - may have formally different dimensions.

4. Please refer to Jupyter notebook for Problem 4.