

Homework 9

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Question 1

(a)

- $U : p \times 2$
- $U^T : 2 \times p$
- $UU^T : p \times p$
- $u_1 u_1^T : p \times p$

(b)

The first one and the third ones are projecting point x on to u_1 and u_2 direction in 2 dimensions.

For the second and the fourth ones, they are for reconstruction to p dimension.

Question 2

(a)

Mean is $2\sqrt{3}$ and The variance is $\frac{8}{3}$

(b)

$$\begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}, \frac{1}{\sqrt{2}} \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix}, \frac{1}{\sqrt{2}} \begin{pmatrix} 1 \\ -1 \\ 0 \end{pmatrix}$$

(c)

First one has 4

Second one has 2

Third one has 8

(d)

$$u_1 = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 \\ -1 \\ 0 \end{pmatrix} \text{ and } u_2 = \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}$$

(e)

$$(2\sqrt{2}, -2)$$

(f)

$$\begin{pmatrix} 2 \\ -2 \\ 2 \end{pmatrix}$$

Question 3

(a)

$$\begin{pmatrix} \frac{7}{5} & \frac{6}{5} \\ \frac{8}{5} & \frac{-2}{5} \end{pmatrix}$$

(b)

$$\begin{pmatrix} 4 & 0 \\ 0 & 1 \end{pmatrix}$$

So, 4 and 1.

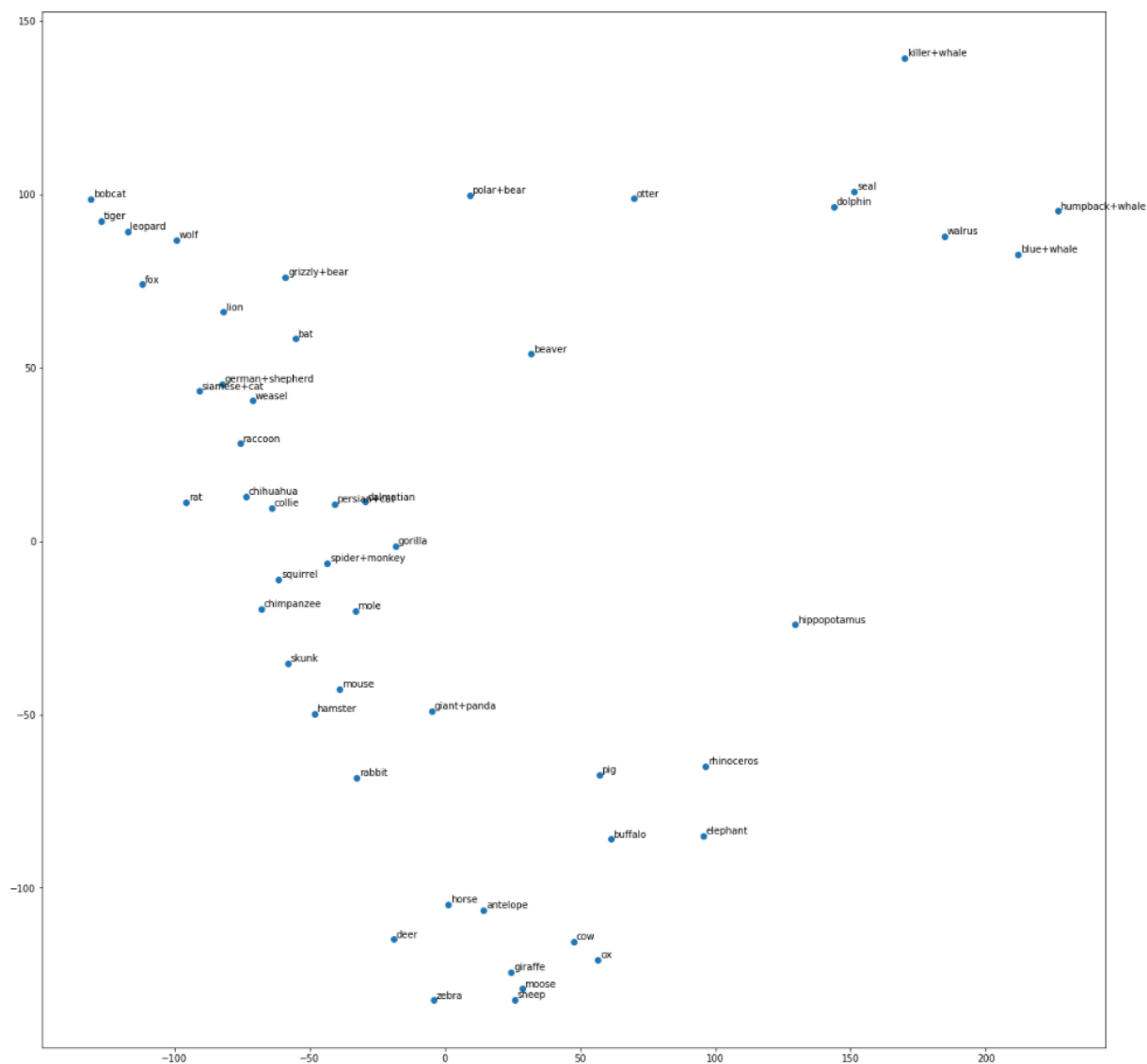
(c)

$$\begin{pmatrix} 4 & 0 \\ 0 & 1 \end{pmatrix}$$

So, 4 and 1.

Question 4

(b)



(c)

The embedding makes sense, because animals that are similar are grouped together. For example, seal, dolphin, walrus, whales and otter are clustered in right upperside. Cat, tiger, leopard, wolf, fox, lion are grouped upper left.

Horse, deer, zebra, cow, and sheep are clustered lower middle. They are all grouped with similar features.