Computer Vision Assignment 1

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Task 3

a)

The expected value is the mean of the values weighted by their respective probabilities.

$$\mathbb{E}[X] = \sum_{i=1}^{5} X_i p(X_i) \tag{1}$$

$$\mathbb{E}[X] = 0 \cdot 0.1 + 1 \cdot 0.3 + 0 \cdot 0 + 3 \cdot 0.2 + 4 \cdot 0.4 + 5 \cdot 0 \tag{2}$$

$$\mathbb{E}[X] = 2.5 \tag{3}$$

The expected value $\mathbb{E}[X]$ of this normalized histogram is 2.5.

In a cumulative histogram, each bin contains the values inside it plus the values of all previous bins. The cumulative histogram of a normalized histogram will always reach the maximum value of 1.0, as that is the sum of all probabilities.

Bins	0	1	2	3	4	5
Cumulative Value	0.1	0.4	0.4	0.6	1.0	1.0

b)

The L_1 distance is given by the sum of the differences of the histogram bins. The L_1 distance between $p(X)$ and $q(X)$ is 1.4.

$$L_1 = \sum_{i=1}^{5} |p(X_i) - q(X_i)| \tag{4}$$

$$L_1 = |0.1 - 0| + |0.3 - 0.1| + |0 - 0.3| + |0.2 - 0| + |0.4 - 0.2| + |0 - 0.4| \tag{5}$$

$$L_1 = 1.4 \tag{6}$$