* 1. **Histogram features**

The histogram features that we are considered are statically based features where the histogram is used as a model of the probability distribution of the gray levels. These statistical features provide us with information a bout the characteristic of the gray – level distribution for the image or sub image. We define the first – order histogram probability P(a) as :

p

n\*m is the number of pixels in the image or sub image, and H(I) is the number of pixels at gray level I as with any probability distribution, all values for P(I) are less than or equal to 1,

**Examples:**

SOL:

K=22=4 I=(0,1,2,3)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 3 | 2 | 1 | 0 | I |
| 0 | 2 | 3 | 1 | H(I) |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 3 | 2 | 1 | 0 | I |
| 0/6 | 2/6 | 6/3 | 1/6 | P(I) |

histogram probability are mean, standard deviation , energy and entropy.

1. **Mean**: the mean is the average value, so it tells us something about the general brightness of the image. A bright image will have a high mean, and a dark image will have a low mean. We can define the mean as follows:

We sum over the rows and columns corresponding to the pixels in the image or sub image under consideration.

1. **Standard deviation** : Which is also known as the square root of the variance, tell us something about the contrast. It describe the spread in the data , so a high contrast image will have a high variance, and a low-contrast image will have a low variance. It is defined as follows:

3.**Energy** : The energy measure tell us something about how the gray level are distributed

The energy measure has a maximum value of 1 for an image with a constant value and gets increasingly smaller as the pixel values are distributed across more gray level value (remember that al the P(I) values are less than or equal to 1). The larger this value is the easier it is to compress the image data. If the energy is high, it tells us that the number of gray levels in the image is few, that is, the distribution is concentrated in only a small number of different gray levels .

1. **Entropy** : The entropy measures the randomness of the distribution of the coefficients values over the intensity levels. If the value of entropy is high, then the distribution is among more intensity levels in the image. This measurement is the inverse of energy. A simple image has low entropy while a complex image has high entropy. Entropy can be defined given by:

**Examples:**

**Solution:**

**1-Mean =**

=

=

2- S.D=0.55

4- Entropy

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| P(I)2 | P(I).LogP(I) | P(I) | H(I) | I |
| 1/81 | 0.106- | 1/9 | 1 | 0 |
| 81/36 | -0.117  | 9/6 | 6 | 1 |
| 4/81 | -0.145  | /92 | 2 | 2 |
| 0 |  0  | /90 | 0 | 3 |

py=0.368

4-Energy : E=