Solution

a)

$$r(a,b) = \frac{L_x L_y}{(L_x - |a|)(L_y - |b|)} \frac{\sum_x \sum_y f(x,y)f(x-a, y-b)}{\sum_x \sum_y f^2(x,y)}$$

$$r(1,0) = (1 \cdot 2 + 1 \cdot 2 + 1 \cdot 3 + 1 \cdot 3)\frac{16}{12 \cdot 56} \approx 0.24$$

$$r(2,0) = (3 \cdot 2 + 3 \cdot 2 + 2 \cdot 3 + 2 \cdot 3)\frac{16}{8 \cdot 56} \approx 0.86$$

$$r(3,0) = (3 + 3 + 2 + 2)\frac{16}{4 \cdot 56} \approx 0.71$$

$$r(0,1) = (1 + 9 + 4 + 1 + 6 + 6 + 1 + 4 + 9)\frac{16}{12 \cdot 56} \approx 0.98$$

$$r(0,2) = (1 + 6 + 6 + 1 + 6 + 6)\frac{16}{8 \cdot 56} \approx 0.93$$

$$r(0,3) = (1 + 6 + 6)\frac{16}{4 \cdot 56} \approx 0.93$$

Solution

b)   The autocorrelation function dropps off more quickly in the horizontal direction: higher frequencies

Solution

c)   Horizontal   Vertical

	0	1	2	3
0	0	0	4	4
1	0	0	2	2
2	4	2	0	0
3	4	2	0	0

	0	1	2	3
0	6	0	0	0
1	0	6	0	0
2	0	0	4	2
3	0	0	2	4

Solution

d)   The GLCM computed for the horizontal direction has a lot of values outside the diagonal: high frequencies in the horizontal direction. Vice-versa for GLCM computed for the vertical direction

Solution

e)   Contrast:

Horizontal
direction:

$$\sum_i \sum_j (i-j)^2 p(i,j) \;\; = \;\; (2^2 \cdot 4 + 3^2 \cdot 4 + 1^2 \cdot 2 + 2^2 \cdot 2) \cdot 2$$

$$= \;\; (4 \cdot 4 + 9 \cdot 4 + 1 \cdot 2 + 4 \cdot 2) \cdot 2$$

$$= \;\; (16 + 36 + 2 + 8) \cdot 2$$

$$= \;\; 124$$

Vertical
direction:

$$\sum_i \sum_j (i-j)^2 p(i,j) = 1^2 \cdot 2 + 1^2 \cdot 2 = 4$$