Methods for Image Processing, a.y. 2015/16

Control questions

Stefano Ferrari (stefano.ferrari@unimi.it)

September 28, 2015

1 Vision

1. What law correlates the perceived brightness, B, with the intensity, I, of the visual stimulus?
   (a) power law: $I = k \cdot B^{\gamma}$
   (b) linear law: $I = k \cdot B$
   (c) negative law: $I = B_{\max} - k \cdot B$
   (d) logarithmic law: $I = k \log B$
   (e) quadratic law: $I = k_0 + k_1 B + k_2 B^2$
2. A visual stimulus can be discriminated from the background
   (a) if its intensity is larger than 3 lm with respect to the background intensity
   (b) if its duration is longer than 1 second
   (c) if its shape is irregular
   (d) if the difference between its intensity and the background intensity is higher than a threshold that depends on the background intensity
   (e) if its intensity is lower than 3 lm with respect to the background intensity

2 Acquisition and representation of images

3. A light source is called monochromatic (or achromatic) if
   (a) it is red
   (b) it is composed of a narrow sub-band of the spectrum
   (c) it is white
   (d) the lightened object is gray
   (e) it is used to obtain gray-level images
4. The light can be characterized for
   (a) its frequency
   (b) its radiance
   (c) its luminance
   (d) its brightness
   (e) all of the above

5. Sampling refers to

   (a) choose the most appealing colors in the image
   (b) obtain a measurement for each component of the sensor
   (c) improve the perception of the objects in the image
   (d) calibrate the sensor to improve the contrast
   (e) the behavior of a defective sensor

6. Quantization refers to

   (a) the removal of the noise in the measurement
   (b) the improvement of the contrast in the image
   (c) the reduction of the number of pixel of an image
   (d) assign a quantitative value to a qualitative estimate
   (e) map the measurements of a sensor in a discrete number of possible values

7. If each pixel is coded using k bits, the maximum number of gray shades is

   (a) $8k$
   (b) k^2
   (c) 2^k
   (d) 256
   (e) $2k$

8. The dynamic range of an image is

   (a) the ratio between the higher and the lower intensity level in the image
   (b) the ratio between the numbers that code the white and the black
   (c) the maximum difference in intensity between neighboring pixels in the image
   (d) the ratio between the number of rows and columns of the image
   (e) the number of bits per pixel

3 Topological structure of images

9. The neighborhood is

   (a) a relationship between pixels that is based on their value only
   (b) a relationship between pixels that is based on their position only
   (c) a measure of the closeness of the pixel color to the real color
   (d) the set of the values used to code the gray levels of the image
   (e) the distance of the pixel from the borders

10. The adjacency is a relationship between pixels that considers

    (a) only the color of the pixels
    (b) only the position of the pixels
    (c) only the distance of the pixel from the borders
    (d) only the similarity of the pixels
    (e) both the similarity and the position of the pixels

11. With reference to the following figure, the 4-neighborhood of the pixel p, N_4, is

p_1	p_2	p_3
p_4	p	p_5
p_6	p_7	p_8

(a) $N_4 = \{p_1, p_2, p_3, p_4\}$
(b) $N_4 = \{p_1, p_3, p_6, p_8\}$
(c) $N_4 = \{p_1, p_3, p_5, p_7\}$
(d) $N_4 = \{p_2, p_4, p_5, p_7\}$
(e) $N_4 = \{p_2, p_3, p_4, p_6\}$

12. With reference to the following figure, the diagonal-neighborhood of the pixel p, N_D, is

p_1	p_2	p_3
p_4	p	p_5
p_6	p_7	p_8

(a) $N_D = \{p_1, p_2, p_3, p_4\}$
(b) $N_D = \{p_1, p_3, p_6, p_8\}$
(c) $N_D = \{p_1, p_3, p_5, p_7\}$
(d) $N_D = \{p_2, p_4, p_5, p_7\}$
(e) $N_D = \{p_2, p_3, p_4, p_6\}$

13. With reference to the following figure, the 4-adjacent pixels to the pixel p are

p_1	p_2	p_3
p_4	p	p_5
p_6	p_7	p_8

(a) $\{p_2, p_3, p_5, p_6\}$
(b) $\{p_2, p_5\}$
(c) $\{p_2, p_3, p_5\}$
(d) $\{p_1, p_4, p_7, p_8\}$
(e) $\{p_2, p_4, p_5, p_7\}$

14. With reference to the following figure, the 8-adjacent pixels to the pixel p are

p_1	p_2	p_3
p_4	p	p_5
p_6	p_7	p_8

(a) $\{p_2, p_3, p_5, p_6\}$
(b) $\{p_2, p_5\}$
(c) $\{p_3, p_6\}$
(d) $\{p_1, p_4, p_7, p_8\}$
(e) $\{p_1, p_3, p_6, p_8\}$

15. A path in an image is

(a) a sequence of adjacent pixels
(b) a sequence of pixel having decreasing intensity
(c) a subset of the border pixels
(d) any vertical slice of the image

(e) a set of pixel having a predefined shape

16. A connected component is

(a) any set of pixel with at least one element on the border
(b) a set of pixel that are neighbors of the same pixel
(c) a set of pixels that are connected through a path to the same pixel
(d) any set of pixel with at least a white pixel
(e) any set of pixel with the same intensity level

17. With reference to the following figure, which of the following are 8-paths?

p_1	p_2	p_3	p_4
p_5	p_6	p_7	p_8
p_9	p_{10}	p_{11}	p_{12}

(a) $\{p_2, p_3, p_7, p_{11}\}$
(b) $\{p_1, p_6, p_7, p_{12}\}$
(c) $\{p_2, p_3, p_8, p_{11}\}$
(d) $\{p_2, p_3, p_4, p_8\}$
(e) $\{p_7, p_6, p_1, p_5\}$

18. With reference to the following figure, which of the following are 4-paths?

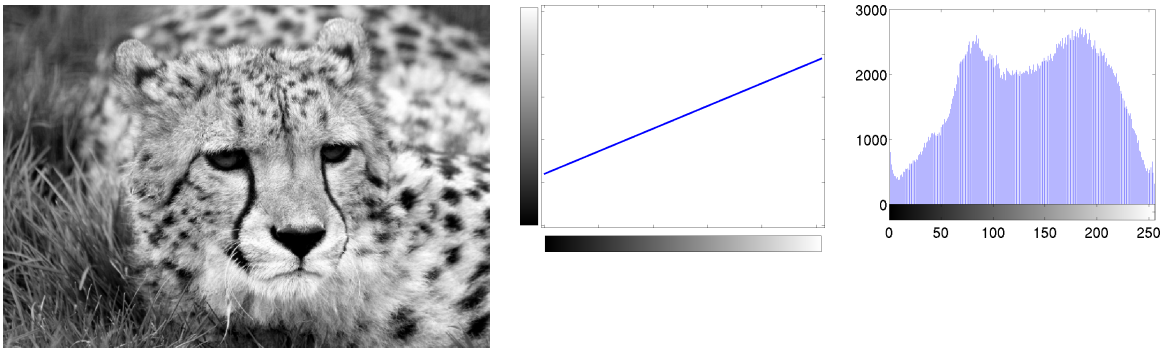
p_1	p_2	p_3	p_4
p_5	p_6	p_7	p_8
p_9	p_{10}	p_{11}	p_{12}

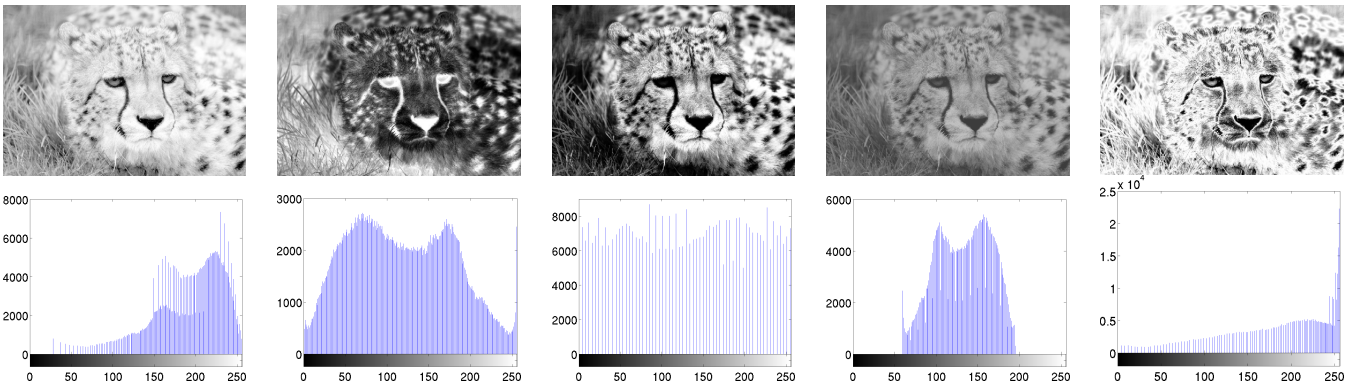
(a) $\{p_2, p_3, p_7, p_{11}\}$
(b) $\{p_1, p_6, p_7, p_{12}\}$
(c) $\{p_2, p_3, p_8, p_{11}\}$
(d) $\{p_2, p_3, p_4, p_8\}$
(e) $\{p_7, p_6, p_1, p_5\}$

4 Intensity transformations

19. Which of the following pictures corresponds to $T(I)$ for the given image I and transformation T?

I T hist(I)

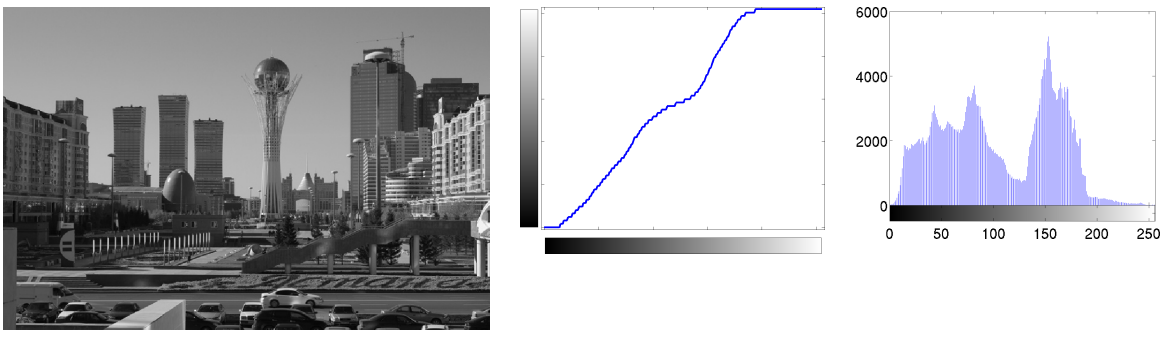


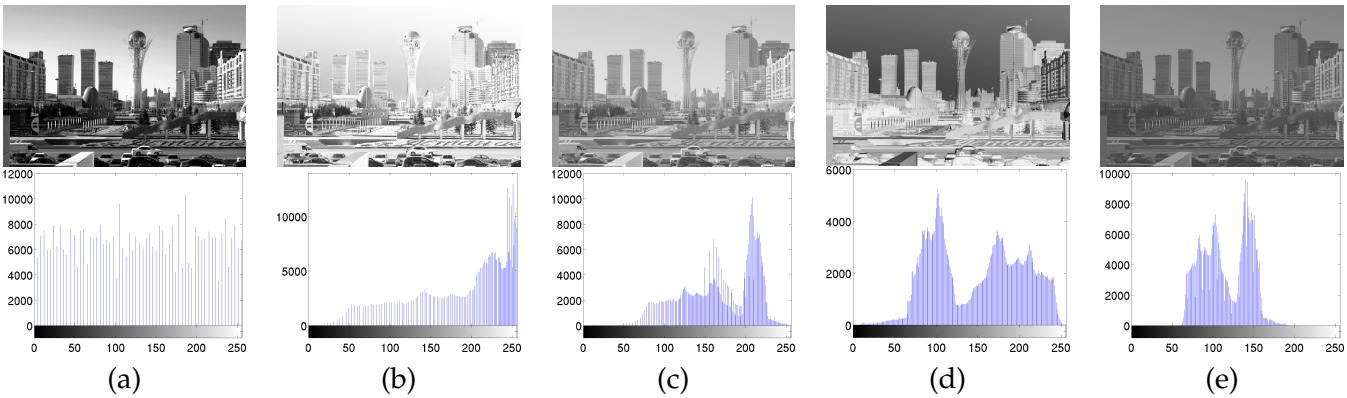


(a) (b) (c) (d) (e)

20. Which of the following pictures corresponds to $T(I)$ for the given image I and transformation T?

I T hist(I)

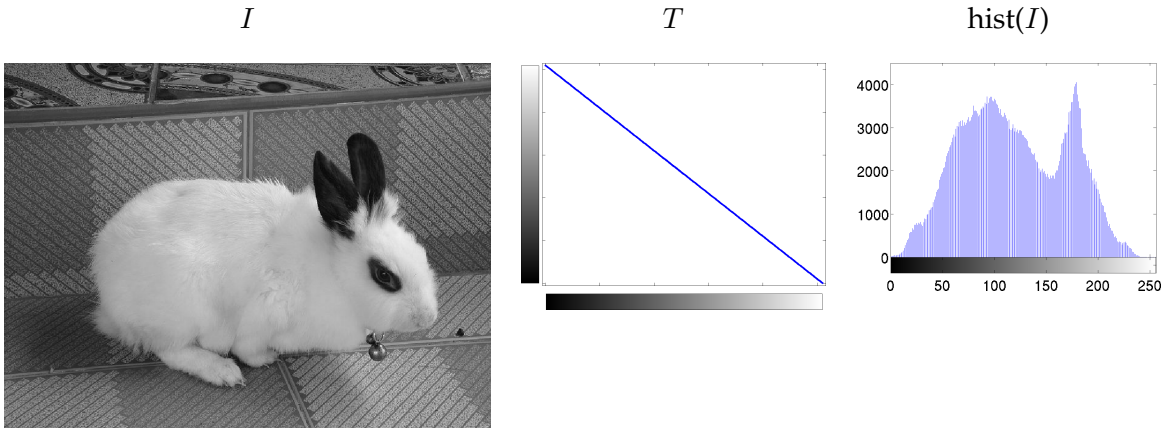


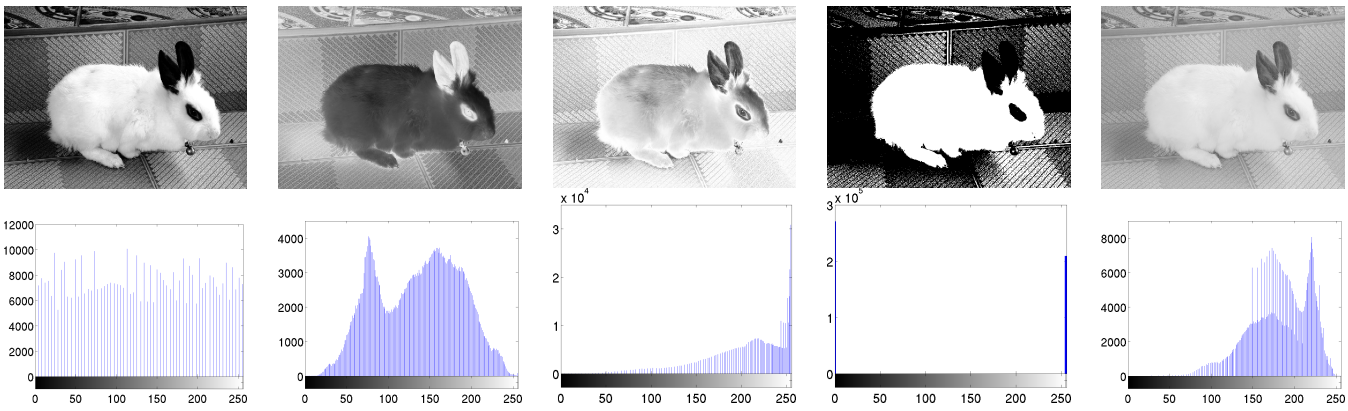


(a) (b) (c) (d) (e)

21. Which of the following pictures corresponds to $T(I)$ for the given image I and transformation

T?

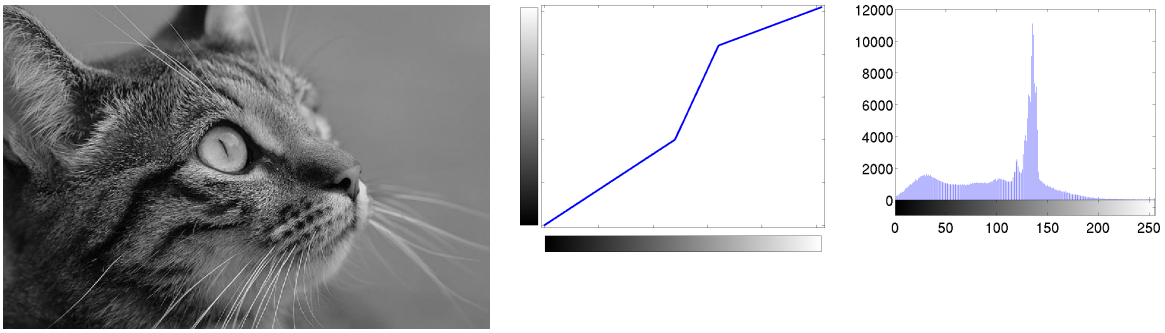


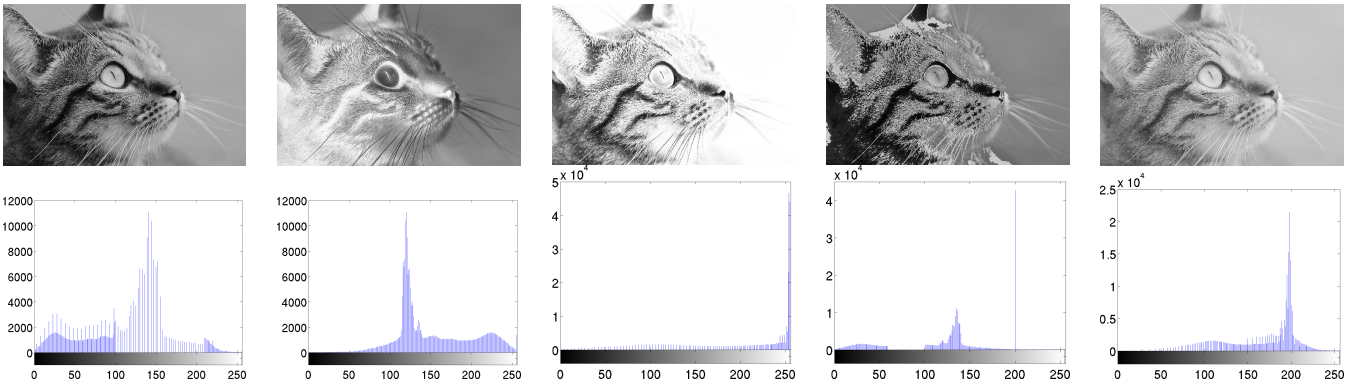


(a) (b) (c) (d) (e)

22. Which of the following pictures corresponds to $T(I)$ for the given image I and transformation T?

I T hist(I)

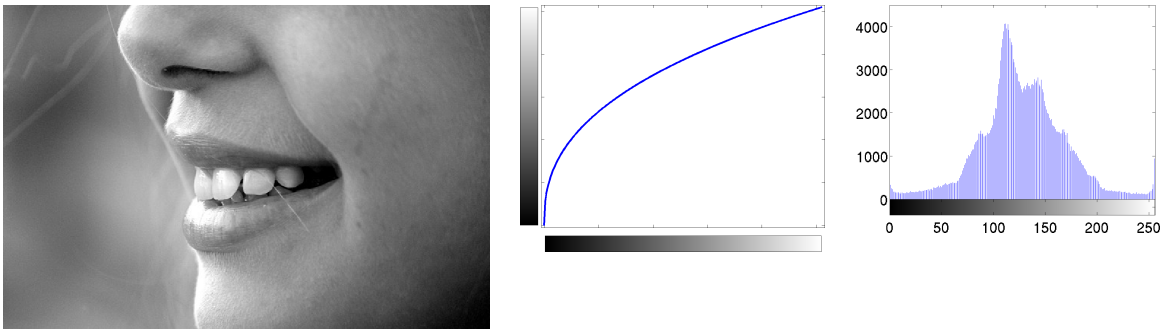


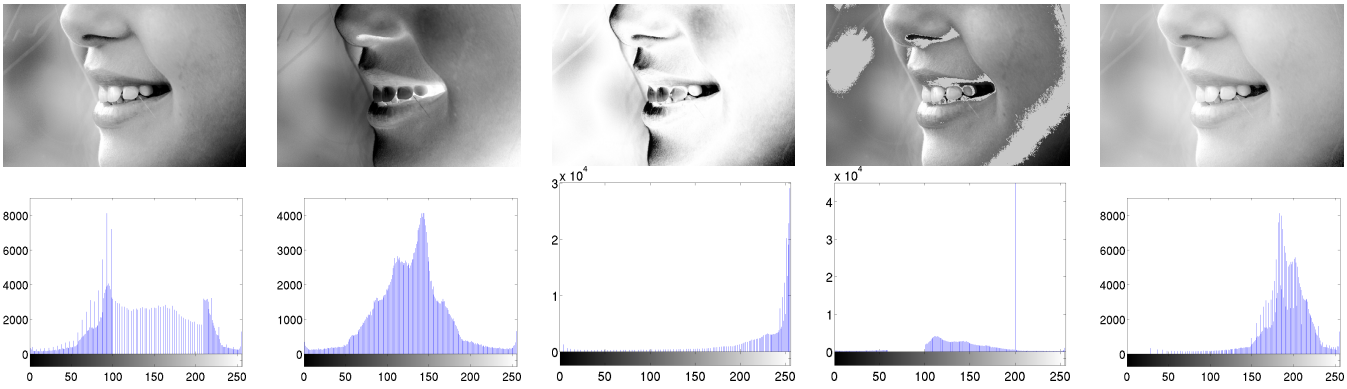


(a) (b) (c) (d) (e)

23. Which of the following pictures corresponds to $T(I)$ for the given image I and transformation T?

I T hist(I)

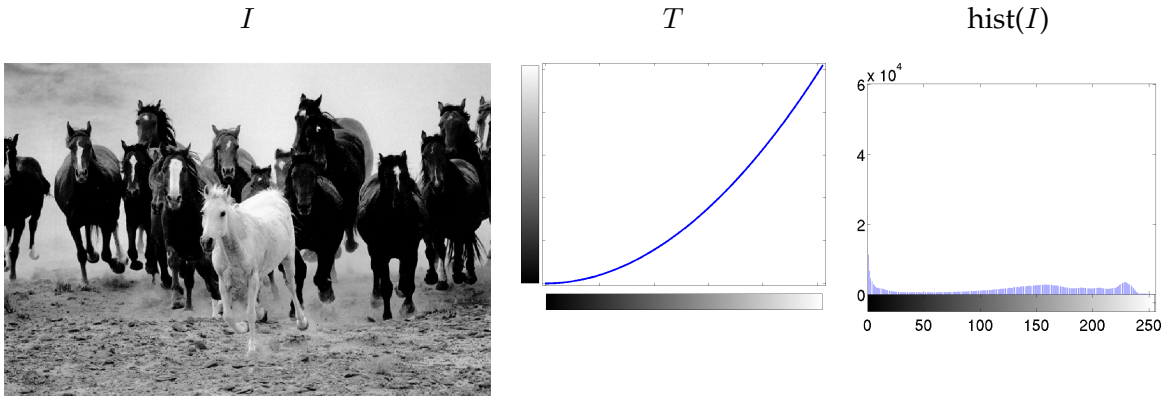


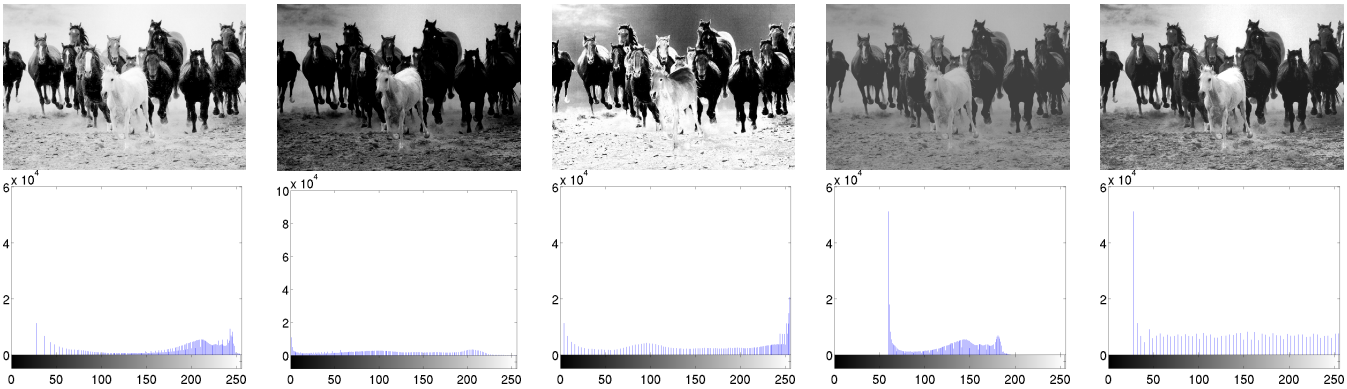


(a) (b) (c) (d) (e)

24. Which of the following pictures corresponds to $T(I)$ for the given image I and transformation

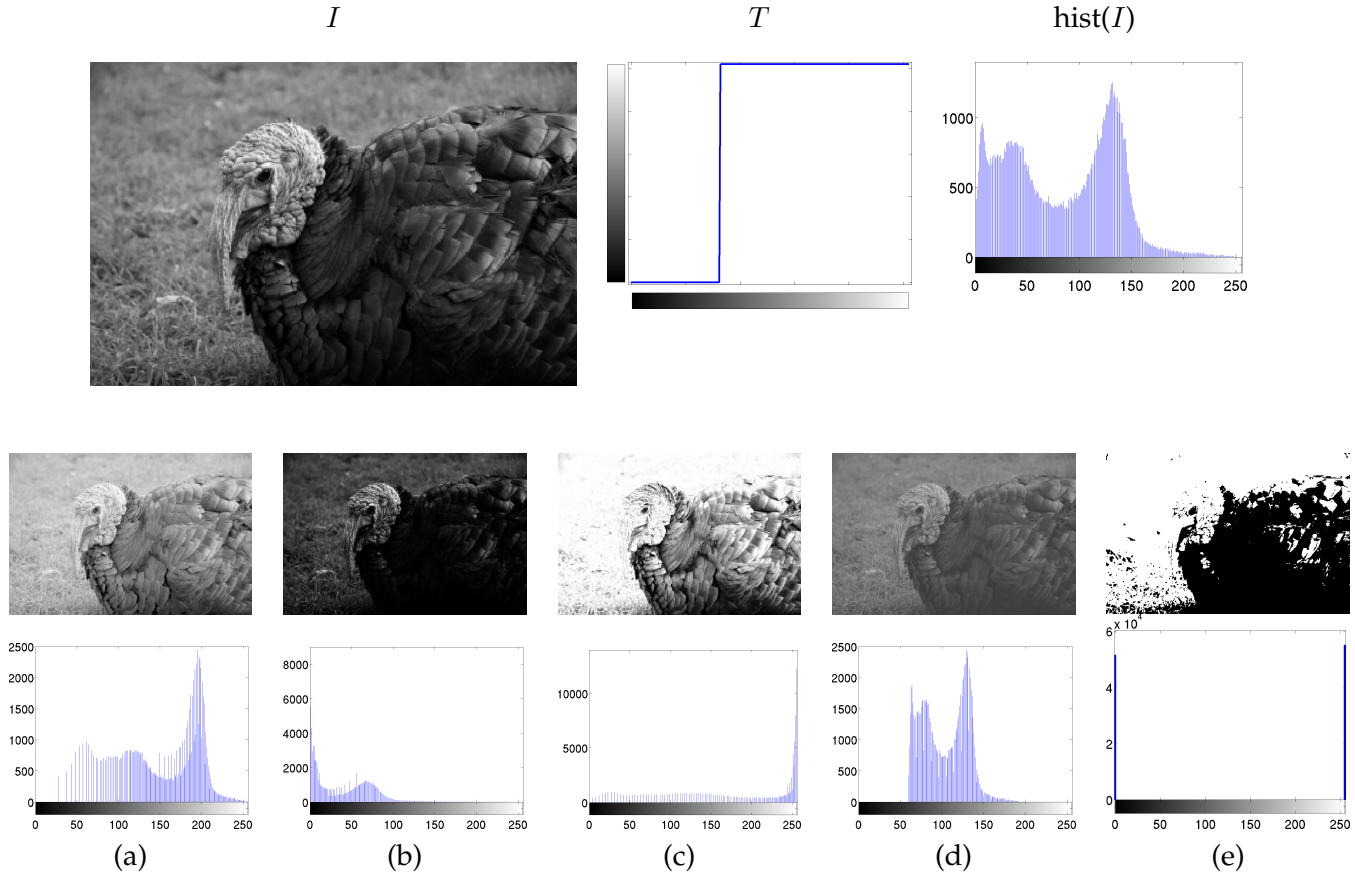
T?





(a) (b) (c) (d) (e)

25. Which of the following pictures corresponds to $T(I)$ for the given image I and transformation T?



5 Histogram processing

26. The histogram of a digital image describes

    (a) the overall size of the image
    (b) the richness of details
    (c) the uniform distribution of the intensity levels
    (d) the number of neighbors for each pixel
    (e) the number of pixels for each intensity levels

27. Given the following image, which of the following array can be its histogram?

6	7	2	7
7	5	4	1
1	0	7	7

    (a) $[-1\ 1\ 2\ 0\ 1\ 1\ 3\ 5]$
    (b) $[1\ 0\ 1\ 2\ 5\ 1\ 1\ 1]$
    (c) $[1\ 1\ 0\ 1\ 1\ 5\ 1\ 2]$
    (d) $[1\ 2\ 1\ 0\ 1\ 1\ 1\ 5]$
    (e) $[0\ 1\ 1\ 1\ 5\ 2\ 1\ 1]$

28. Given the following image, which of the following array can be its histogram?

6	3	2	0
0	4	2	7
4	7	2	4

    (a) $[3\ 0\ 0\ 3\ 2\ 1\ 1\ 2]$

(b) $[2\ 0\ 3\ 1\ 3\ 0\ 1\ 2]$

(c) $[3\ 2\ 1\ 4\ 0\ 3\ 0\ -1]$

(d) $[2\ 0\ 3\ 1\ 3\ 3\ 0\ 0]$

(e) none of the above

29. Given the following image, which of the following array can be its histogram?

7	5	4	2
6	4	0	0
4	0	7	7

(a) $[3\ 0\ 1\ 0\ 3\ 1\ 1\ 3]$

(b) $[3\ -1\ 3\ 3\ 0\ 1\ 1\ 2]$

(c) $[1\ 0\ 3\ 0\ 1\ 1\ 3\ 3]$

(d) $[1\ 3\ 3\ 3\ 0\ 1\ 1\ 0]$

(e) $[1\ 1\ 1\ 3\ 3\ 3\ 0\ 0]$

30. Given the following image, which of the following array can be its histogram?

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

(a) $[2\ 1\ 0\ 2\ 2\ 0\ 0\ 5]$

(b) $[1\ 4\ -1\ 2\ 2\ 2\ 2\ 0]$

(c) $[2\ 0\ 2\ 0\ 1\ 0\ 5\ 2]$

(d) $[0\ 0\ 0\ 5\ 1\ 2\ 2\ 2]$

(e) none of the above

31. Given the following image, which of the following array can be its histogram?

5	0	7	7
1	5	4	1
5	3	5	5

(a) $[-1\ 0\ 3\ -1\ 0\ 1\ 7\ 3]$

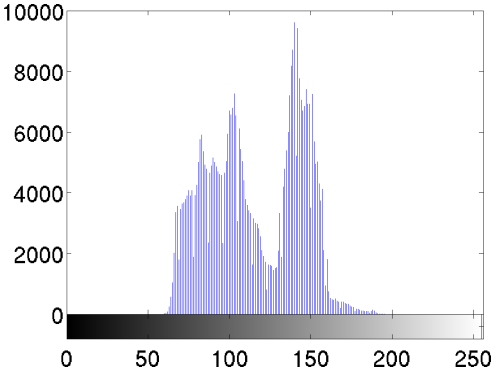
(b) $[5\ 2\ 0\ 1\ 2\ 0\ 1\ 1]$

(c) $[1\ 3\ 2\ 0\ 0\ 1\ 5\ 0]$

(d) $[0\ 5\ 0\ 1\ 2\ 1\ 2\ 1]$

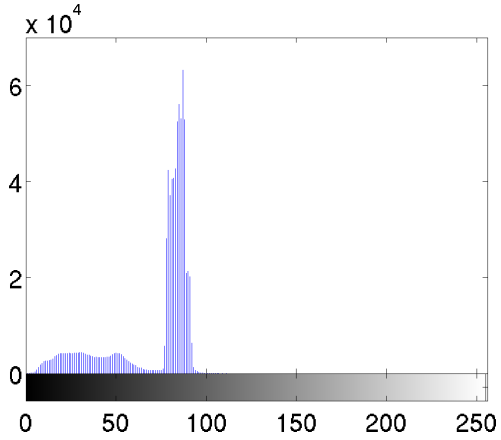
(e) $[1\ 2\ 0\ 1\ 1\ 5\ 0\ 2]$

32. What can be inferred about the image that has the following histogram?



(a) Surely, it must be equalized
(b) Probably, it has a poor contrast
(c) Probably, there is an excess of white pixels
(d) It is the typical gamma function image
(e) Probably, it cannot be equalized

33. What can be inferred about the image that has the following histogram?



(a) Surely, it has a high contrast
(b) It has too many white pixels
(c) This histogram cannot belong to an image
(d) It should be darkened
(e) Probably, it is dark

34. Histogram equalization of digital images is a transformation

(a) that can be applied only to dark images
(b) that can be applied only to monotonic histogram images
(c) that aims to obtain a uniform histogram image
(d) that allows to obtain a light image
(e) that preserves the details of all the shades

35. An image processed through histogram equalization usually

(a) has the same number of pixels for each intensity level
(b) is lighter than its negative
(c) is more contrasted than the original
(d) is darker than the original
(e) is lighter in the center than in the border regions

36. The histogram equalization

(a) maps the most used intensities into a larger range
(b) uniformly distributes the intensities
(c) sorts the intensities for their number of pixels
(d) swaps the most used with the least used intensities
(e) add some randomness to the intensities

37. What happens applying the histogram equalization more than one time?
    (a) The image becomes darker and darker
    (b) The image becomes lighter and lighter
    (c) Since the second time, the image does not change noticeably
    (d) The image swaps between the equalized and the original
    (e) Since the second time, the intensities tend to the mid-gray range
38. When could be useful to apply the histogram matching technique?
    (a) When the histogram of the image is not uniform, but because of the peculiarities of the scene represented in the image
    (b) When there is an a-priori knowledge on the optimal intensity distribution
    (c) When the standard histogram equalization does not provide a good result
    (d) When we want to achieve a given distribution of the intensities
    (e) In all the above cases
39. The histogram matching technique
    (a) is effective only for invertible images
    (b) requires two histogram equalization processes
    (c) should be avoided due to the numerical errors
    (d) can be applied only on low contrasted images
    (e) requires an already equalized image
40. Local histogram processing refers to
    (a) techniques that make use of the information derived from the histogram of sub-images
    (b) techniques that make use of local computation to provide the histogram of the image
    (c) techniques that approximate the histogram considering the mean intensity of sub-images
    (d) techniques that approximate the histogram as the average histogram of a partition of the image
    (e) none of the above

6 Spatial filtering

41. Spatial filtering consists in
    (a) computing the value for each pixel by considering the position of the pixel
    (b) computing the value for each pixel by considering the value in a given neighborhood of the corresponding pixel of the original image
    (c) computing the value for each pixel by considering the only the value in of the corresponding pixel of the original image
    (d) computing the value for each pixel as a local average of intensities
    (e) none of the above
42. A filter is called “linear” if
    (a) the value of the filtered pixel can be computed as a linear combination of the values of the neighborhood with fixed coefficients of the filter
    (b) the coefficients of the filter are linearly related to their position in the filter mask

(c) it can be applied to the image in linear time with respect to the number of pixels

(d) the mask is a row or a column vector

(e) all the element of the mask has the same value

43. The convolution

(a) formalizes the linear spatial filtering operation

(b) coincides with the correlation for symmetric filters

(c) differs from the correlation only for the rotation of the filter mask

(d) requires the extension of the image to be defined for each pixel

(e) all the above

44. Giving the following image, f, and filter, w, the value for the central pixel resulting from the filtering is

f:

2	3	0
1	4	3
0	2	3

w: $1/9\times$

1	1	1
1	1	1
1	1	1

(a) 3

(b) 2.4

(c) 2

(d) 0

(e) 4

45. Giving the following image, f, and filter, w, the value for the central pixel resulting from the filtering is

f:

2	3	0
1	4	3
0	2	3

w:

1	2	1
0	0	0
-1	-2	-1

(a) 1

(b) -2

(c) 2

(d) 0

(e) -4

46. The following filter computes

0	1	2	1	0
1	2	4	2	1
2	4	8	4	2
1	2	4	2	1
0	1	2	1	0

$\times\ 1/48$

(a) the 8-th derivative of the image

(b) the image Laplacian with diagonal contribution

(c) the local arithmetic average of each pixel

(d) the local standard deviation of each pixel

(e) the local weighted average of each pixel

47. A smoothing filter

(a) computes a local average
(b) removes the small details
(c) distribute the intensity of a bright pixel in its neighborhood
(d) removes the noise
(e) all of above

48. Given the following image, the output of the 3×3 median filter for the central pixel is

2	3	0
1	4	3
0	2	3

(a) 0
(b) 1
(c) 2
(d) 3
(e) 4

49. Given the following image, the output of the 3×3 max filter for the central pixel is

2	3	0
1	4	3
0	2	3

(a) 0
(b) 1
(c) 2
(d) 3
(e) 4

50. Given the following image, the output of the 3×3 min filter for the central pixel is

2	3	0
1	4	3
0	2	3

(a) 0
(b) 1
(c) 2
(d) 3
(e) 4

51. What is the results to apply iteratively a linear smoothing filter?

(a) The resulting image becomes lighter and lighter
(b) The resulting image becomes blurred and blurred at each iteration
(c) The resulting image becomes smaller and smaller at each iteration
(d) The resulting image alternatively swaps between the original image and its smoothed version
(e) The resulting image does not change significantly from the one obtained after the first step

52. A sharpening filter

(a) enhance the noise
(b) operates on the border of the image
(c) is based on the integral of the image
(d) is a non-linear filter
(e) all of the above

53. The Laplacian filter

(a) is based on the second derivatives of the image
(b) enhance the noise
(c) can produce negative values
(d) is a linear filter
(e) all the above

54. How a Laplacian filter can be used to enhance an image?

(a) Convolve the Laplacian filter with the image
(b) Convolve the Laplacian filter with the image, scale the resulting image in the range $[0, 255]$ and multiply pixel-wise to the original image
(c) Convolve the Laplacian filter with the image, multiply the resulting image by a negative constant and sum to the original image
(d) Sum the Laplacian filter pixel-wise to the original image
(e) The Laplacian filter cannot be used for this task

55. The gradient of a digital image

(a) is based on the second derivatives of the image
(b) can be computed by mean of non-linear filters
(c) is a two-value function
(d) is used to smooth the image
(e) none of the above

56. Which of the following is a Laplacian operator?

(a)
-1	-1	-1
0	0	0
1	1	1

(b)
1	1	1
1	-8	1
1	1	1

(c)
1	1	1
1	8	1
1	1	1

(d)
1	1	1
1	-4	1
1	1	1

(e)
-1	-1	-1
-1	-8	-1
-1	-1	-1

57. Which of the following is the Sobel operator for computing the vertical derivative?

(a)
-1	-1	-1
0	0	0
1	1	1

(b)
-1	0	1
-2	0	2
-1	0	1

(c)
0	-2	0
1	1	1
0	2	0

(d)
-1	-2	-1
0	0	0
1	2	1

(e)
-2	-2	-2
0	0	0
2	2	2

58. In the unsharp masking technique the regions with rapid change in intensity are obtained

(a) by filtering through Sobel operators
(b) as the difference between the image and its blurred copy
(c) as the difference between the image and its Laplacian
(d) by filtering with a bilinear filter
(e) none of the above

7 Color images

59. Why the human vision system is able to perceive the colors?

(a) In the retina there are cells that have a response proportional to the wavelength of the light
(b) In the retina there are three kind of sensors which response is differentiated for the same wavelength
(c) The cornea reacts proportionally to the wavelength of the incoming light and this information is sent to the retina
(d) The retina adapts its activity to the environment brightness
(e) The rods in the retina processes the color information in the fovea

60. The primary colors are

(a) red, green, and blue, for additive composition
(b) the colors composing which all the colors can be obtained
(c) yellow, magenta, and cyan, for subtractive composition
(d) the colors pair-wise composing which the secondary color can be obtained
(e) all the above

61. The hue of a color is

(a) its wavelength
(b) its perceived brightness

(c) its dominant color
(d) a measure of its closeness to white
(e) the mapping in the tristimulus space

62. Which of the following are true statements?

(a) RBG is the color model used for light-emitting devices
(b) CMY is the color model used for light-reflective devices
(c) Any device can represent the same color spectrum
(d) HSI representation of each color can be computed from its RGB representation
(e) Each color is uniquely represented in HSI color space

63. A digital color image is usually represented by

(a) three matrices, one for each component of the color space
(b) one matrices, with elements belonging to the real numbers
(c) six matrices, one for each vertex of the RGB cube
(d) none of the above
(e) all the above

64. Spatial filtering and other transformations (e.g., histogram equalization) can be applied to digital color images by applying them to

(a) the intensity component
(b) all the components
(c) the components most suitable depending on the processing
(d) the average of the components
(e) none of the above

8 Image segmentation

65. Edge detection is an image processing technique for

(a) finding the border of the image
(b) finding the most bright pixels in the image
(c) identifying the most external pixels of a region
(d) partitioning the images in homogeneous regions
(e) identifying those pixels where a discontinuity in the intensity occurs

66. Image discontinuities are important because

(a) they can be used to model the dynamic range of the image
(b) they can be easily computed through the histogram analysis
(c) they are the points where the regions are not homogeneous and so they can be discarded
(d) since they occur usually on the border of the objects, they carry useful information on the scene
(e) all of the above

67. Discontinuity detection is operated through

(a) region growing

(b) smoothing filters
(c) derivative operators
(d) histogram matching
(e) none of the above

68. Edge detection can be easier realized if

(a) the image is dark
(b) the image histogram is Gaussian
(c) the image is preprocessed by smoothing
(d) the image is negated before the detection
(e) the image is subdivided in 4×4 blocks before the detection

69. A ramp edge is

(a) a uniform change in the intensity
(b) a homogeneous region of the image
(c) the main result of a sharpening process
(d) an artifact that should not be considered
(e) a rapid increase in the intensity followed by a rapid decrease

70. A ramp edge

(a) can be identified by the zero crossing in the second derivative
(b) can be considered an artifact of the histogram equalization
(c) can be part of a path which cross it
(d) can be removed by sharpening
(e) none of the above

71. The presence of noise

(a) transforms the ramp edge in steps
(b) can be attenuated through sharpening
(c) makes the histogram equalization impossible
(d) makes the second derivative computation unreliable
(e) all the above

72. Gradient based edge detection

(a) allows to identify bot the presence of an edge and its direction
(b) makes use of more than one operator
(c) can enjoy a smoothing preprocessing
(d) is made more difficult by the noise
(e) all the above

73. The thresholding of the gradient of an image aims to

(a) select the points with higher discontinuity
(b) approximate the histogram equalization
(c) reduce the information to be processed
(d) smooth the resulting image

(e) improve the histogram

74. The Marr-Hildreth edge detector

(a) requires the zero crossing detection
(b) allows to operate at different scales
(c) uses the Laplacian of the Gaussian as discontinuity detector
(d) is computationally efficient because it encapsulate the smoothing and the derivative processing in a single operator
(e) all the above

75. The Canny edge detector

(a) uses the gradient direction for a more robust edge detection
(b) is faster than the Marr-Hildreth edge detector
(c) requires the computation of the histogram
(d) uses a single threshold
(e) none of the above

76. Which of the following statement about the Canny edge detector are true?

(a) computes the zero crossing as final stage
(b) uses a Gaussian smoothing as preprocessing
(c) uses the direction for selecting the more robust edge points
(d) uses the weak edge points as candidates to increase the strong edge point set
(e) uses a double threshold to select those points that are likely to be edge points

77. Which of the following statements are true differences between the Marr-Hildreth and the Canny edge detectors?

(a) The Marr-Hildreth requires smoothing preprocessing
(b) The Canny operates using only one mask
(c) The Canny requires thresholding
(d) The Canny uses edges direction
(e) The Marr-Hildreth uses zero crossing

78. The Hough transform can be used for

(a) detecting those pixels that belongs to an edge
(b) improving the efficiency of the spatial filtering
(c) finding the most probable lines in the image
(d) smoothing the edges
(e) none of the above

79. The Hough transform

(a) takes into account the lines that pass through each pixel
(b) computes the most probable orientation of the image
(c) reduces the computational cost of the histogram
(d) processes the ramp edges in the image
(e) detects the uniform regions

80. Segmentation through thresholding

    (a) is easier in presence of non-uniform illumination
    (b) is the simplest method for image segmentation
    (c) makes use of the histogram information
    (d) enjoys the dynamic range reduction
    (e) can be improved adding some noise

81. Which of the following statements is true about the segmentation through thresholding technique?

    (a) using k thresholds, can provide a $k + 1$ class partitioning
    (b) can be speeded-up using the histogram information
    (c) the threshold value can be adaptively computed
    (d) can be used only for a two classes partitioning
    (e) the threshold value must be fixed in advance

82. The use of the histogram to choose the segmentation threshold

    (a) is not affected by the uniformity of the illumination of the scene
    (b) can be effective when there are only two well-separated peaks
    (c) cannot be applied if the image is a gray-level image
    (d) can make robust the choice in case of noise
    (e) allows the detection of small objects

83. The global thresholding segmentation technique

    (a) is an iterative process based on the histogram difference among the classes
    (b) is an iterative process based on the average intensities of the classes
    (c) is an effective methods for all the images in real cases
    (d) is operated exploiting the gradient information
    (e) requires the smoothing as preprocessing step

84. Otsu's method

    (a) identifies the value of the threshold adaptively with respect to the position
    (b) is a smoothing procedure based on the histogram of the classes
    (c) is an iterative method based on the gradient information
    (d) aims to find the optimal value of the threshold
    (e) makes use of filtering to improve its efficiency

85. Which of the following statements about the Otsu's method are true?

    (a) It estimates the best threshold as the one that maximize the dissimilarity among the classes
    (b) No other technique can provide a better segmentation with a single threshold
    (c) It computes the goodness index for each possible value of the threshold
    (d) It exploits the histogram information to gain efficiency
    (e) It can be used only in a two classes scenario

86. Which of the following statements about the Otsu's method are true?

    (a) Sharpening preprocessing can improve the results when the illumination is not uniform

(b) Sub-region processing can help when the illumination is not uniform

(c) Edge selection can help when the size of the object is small

(d) Smoothing preprocessing can help to cope with noise

(e) Histogram smoothing can help with noise

87. Growing based segmentation

(a) starts from some points that belong to the objects and adds the neighbors until a stopping criterion is met

(b) starts from the corners of the images and grows diagonally until a pixel that belong to an object is met

(c) starts from the peaks of the histogram and adds the similar intensities to the classes

(d) starts from the darkest pixels and add the pixels with an improving intensity

(e) requires the user interaction to set the directions of the growing

88. Which of the following statements about the segmentation through region splitting and merging are true?

(a) It can be applied only to square images

(b) It uses iterative smoothing for blending the regions

(c) It is an iterative procedure structured in two phases

(d) It makes use of the gradient information to decide the splitting direction

(e) It makes use of the similarity between adjacent regions as merging criterion

89. Watershed is a technique used for

(a) edge smoothing

(b) image sharpening

(c) histogram matching

(d) image segmentation

(e) image linear filtering

90. Which of the following statements about the watershed technique are true?

(a) It is applied on the derivative of the image

(b) At the end of the process, the histogram is uniform

(c) It is based on the metaphor of the water rising from the ground

(d) The regions are identified by the dams that are iteratively grown

(e) At each iteration, a predefined number of pixels are assigned to each basin