

# MACHINE VISION

Examination 18.12.2018

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1. (6p.)

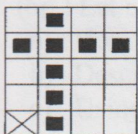
- What is the main idea of binary erosion and dilation in mathematical morphology. Are they inverse operations?
- Calculate and draw erosion of  $X$  using  $B$  as structuring element.
- What is the result if you calculate erosion of  $B$  using  $X$  as structuring element?

Erosion — example



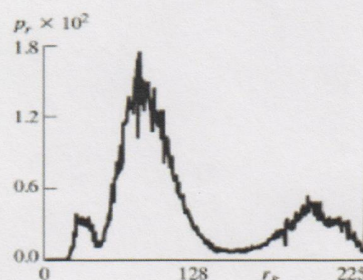
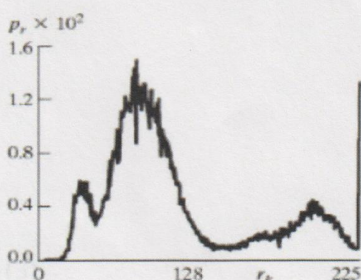
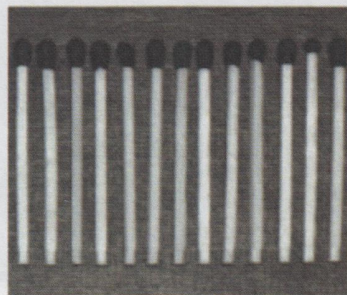
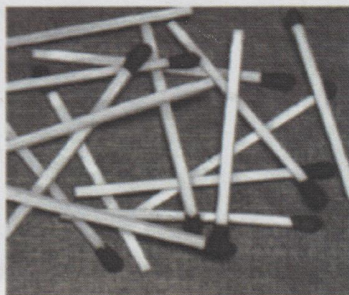
$$X = \{(1, 0), (1, 1), (1, 2), (0, 3), (1, 3), (2, 3), (3, 3), (1, 4)\}$$

$$B = \{(0, 0), (1, 0)\}$$



2. (6p.)

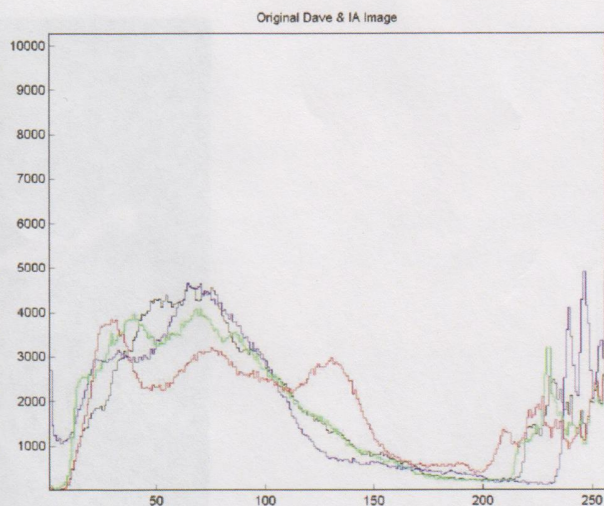
Below are two images containing sticks. Below them are the corresponding histograms, which are about equal. Design and describe a method with which you can classify these two stick images from each other. What kind of features should be calculated?





# Saturation Adjustment

original



3. (6p.) Let us consider the color image above.

- How would you automatically find out if there is anything yellow in the image?
- Describe the algorithm(s) (methods) to segment the red shirt of the man on right hand side.
- Using what kind of color space would it be easy to segment the red shirt?

4. (6 p.) Present an algorithm how to calculate and show the shortest route on the surface of a gray-level image between points a and b using a suitable distance transform.



Points a and b on the surface of a gray-level image.

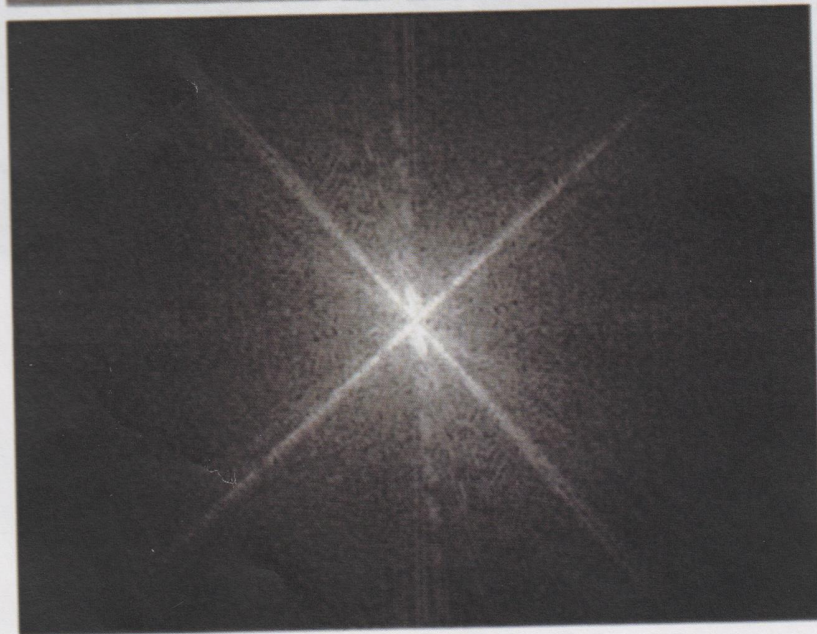


Shortest route between a and b.



5. (6p.) Below is a gray-level image and its Fourier spectrum.

- What can be deduced from the Fourier spectrum about the original image?
- What are the application areas of Fourier transform?
- Is it meaningful to use it with noisy images?





6. JOKER (8p.) You can replace any of the tasks 1-5 with JOKER.

- Let  $A \in \mathbb{Z}^2$ ,  $B \in \mathbb{Z}^2$ , and  $D \in \mathbb{Z}^2$ . A opened by structuring element  $B$  is defined as follows:  
 $A \circ B = (A \ominus B) \oplus B$ . Is the following equation true in general:  $(A \circ D) \circ B = (A \circ B) \circ D$ ? If not, could it be true in some special cases?
- What is a spectral image? In what kind of applications can it be used?
- What is the main idea of Hough Transform?
- Below are two Lena images with the same compression ratio (bitrate 0,3 bpp). Which one of these is compressed using the original JPEG, and which one with the JPEG2000 image compression standard, and why?

