

MACHINE VISION

Examination 26.1.2010

Pekka Toivanen

1. a) Develop a procedure for computing the median of an $n \times n$ neighborhood.
b) Propose a technique for updating the median as the center of the neighborhood is moved from pixel to pixel.
c) What is the main application of Median Filtering?

2. Huffman coding creates variable-length codes that are an integral number of bits. Symbols with higher probabilities get shorter codes. Huffman codes have the unique prefix attribute, which means they can be correctly decoded despite being variable length.

Assume you have a source generating 5 different symbols {'A','B','C','D','E'} with frequencies {14, 7, 5, 5, 4}. Generate a Huffman code for that source.

3. Distance transforms for binary and gray-level images. In what kind of applications can they be used?

4. In automated analysis of digital images, a sub-problem often arises of detecting simple shapes, such as straight lines. In many cases an edge detector can be used as a pre-processing stage to obtain image points or image pixels that are on the desired straight line in the image space. Due to imperfections in either the image data or the edge detector, however, there may be missing points or pixels on the desired line as well as spatial deviations between the ideal line and the noisy edge points as they are obtained from the edge detector. How would you group the extracted edge features to an appropriate set of straight lines ?

5. a) Below is an image X and a structuring element B. Calculate and draw the dilation of X by B.
b) Below is an image X and a structuring element B. Calculate and draw the erosion of X by B.

Dilation — example

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

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

