Aula Prática 6

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Data: 11/11/2011

1. Erosion and Dilation

- Create two morphological filter functions that operate on binary images: *Erosion* and *Dilation*. Use a 3x3 *kernel*, where every entry is equal to 1 (see Figure 1).
- Apply the created functions to *Imagem_AP6_2*, which is the result of the segmentation of an image (*Imagem_AP6_1*) degraded by salt and pepper noise.
- [Optional] Make the functions more flexible, allowing the *kernel* to be passed as a parameter.

a) *Imagem AP5_2*

1	1	1
1	1	1
1	1	1

b) Kernel 3x3

c) Erosion

d) Dilation

Figure 1

2. **Opening and Closing.**
   - Reuse the previously created functions to create two new morphological filter ones: *Opening* and *Closing*.
   - Apply the new functions to *Imagem_AP6_2*.

| a) Opening | b) Closing |

Figure 2

3. *Connected Component Analysis.*
   - Implement a function that does the *connected component analysis* of a binary image. As a result, you should 'paint' each component using a different color. Hints:
       i. Create an empty matrix, with the same size of the image, where each value identifies the number of the component that the pixel belongs to. The component '0' corresponds to the background.
       ii. Create a loop that scans the segmented image, creating a new region whenever it finds the value '1', that is still labeled as background (component '0')
       iii. Create a new identifier number for this component (e.g. '2') and use a recursive algorithm to propagate this value to all pixels with value '1' that are connected to this region.
       iv. Assume a 4-neighbor connectivity.
       v. Limit the number of components to 20, ignoring the rest of the image when you reach this number.
   - Apply the created functions to *Imagem_AP6_3*.
   - [Optional] Allow that your function automatically rejects components that are smaller than *K* pixels.

4. **Counting components.**
   - [Optional] Using the implemented methods, create an automatic counting function for the dark spots in image *Imagem_AP6_4*.