INF 4300 Mandatory term project 2013 – Part I

Separation of textured regions in an image

In this mandatory exercise you are going to describe textured regions in an image, compute and visualize GLCM's from each texture, extract GLCM features, and segment the images.

The algorithm should be based on a combination of programs and routines available in image analysis program systems we have at IFI, and your own programs/routines. You chose which system you will use (C, MATLAB, IDL, XITE, OpenCV, ImageJ etc).

The next exercise (Part II) will be about classification, and will not necessarily be based on the same data set as Part I.

Time table

• Exercise and images Part I available: Wednesday 3. October 2013
• Deadline for part I: Wednesday 24. October 2013

Submission:

Your solution must be submitted as a single PDF file containing the problem description, discussion, and the supporting source code. The file should be mailed to the group teacher Sigmund Rolfsjord <sigmund.rolfsjord@gmail.com by the deadline above, with subject titled "INF4300 PART 1".

Evaluation:

- The two exercises will be evaluated separately.
- Please note that in order to take the exam, both mandatory exercises must be passed.
- Contrary to previous years, the mandatory term project is NOT part of the final exam.

Since image processing is a field where solutions often are found by experimenting with different methods, we would like to emphasis the following point:
You should analyse the problem and the input images so you can select suitable methods and parameters. You should not start testing all available methods that you know, even if that would be an impressive amount of work. Analysis and logical reasoning about alternatives, and then chosing and eventually comparing just a few approaches is usually a better approach.

How to work:

The exercise is an individual work, and each student should deliver a written report.
Your report should be genuine, in particular we will check that each report provides it own discussion of all method and parameter choices. Include references if you use external sources.

The report should contain the description of the problem, theory, chosen methods, results and algorithms used. You have to document all steps in the algorithms, and listings of our own code should be included as appendix.

The images:

The following two images should be used:
http://heim.ifi.uio.no/~inf3300/bilder/mosaic1.png
http://heim.ifi.uio.no/~inf3300/bilder/mosaic2.png
From linux the images are to be found at ~inf3300/www_docs/bilder/mosaic*.png

The four steps:

Part I can be divided into four steps, but must be seen together.

A. Analyzing the textures.

Describe the texture by words. What characterizes each texture? How do the textures differ? Keywords to discuss are: direction, frequency, variance, homogeneity, texture element size.

B. Visualizing GLCM matrices

For this step, create one subimage for each texture. Compute the normalized, symmetric GLCM matrix for the chosen parameter values for each texture. You should explain your choise of parameter values**.**
Instead of testing a massive list of GLCM parameter combinations, you should give good reasons for a shorter list of parameters.
If you use isotropic GLCM, you should give the detail on how it is computed.
Include the GLCM matrices as images in the report, and include a color bar on the figures.
From the GLCM matrices, discuss similarities and differences between the image textures.
Which parts of the matrices seem to be useful for discriminating between the textures ?

C. Computing GLCM feature images in local windows

Compute the GLCM features:

- GLCM homogeneity
- GLCM contrast
- GLCM inertia
- GLCM cluster shade

The feature images should be computed in local windows. Please give the reasons for your choise of window size.

Include the GLCM feature images in your report. Make sure to scale them so they show proper contrast in your PDF file.

D. Segment the GLCM feature images and describe how they separate the textures.

Apply global thresholding to the GLCM feature images. You can experiment with the global threshold to manually find a threshold value for each feature image that gives the best separation of the textured regions.

Include the tresholded feature images in your report, and discuss which image textures that are best separated in each GLCM texture feature image, both in terms of correct boundaries between textures and errors within the textured regions.

Good luck!
Fritz Albregtsen and Anne S. Solberg