

# TEL411 – Digital Image Processing

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## Assignment 6

Due date: Sunday, November 22, 2020

### STEP 1

In this exercise, we consider the problem of detecting and delineating urban areas from satellite images. Consider the SPOT image “village.gif”. Our goal is to provide an urban mask, a useful tool that creates a binary image where each pixel is labelled as urban or non-urban.



Fig. 1 – Village.

**Question 1:** Binarize the given image using the `im2bw()` function for different threshold values and comment the results. ***Plot the optimal case.***

## **STEP 2**

To characterize the urban area with respect to the “background”, we can consider different texture parameters. For computing these parameters, we consider an algorithm based on a sliding window. You are given a function called “UrbanDetec.m”. This function computes the variance over a local window. It depends on 2 parameters the size of the window (an odd number) and a threshold to binarize the image.

**Question 2:** Run the UrbanDetec.m program with different values for the parameters and comment the results. ***Plot the optimal case.***

**Question 3:** What is the advantage/disadvantage of the first algorithm if compared to the local computation of the statistical moment on each pixel?

## **STEP 3**

Another approach that allows the detection of an urban area is based on mathematical morphology techniques. The proposed approach is divided in several steps:

1. Apply the top-hat (TH) and its dual technique (BH) to the initial image. You are allowed to use only the “imerode()” and “imdilate()” functions, respectively. ***Plot your results (2 images).***
2. Normalize the TH and BH images.
3. Use the Otsu method to the normalized images (2 thresholds).
4. Use these 2 thresholds to binarize the TH and the BH images, respectively (BWTH, BWBH). You are allowed to use the “im2bw()” function. ***Plot your results (2 images).***

5. Use the opening technique for the BWTH image to decrease the retrieved area. You are allowed to use the “imopen()” function.
6. Use the closing followed by the opening technique for the BWBH image to sketch the urban area. You are allowed to use the “imclose()” and “imopen()” functions.
7. The final results are obtained by fusing the images of step 5 and step 6. You are allowed to use the “imfuse()” function.  
**Plot your results (1 images).**

Note - TH: Top-Hat, BH: Bottom-Hat, BW: Black and white (binary).

**Question 4:** Write an algorithm following the above tasks. For each step, explain the action of the operation and its purpose for addressing the problem.

**Question 5:** What are the involved parameters? Study their robustness.

### **What to turn in**

You should turn in both your code and a report. Justify your choices. Make sure you illustrate **the 7 images** along this process, as required.