Assignment GEO1001 2019-2020: Multispectral Classification and Accuracy Assessment Sensing Technologies for the Built Environment

Description

You will carry out this assignment, consisting of two parts, in groups of three students.

1. In the first assignment your main task is to write a software implementation of a maximum likelihood classifier and to apply your programme on a small image patch taken from a multispectral images consisting of the Red and the NIR bands. The image patch consists of a square of 20 x 20 pixels and is stored in an Excel spreadsheet, named multispectral classification. You have to perform a multispectral classification into three classes: vegetation, bare ground and water. The spreadsheet consists of two tabs. Under the first tab you find the Red and NIR values of the image patch. Under the second tab you find the training samples.

2. In the second assignment you will carry out an accuracy assessment of a semantically enriched point cloud. Semantically enriched means that there are classes assigned to each and every point in the point cloud. For this task you need the spread sheet: semantically enriched point clouds.

Deadline: Monday 28 October, 17:00

During the interactive lecture on 29 October, from 13:45 onwards, your answers will be discussed. In order to prevent huge file sizes, reduce the size of images and so on. Between brackets the scores you can gain per part and task of this assignment.

Part 1 [65]

1. Compute the NDVI of the 20x20 image patch as stored in the Excel spreadsheet, named Multispectral classification and make a histogram of the NDVI values (take as interval 0.2) *[5]*
2. Plot the 400 red and NIR values in a scatter plot – red along the x-axis and NIR along the y-axis. *[5]*
3. Plot the multispectral feature space using the training samples as shown under the tab: "Training Samples" of the Excel spreadsheet "Multispectral Classification". Explain the differences with the scatter plot in task 2. *[5]*
4. Select on basis of your interpretation of the multispectral feature space which classification method is best suited: maximum likelihood, Mahalanobis distance, box or minimum distance to mean (motivate your selection). *[5]*
5. The covariance matrix of each of the classes has to be determined from training samples and the training samples also provide the data to compute the mean vector of each of the classes. Compute the mean vector, the covariance matrix and the inverse of the covariance matrix of each of the classes. *[5]*
6. Write a computer programme which is able to perform a maximum likelihood classification and run the programme on the 20 x 20 patch of the multispectral image. Code the class vegetation with 1, the class bare ground with 2, and the class water with 3. Your output should again be an Excel spreadsheet. *[25]*
7. Compare your maximum likelihood result with the NDVI you computed under task 1 and select on basis of the comparison and histogram you have plotted under task 1 thresholds for the NDVI. *[5]*
8. For some pixels it is difficult to assign a class to. Explain the reason. *[5]*

Part 2 [35]

Above you have written a computer programme to conduct a Multispectral Classification on a 20 x 20 image patch of the Red and the NIR bands of a multispectral image. Within this second part of the assignment you will compute the confusion matrix and accuracy measures of a semantically enriched point cloud acquired by a mobile laser scanning system. The method used is a non-parametric machine learning method, called Random Forest. Each record contains the following information: (X, Y, Z) coordinates, Ground Truth Class, Classified Class

In total there are five classes, which are coded as follows:

Compute:

a. the confusion matrix *[10]*

b. overall accuracy *[10]*

c. Kappa coefficient *[15]*

Code	Class
1	Facade
2	Cars
3	Pedestrians
4	Motor cycles
5	Traffic signs

Deliveries: A brief report containing your outputs of the above tasks. One group delivers one report.

Deadline: Monday 29 October 2019, 17:00

Groups: You will carry out this assignment in groups of three students. Check whether your name is on the list or should not be listed.

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