

2021 Image Processing for Remote Sensing Course

Final Exam

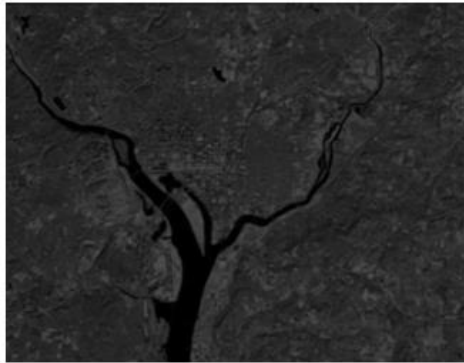
Total Time=75 min, 22/07/2021

Student's Name-Surname:

Student's ID:

- 1) For each description below, inciate TRUE or FALSE and briefly explain your answers (16p).
 - (a) The size of an area represented in a pixel is called as temporal resolution and it depends on the capability of the sensor to detect details.
 - (b) The histograms of two different multispectral images acquired in different geographical areas can be identical. If a same low-pass filter applied to both images, the resultant histograms can be different.
 - (c) If there are very few changes in pixel values over a given area in an image, this is commonly referred to a high-frequency area.
 - (d) High NDVI values result from the combination of a high reflectance in the near infrared and lower reflectance in the red band.
 - (e) Several different features can be computed from the gray-level co-occurrence matrix. One of them is the energy that measures the closeness of the distribution of elements in the matrix.
 - (f) The benefits of using convolutional layers instead of fully connected ones for remote sensing image classification are: i) reducing the number of parameters; and ii) using spatial context.
 - (g) After training a neural network, you observe a large gap between the training accuracy (100%) and the test accuracy (42%). To reduce this gap, sigmoid activation is commonly used.
 - (h) Consider a Generative Adversarial Network which successfully produces images of urban areas. The generator aims to learn the distribution of images with urban areas, while the discriminator can be used to classify images as urban vs. non-urban.
- 2) Describe the morphological operations: a) Dilation; b) Erosion; c) Opening; and d) Closing for remote sensing images and give an example of their use in remote sensing image processing (20p).
- 3) What are the pre-processing approaches that we should consider before applying any change detection method in multitemporal remote sensing images (10)?

- 4) Assume that you have a satellite image called 'before' given below. To better visualize different land-cover classes (as given in image 'after' below), which operations can be applied (14p)?



Before



After

- 5) The following figure shows a remote sensing image band of size 5x5 pixels (20p).

	0	1	2	3	4
0	3	7	6	2	0
1	2	4	6	1	1
2	4	7	2	5	4
3	3	0	6	2	1
4	5	7	5	1	2

- a) Define a Laplacian filter and compute the output at (2,2) when it is applied to the above image band. Briefly explain what is the effect when we filter the image with a Laplacian filter.
- b) When you apply a median filter to the image, what will be the output at (2,2)? What is the effect when we filter an image with a median filter?
- 6) You want to solve a content based remote sensing image retrieval task by designing a system that includes convolutional neural networks followed by an image search approach. Assume that a sufficient number of training images (each of which is labeled with a single label) is available. What are the basic modules/components of your system from feature learning to image search and retrieval? (20p).

Good Luck!