HACETTEPE UNIVERSITY
DEPARTMENT OF
GEOMATICS ENGINEERING

GMT345

REMOTE SENSING AND IMAGE PROCESSING

HOMEWORK -2

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Basic Explanations For FIRST Question ;

First of all, I took the given satellite image from Erdas Imagine in Raster → Spectral → Layer Stack as a single band (red). Now I accepted our original image as a red band image and continued the process.

To use the subtraction method, I applied a 3x3 Low Pass filter to the red band image (Raster → Spatial → Convolution → Kernel). The reason we chose a 3x3 filter is to get an image with less noise. When I applied an 11x11 kernel filter for image detection, I got a lot of noise, so I found that a 3x3 kernel gave more meaningful results for this project.

Low Pass Filter smoothes spatial contrast in an image by minimizing spatial variability in BVs inside the kernel.

Subtraction method is for subtracting the value of each pixel in the image from the value of the center pixel. This creates an image that emphasizes edges and reduces overall density.

subtraction_method = (red_band_ırvıne) – (low_pass)

I used the Higher Pass filter to use the Mean Difference method. They highlight high spatial frequency variations in BVs. They also detect edges and increase contrast.

Mean Difference convolution kernel method is for calculating how much the average value of pixels in a window differs from the value of each pixel in the window. This method creates an image that emphasizes edges and increases overall contrast.

Which of these two methods gives better results may vary depending on the characteristics of the image and the purposes of the processing.

Now let's evaluate the two methods we applied to the red band by taking a screenshot.

1. **Evaluate and comment on the results that you have acquired using "Subtraction" and "Mean Difference" method ;**

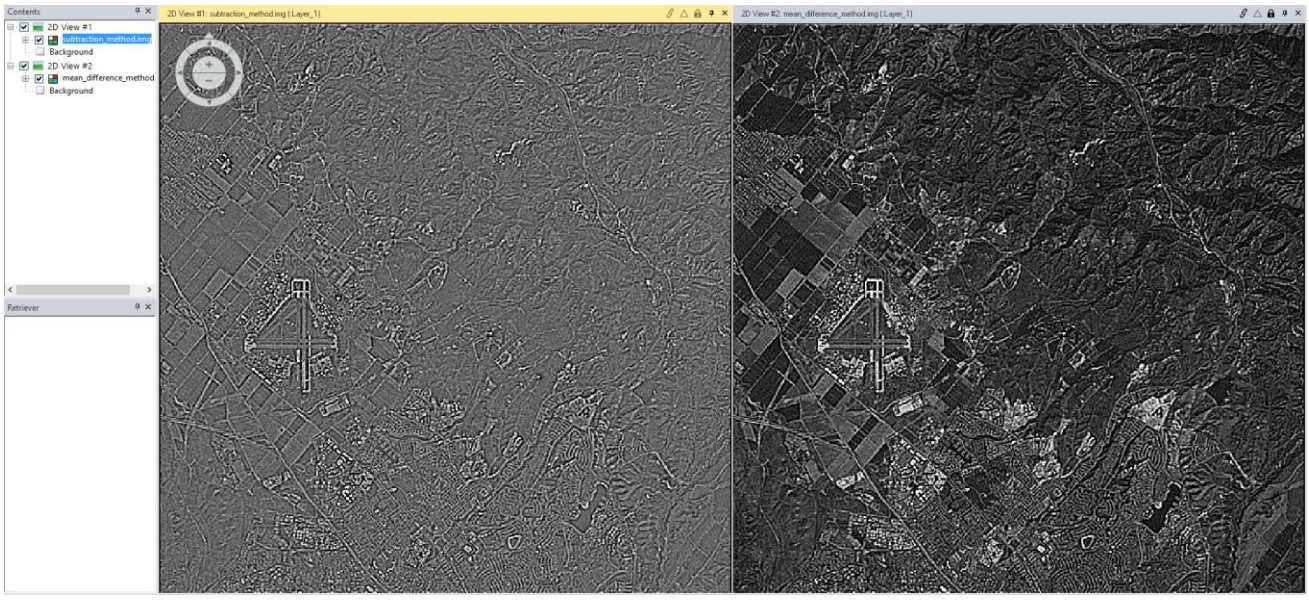

Figure 1 : Subtraction Method (on the left) *Mean Difference Method (on the right)*

As seen in Figure 1, while the Subtraction method creates softer and smoother edges, the Mean Difference method creates sharper and more distinct edges. This means that, for example, if you want to identify buildings in a city, the Mean Difference method may give better results. In this image, it is also easier to identify the urban area using the Mean Difference method. In Subtraction Method, on the other hand, creates a smoother image, making it appear more realistic, less distorted, and easy to classify.

Looking at the image, I can easily identify the different tones and details in the image because the Mean Difference method increases the contrast and the edges are more distinct. For example, it is easier to distinguish the vegetation and roads. However, which one to use depends on the task at hand, because the Subtraction method seems to highlight the boundaries better, so we can easily identify the boundaries of the object we will identify.

Evaluating these two methods combined can provide more accurate results.

Basic Explanations For SECOND Question ;

In this section, I applied the Raster → Spatial → Convolution → Kernel (Vertical, Horizontal, Diagonal (NW-SE), Diagonal (NE-SW) filters on the red band, respectively, then collected all of them from the function section and got a single image (sum_v+h+ld+rd).

Edge detection filters are for finding borders and edges in an image. These filters detect where there are sudden changes in the values of the pixels in the image, creating an image that highlights these places. In this way, important details and boundaries in the image can be revealed.

- Vertical edge detection: This filter detects vertical borders in the image.
- Horizontal edge detection: This filter detects horizontal borders in the image.
- Left Diagonal edge detection: This filter detects the left diagonal borders in the image.
- Right Diagonal edge detection: This filter detects the right diagonal borders in the image.

Applying edge detection filters to different aspects of the image helps detect boundaries more thoroughly

Note : For this question, "Vertical Edge Detection", "Horizontal Edge Detection", "Right Diagonal Edge Detection", "Left Diagonal Edge Detection" filters were applied in Erdas software. Because the kernel values given in the assignment are included in these filters. In addition, the small value difference was changed in the edit section and made in accordance with the assignment.

Sum of edge detection filters and threshold applied ;

As you can see in Figure 2, an image was obtained that highlights all the borders in the image. Because this image clearly reveals boundaries in all directions, it highlights important details and boundaries in the image.

This image is useful for distinguishing an object facing any direction.

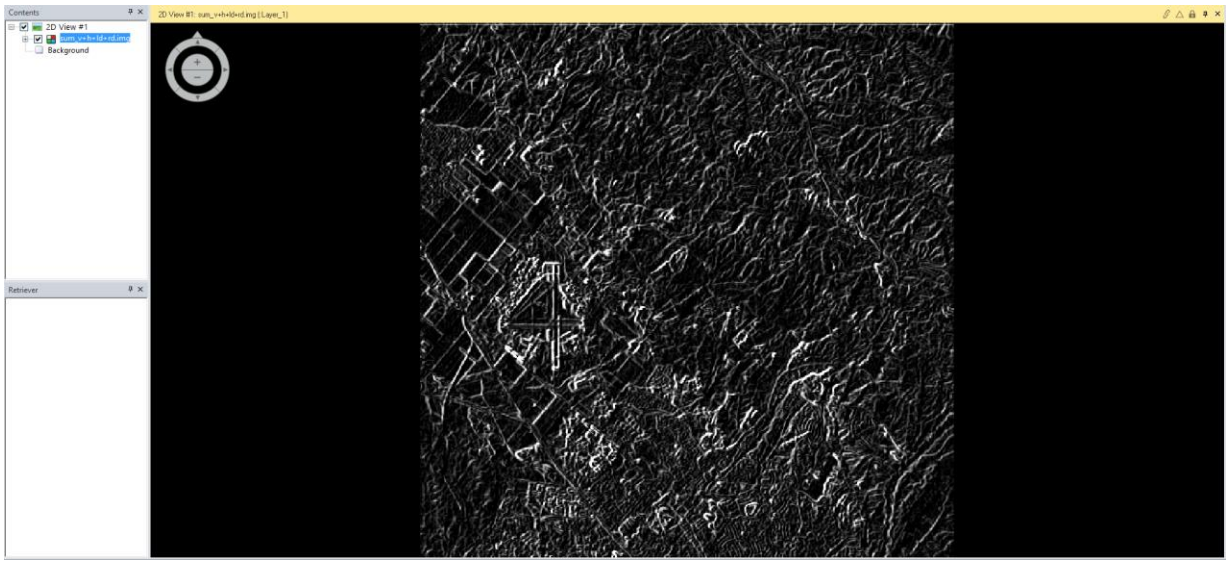

Figure 2 : Total state of edge detection filters (SUM_V_H_LD_RD.img)

I applied Threshold to the sum file of edge filters with Erdas software as requested in HW2.

As seen in Figure 3, I got the pixel values from the histogram of the image and determined a threshold value based on this. Then, by following the steps "Pacnhromatic → Adjust Radiometry → Breakpoints" in Erdas, the breakpoint plugin was opened and the threshold value was fixed at 99.

I analyzed that it is necessary to keep the threshold value lower to extract the edges. A high value made the details in the image clear, while a low value compared to the pixel values in the image made the edges more prominent.

The goal here was to extract the image and the edges were successfully highlighted as seen in Figure 3. (" Normalize the Kernel" box was open in kernel operations)

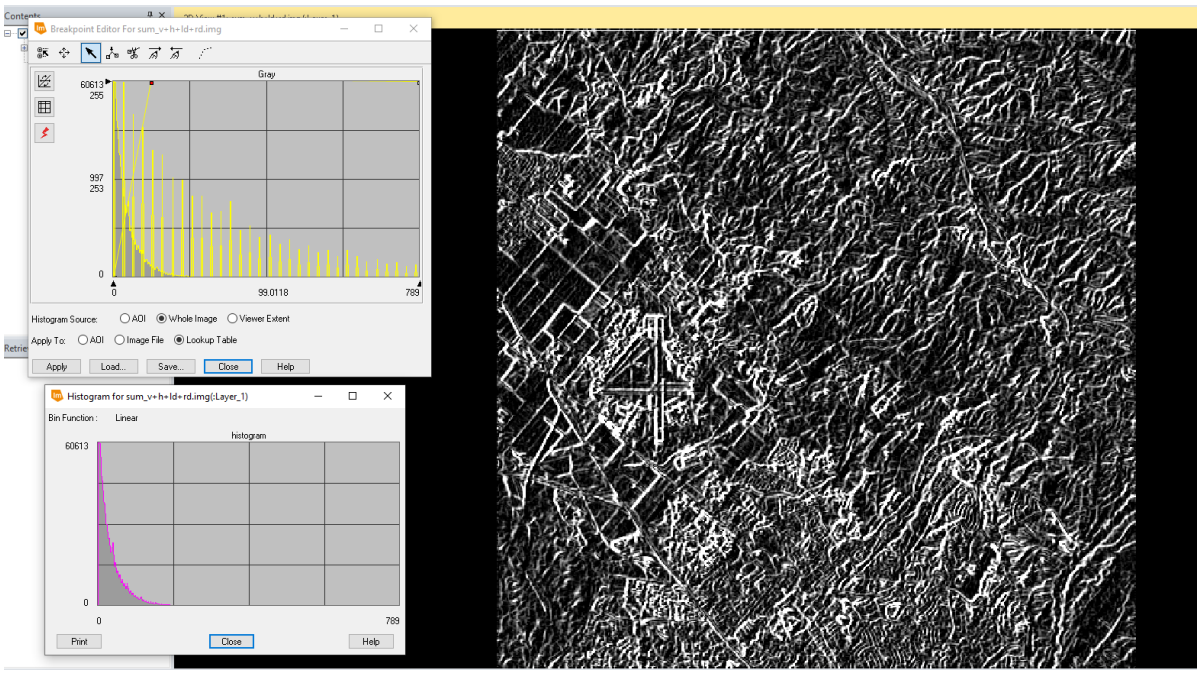

Figure 3 : THRESHOLD OF SUM OF EDGE FILTERS (Horizontal + Vertical + Right Diagonal + Left Diagonal)