

Introduction

This assignment is centered around OBIA and the software eCognition. Based on a Quickbird image of downtown Salzburg as well as a raster file of the Air Quality (in percent), classifications and segmentations are performed.

Firstly, both rasters are loaded into eCognition and visualized

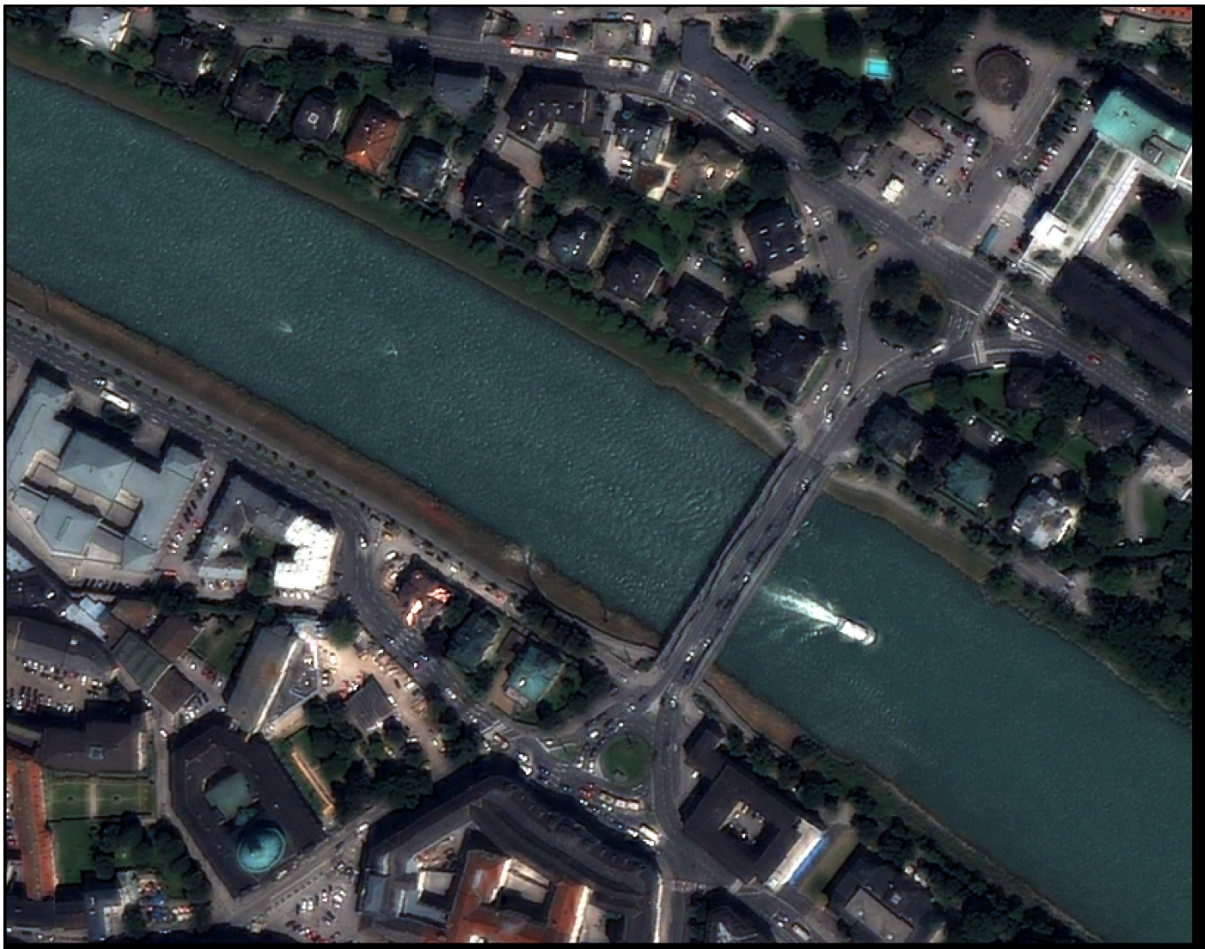


Figure 1: RGB Image of the AOI.

Chessboard Segmentation

In order to create pixel segments, which can then be more closely inspected, a 10x10 pixel chessboard segmentation is drawn across the image.



Figure 2: Chessboard Segmentation into 10x10 pixel segments.

The *Object Image Information* window can show the spectral properties of each segment.

For this exercise, the following information is displayed:

- Mean and Maximum value of blue band
- Area and Shape of the Object
- NDVI value, as calculated by the formula $(\text{NIR} - \text{RED}) / (\text{NIR} + \text{RED})$ in a customized feature

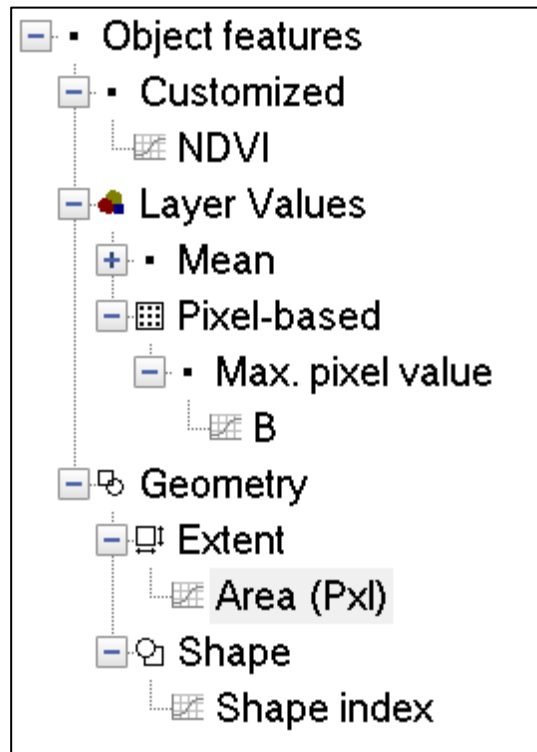


Figure 3: Object Information Window listing the information selected.

Now, these values are investigated both for an object in the water as well as the boat on the water.

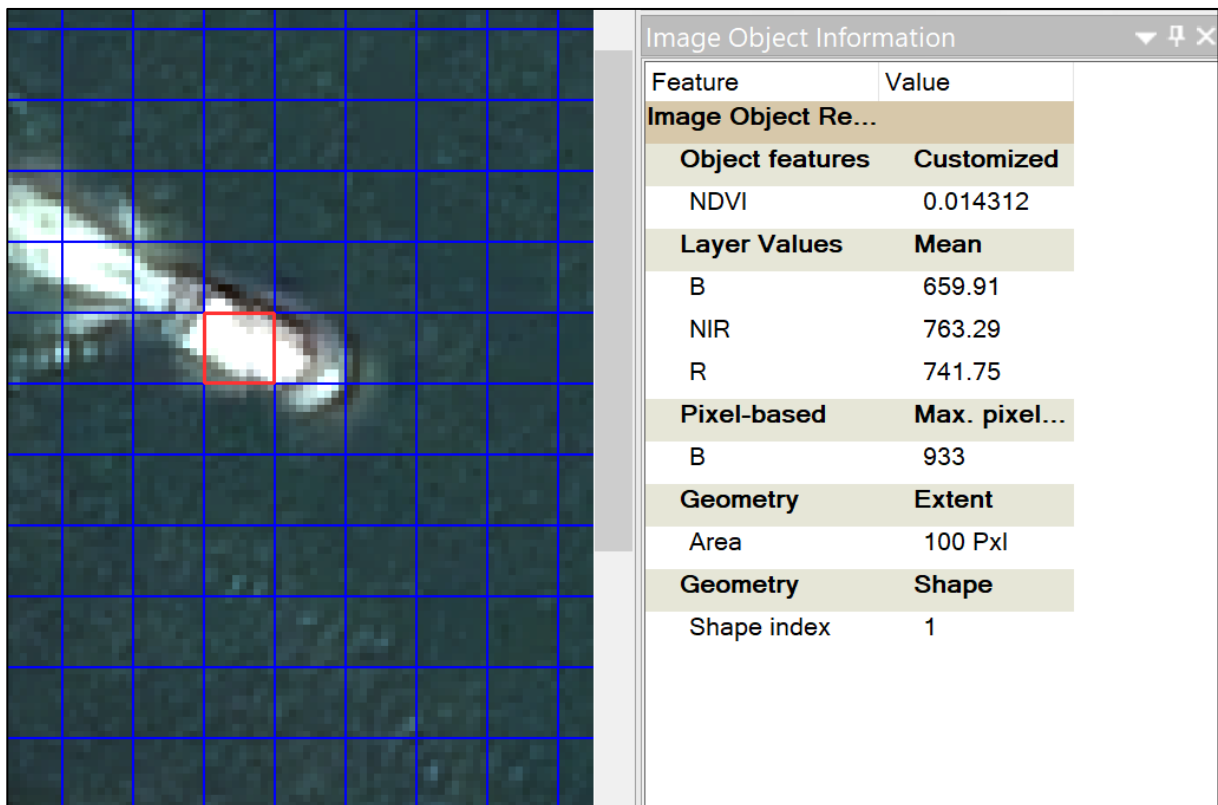


Figure 4: 10x10 pixel boat segment selected, showing the according segment information.

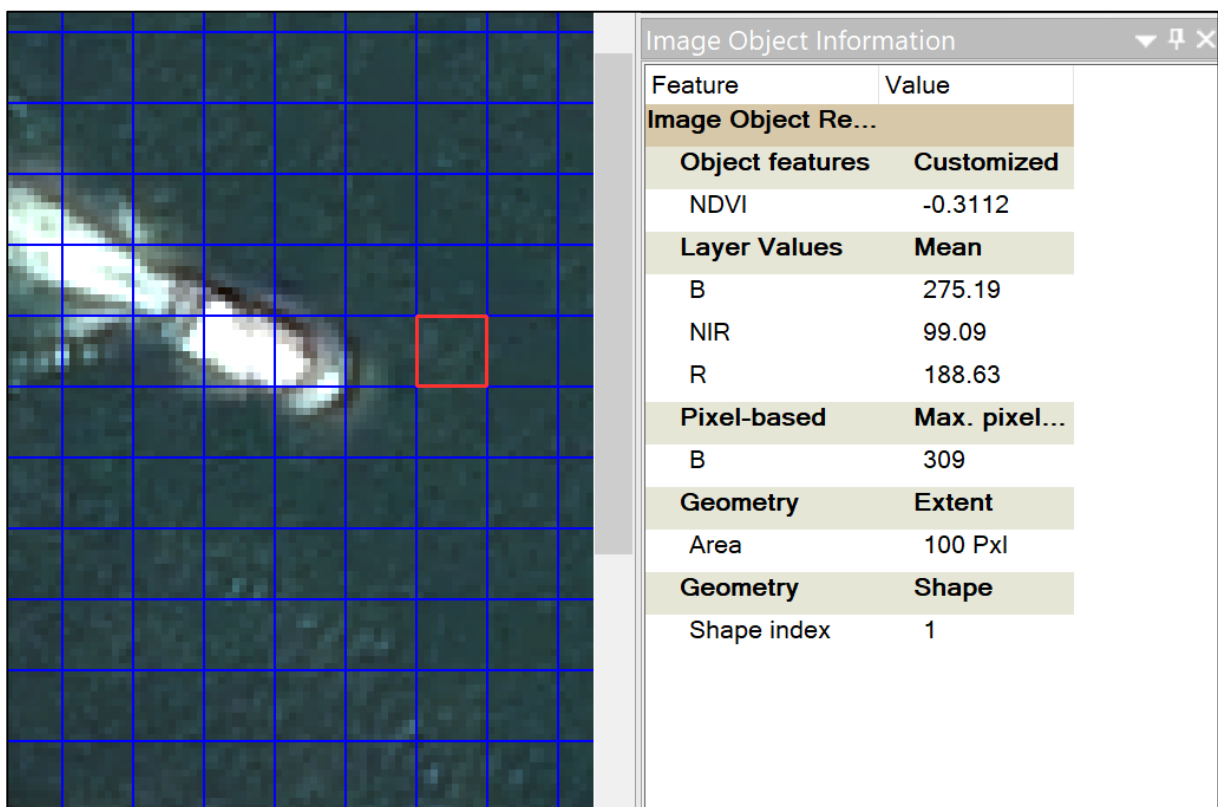


Figure 5: 10x10 pixel water segment selected, showing the according segment information.

Both objects are **parts of the 10x10 pixel chessboard image segmentation and therefore have the same size and shape index**. The mean values of the water are lower since the water appears darker, while the bright reflective surface on top of the boat has higher mean values. The NDVI of course also differs, the water object has a value of under -0.15, confirming the visual interpretation that water is present at this object. The NDVI of the boat object is close to zero, showing that there is no vegetation present.

Multiresolution Segmentation

Now, a segmentation more in line with the actual zones in the image is created. The *Multiresolution Segmentation* feature in eCognition, with a scale value of 200, now segments the image along spectral in geometrical areas of conformity.



Figure 6: Multiresolution segmentation with a scale parameter of 200.

Now, both the *water* and *boat* segments are investigated again regarding the same spectral characteristics.

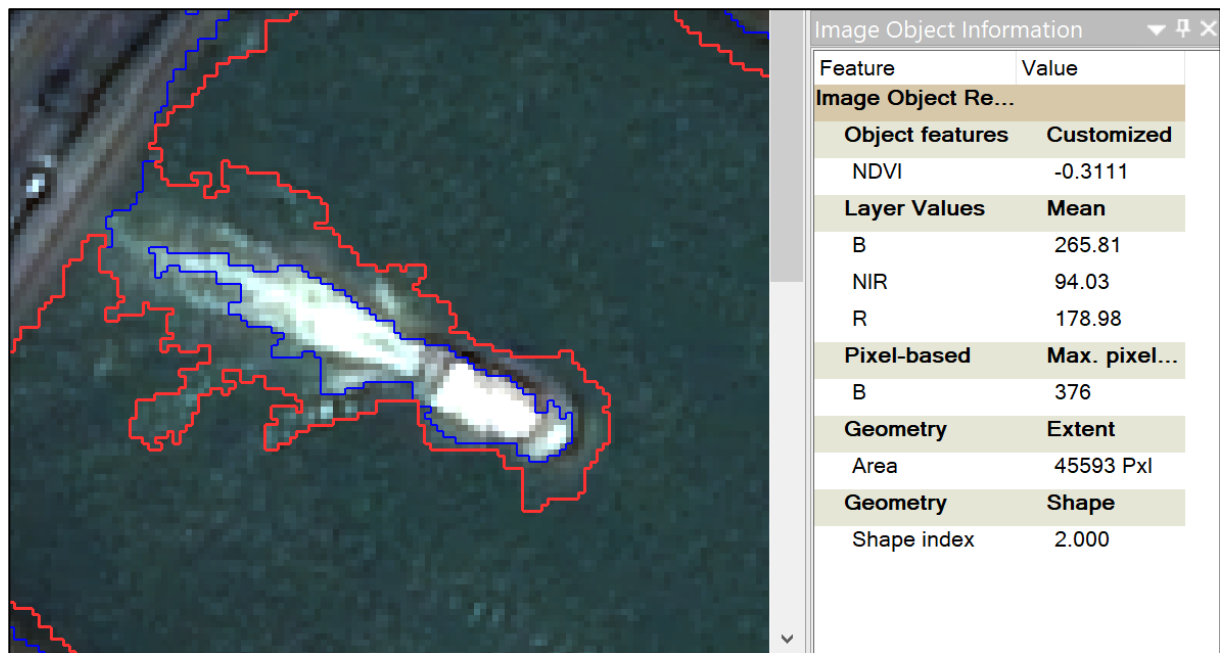


Figure 7: Water segment selected, showing the according segment information.

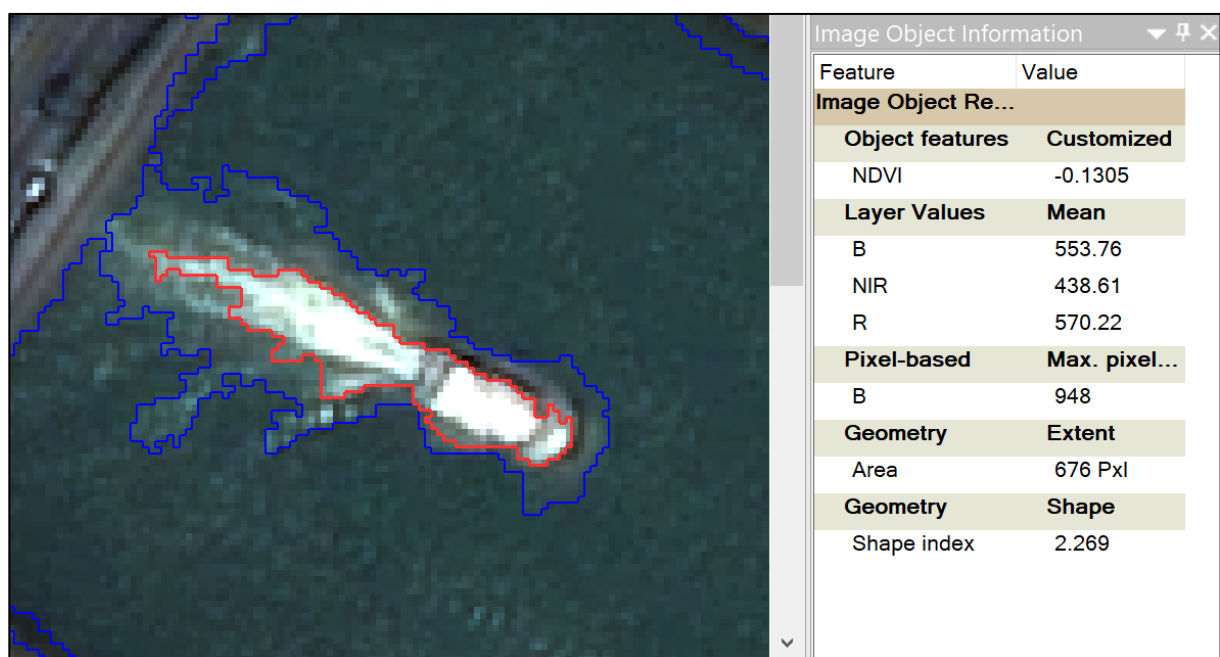


Figure 8: Boat/disturbed water segment selected, showing the according segment information.

Since we don't divide the image into the pre-defined chessboard-pattern anymore, the shape and size of segments are not pre-defined and therefore vary within the image. In this segmentation, the algorithm identified an area of conformity for both the boat and the disturbed water around it, another for undisturbed water, and a third segment for mildly disturbed water in between the boat/whitewater and the undisturbed water. Since all of the water surface west of the bridge is correctly identified as one segment, the size is very large. The NDVI values of the boat and water areas are still similar to the manually identified squares before, which is proof that the segmentation worked as intended.

NDVI calculation and visualization

Taking a step back and focusing on the whole image again, the NDVI value of the whole Area of Interest is put into focus. Visualizing the average NDVI value across each segment creates a visual help in identifying high- and low vegetation segments as well as water. While blue represents NDVI values close to -1 and therefore water, high NDVI values close to 1 are depicted in green. The shadings in between show areas with varying degrees, with 0 and therefore no vegetation/artificial surfaces in the middle of the color range.

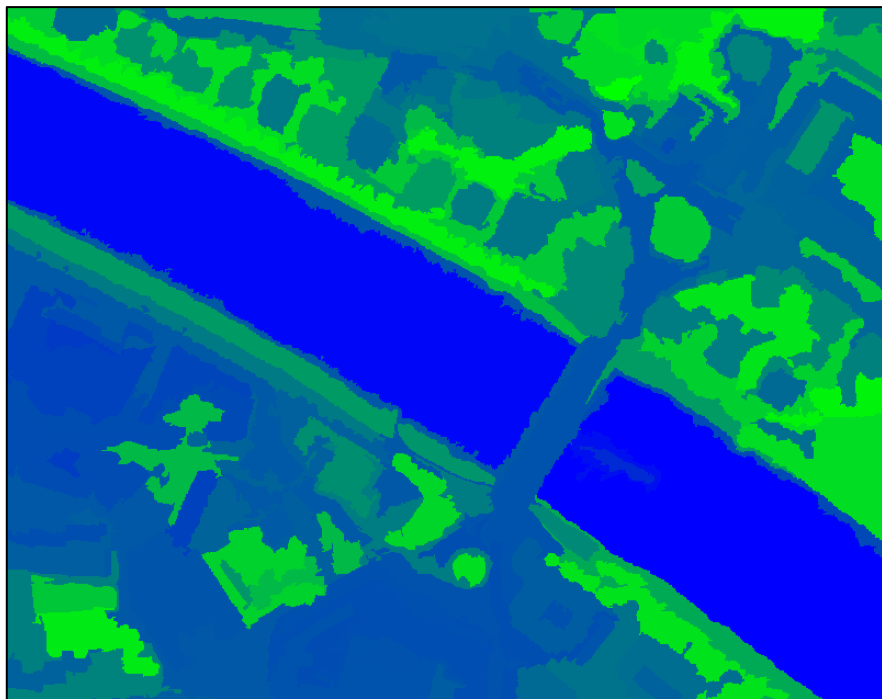


Figure 9: Image segmentation visualized by the average NDVI across this segment.

In order to classify vegetation and water, the thresholds of <-0.15 for water and >0.25 for vegetation are set. The *Assign Class* feature in the *Process Tree* can classify the segments based on this custom NDVI condition. The average NDVI segments in between those thresholds are not classified. Visually inspecting the classification and the underlying RGB image, it seems that except for a few artifacts, the classification has worked as intended.

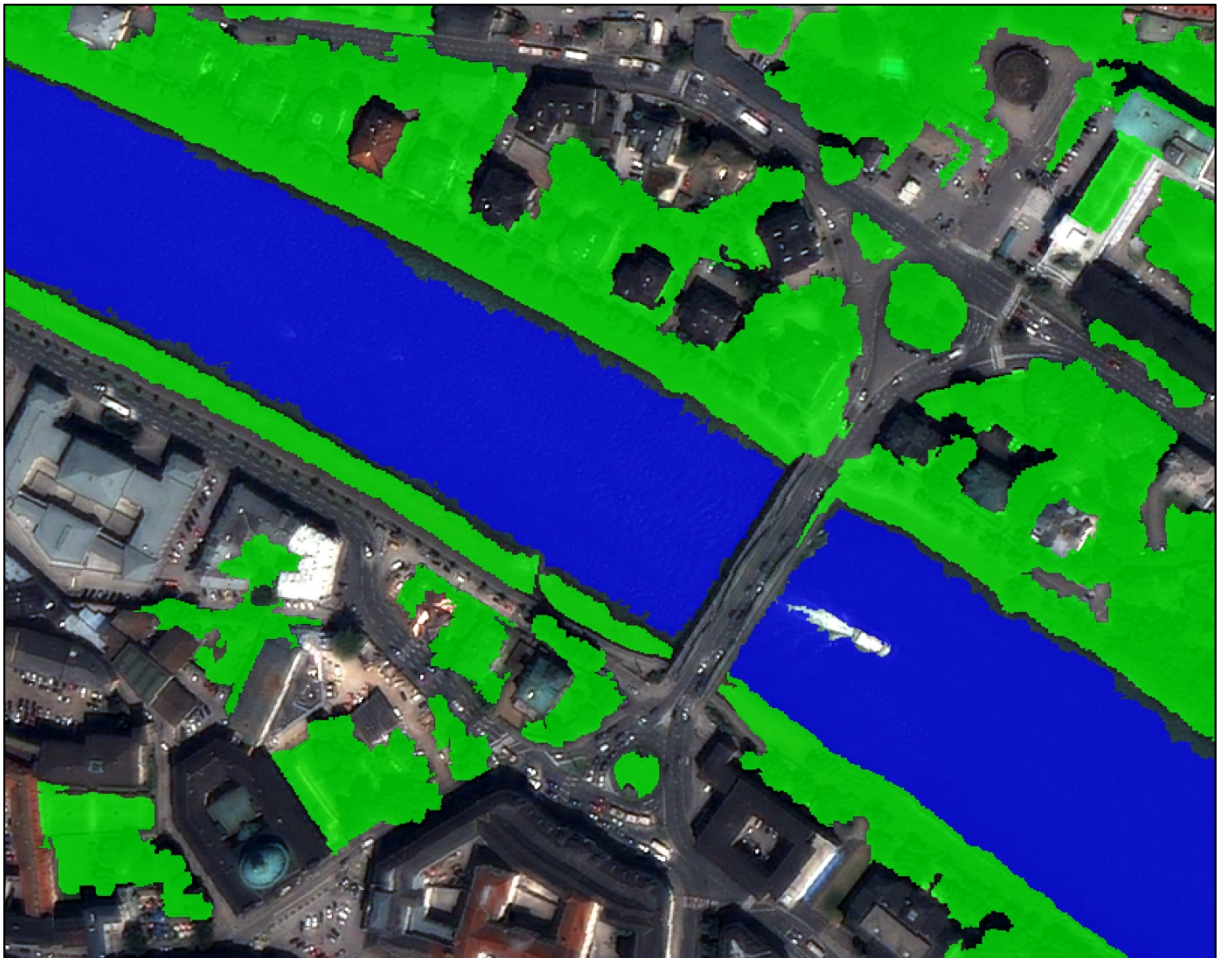


Figure 10: Image segments with average NDVI values above the vegetation threshold (green) and below the water threshold (blue).

Using *Class-related Features*, further classification can be done. Looking at the image, it is clear that geometrically, the main characteristic distinguishing the boat on top is that it is completely surrounded by water. The aforementioned classification can be based on the relative border of one segment to another, therefore assigning the condition as 1 should return all segments that are completely surrounded by segments already classified as “water”.

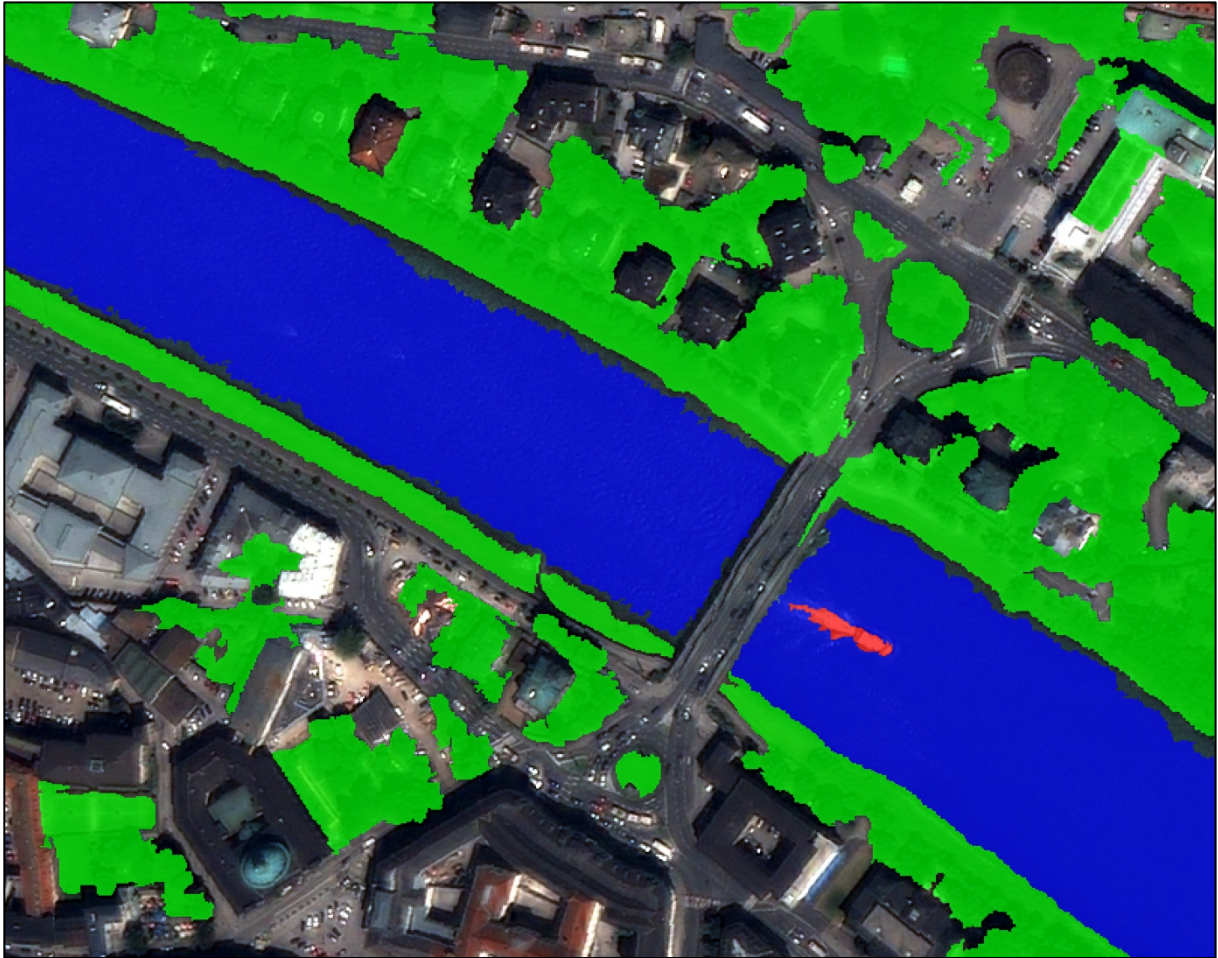


Figure 11: Adding a class for those segments, that are 100% surrounded by water segments. In this case, this is only the boat (red).

Air Quality in vegetated segments

Next up, the question is posed which of the vegetation areas have a high- or low air quality. In order to identify those areas, the *Class-related Features* functionality is used again. This time, for each segment, the average Air Quality value is calculated. If this value is over 50%, the segment is classified as high quality, otherwise as low quality. Since the classes “High Air Quality” and “Low Air Quality” were created as sub-classes of vegetation, only the segments previously classified as vegetated areas are taken into account. **Therefore, if the Air Quality classes are collapsed, the green vegetation areas are displayed again, since they are higher in the hierarchy.**

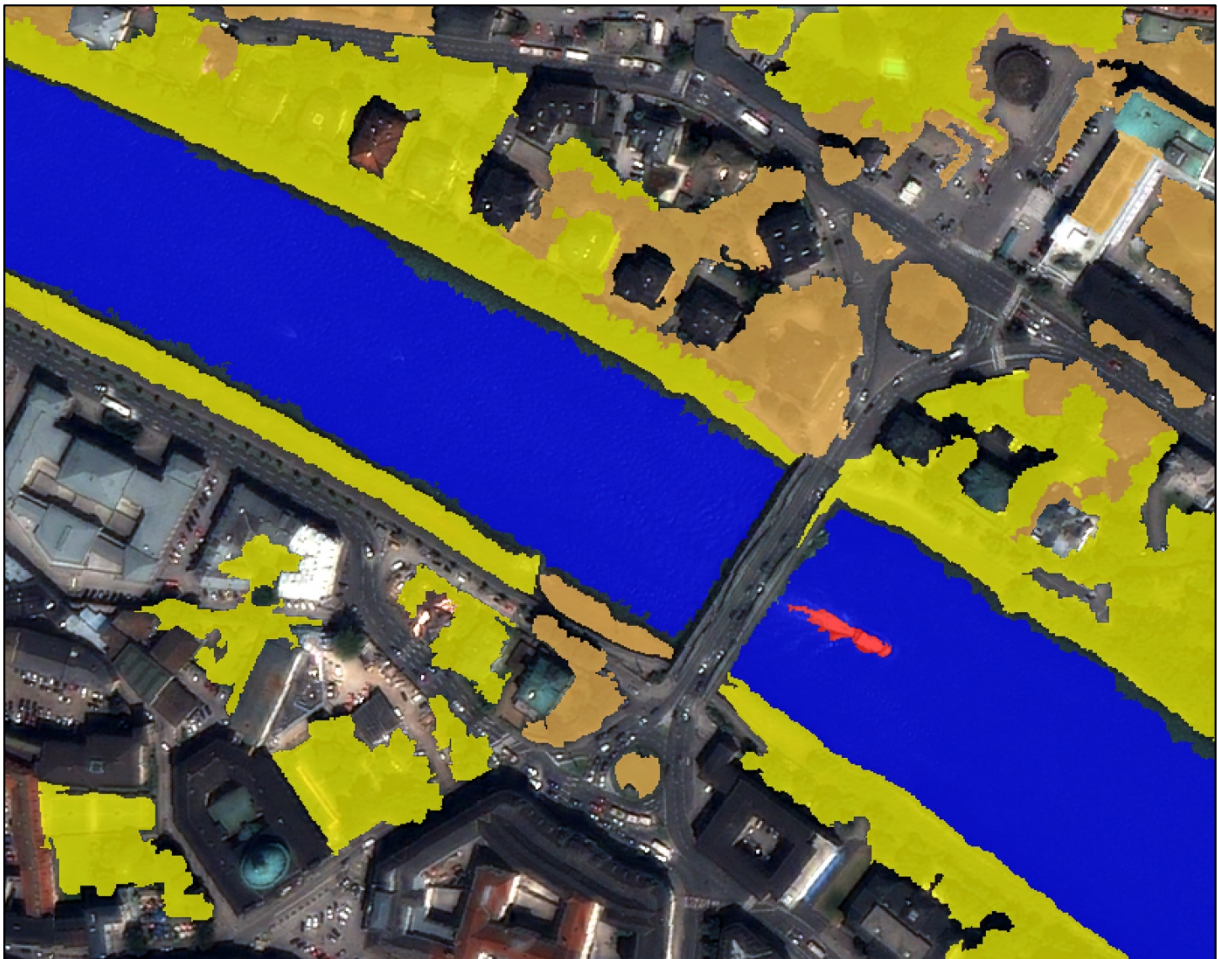


Figure 12: Vegetation segments, visualied by their air quality.

Scene Features

If we now want to find out the **quantity of areas classified as vegetation** or water as well as the **area of the vegetation class**, the Scene-related Features offers some insights. It can display the amount of segments classified as water/vegetation, as well as the area of those segments. **Sub-classes are added into their supra-classes.**

Scene Related F...	
Class-Related	Number of classified objects
water	3
Class-Related	Area of classified objects
vegetation	154321 Pxl

Figure 13: Scene Feature View, answering the questions posed above.

Different levels of Segmentation

Finally, another *multiresolution segmentation* is performed, this time with a scale parameter of 50. The segments will be smaller in size and finer in segmentation, therefore they are sub-segments of the previously created higher level of classification.



Figure 14: Multiresolution segmentation for a scale parameter of 50. This segmentation has been created „below“ the previous segmentation in the hierarchy of this eCognition project.

Taking a look at *Class-related Features* again, using the *Existence of* option in the *Relations to super objects* folder allows the user to find and select those areas, that are within supra objects. Setting the **distance variable as 1** returns a **Boolean true/false value**, where 1/true stands for within the chosen class, which is in this case vegetation. All those sub-classes, that are within the vegetation class, are therefore highlighted.

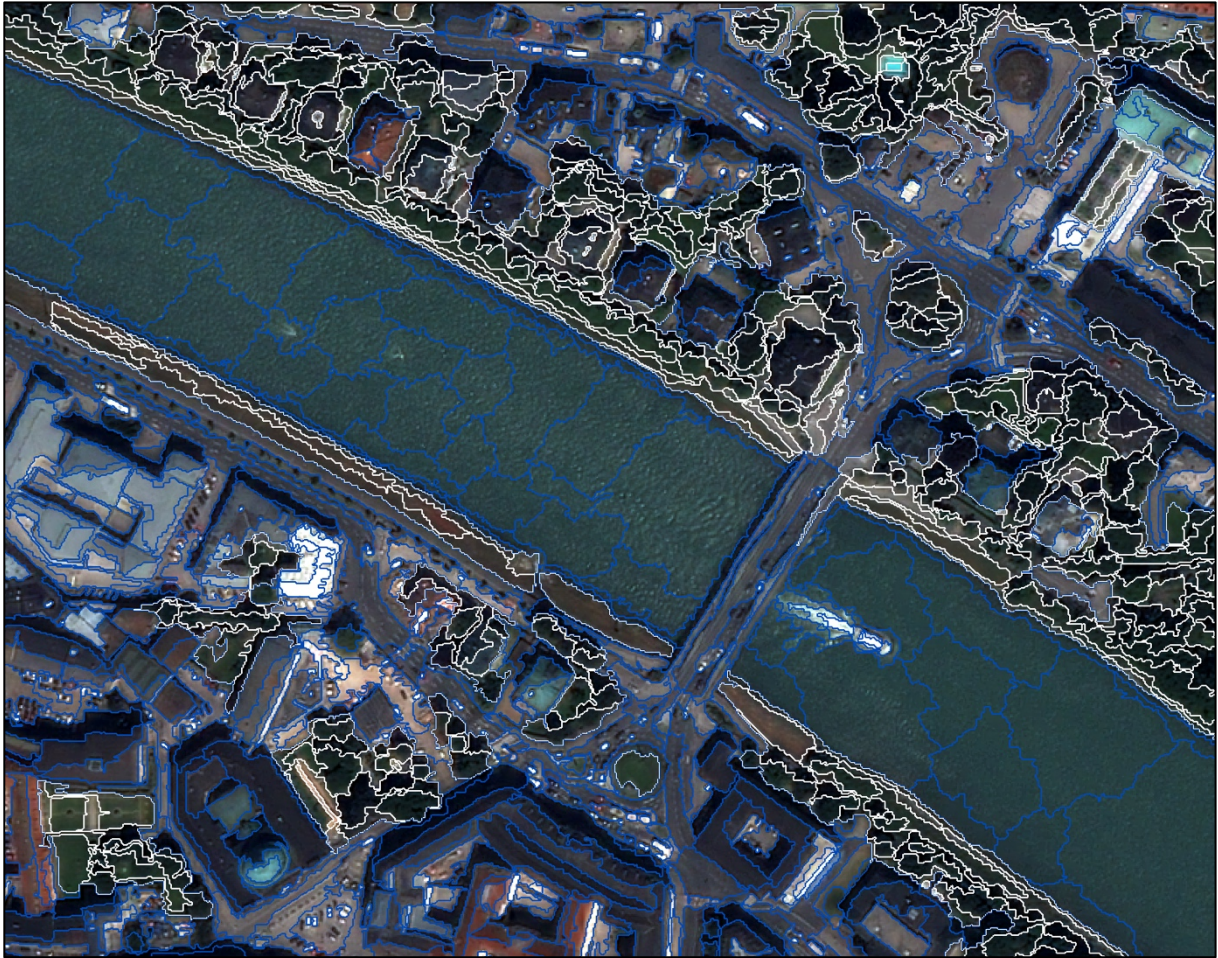


Figure 15: Sub-Segments, visualized in white if their super-segments above in the hierarchy are classified as vegetation.