TP 3: Neighborhood descriptors

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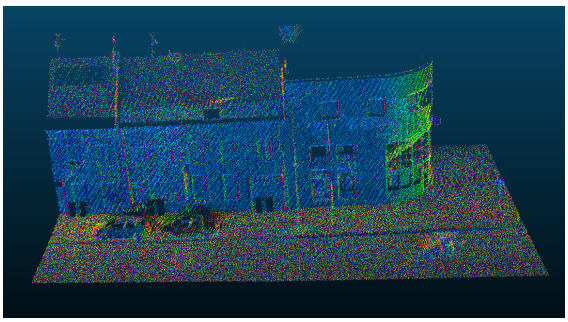
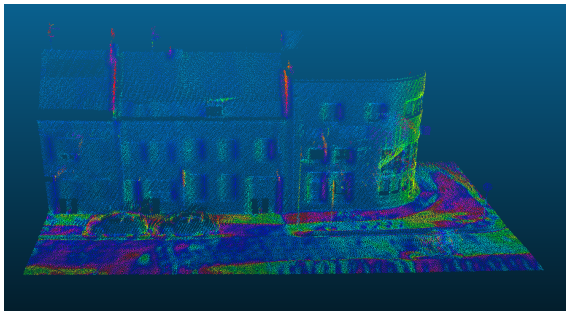
1 Question 1

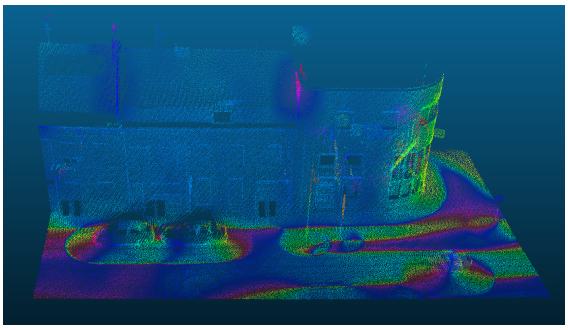


radius = 0.1m

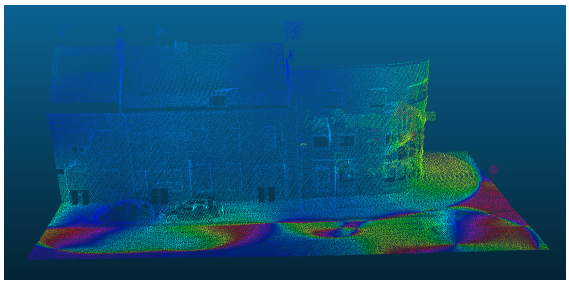


radius = 0.5m

Figure 1: Vertical direction representation of the normals (Dip direction)



radius = 2m



radius = 5m

Figure 2: Vertical direction representation of the normals (Dip direction)

If we use a too small or a too big radius, the estimation of the direction of the normals can be too smooth (images in figure 2) or not sufficient smooth as in image on the left from figure 1.

2 Question 2

To have a good normal estimation, we have to choose the right neighborhood scale. I think to choose it, we need to test it with different values of the radius and choose the one which seems to be the best in the visualization as in question 1.

3 Question 3

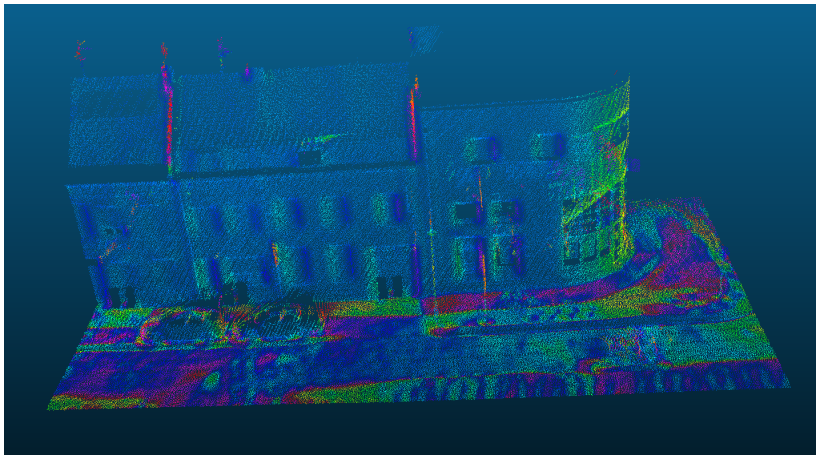
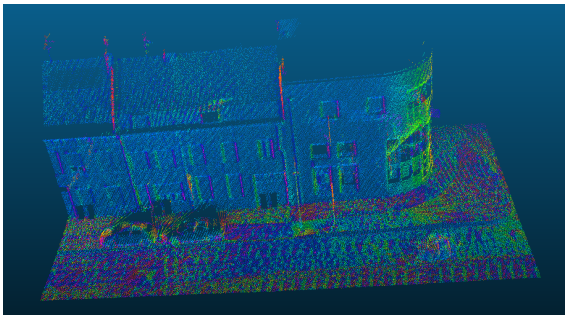
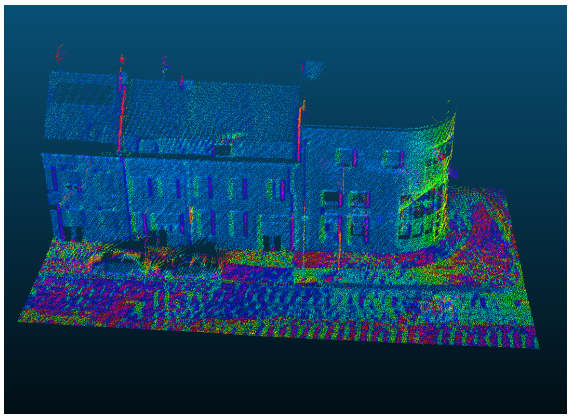


Figure 3: Normals converted as "Dip" scalar field (radius = 0.5m)

4 Question 4



K-nearest-neighbors (k = 30)



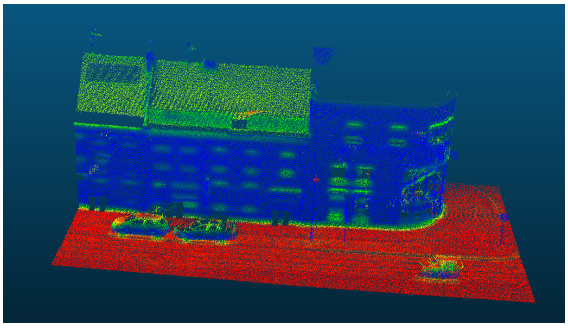
K-nearest-neighbors (k = 50)

Figure 4: Normals converted as "Dip" scalar field

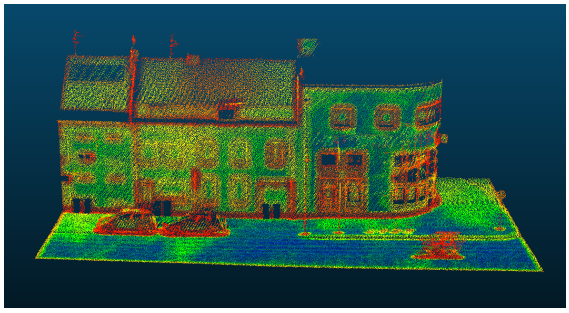
This time with the K-Nearest-Neighbors the normals are least smooth than when it was with the radius method. This can be explained by the fact that the nearest neighbors of a

reference point can have normals that are quite different from the normal of the reference point. With the radius method it's still the case, but it can capture the normals from more points and therefore do a smoothest average around the reference point.

5 Question Bonus

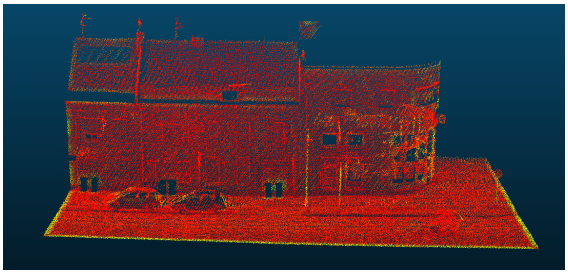


Verticality

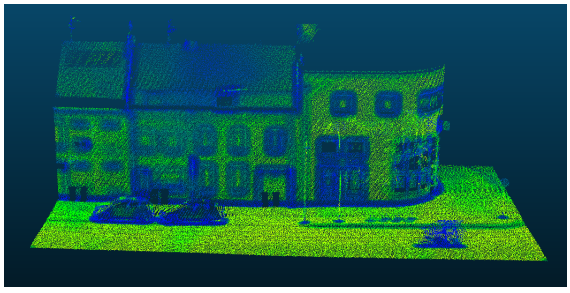


Linearity

Figure 5: Features computed with a radius of 0.5m (epsilon= 10^{-4})



Planarity



Sphericity

Figure 6: Features computed with a radius of 0.5m (epsilon= $10^{|4}$)

Linearity: If the points are strongly aligned in one direction (like a line), λ_1 will be much larger than λ_2, resulting in a high linearity value close to 1.

Planarity: If the points are distributed mostly along a plane, λ_2, will be much larger than λ_3, giving a high planarity value.

If the points are distributed uniformly in all directions (forming a spherical shape), λ_3 will be relatively large compared to λ_1, resulting in a high sphericity value.