
Topological Data Analysis – group project

Sensors

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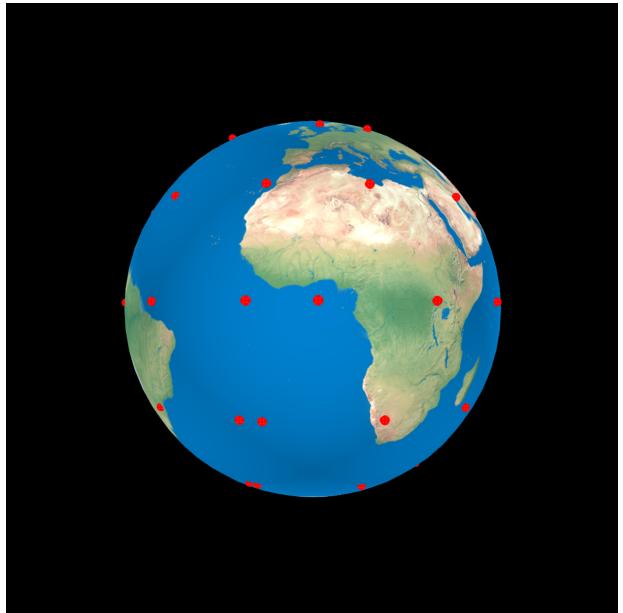
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1 Introduction

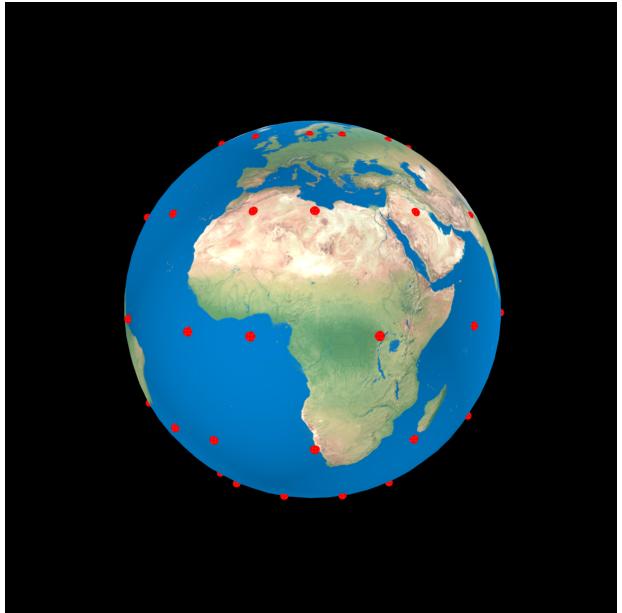
In this project we are trying to find optimal parameters for a sensor network which covers the whole surface of the earth. The network is determined by two parameters:

- r , which is the distance over which the sensors can communicate with each other – each sensor can communicate with other, if they are at most r away.
- R , which is the radius of the surrounding area in shape of a circle where the sensor can gather data.

Given the coordinates of each sensor, we had to determine lowest possible parameters r and R so that: The parameters have to be as low as possible (to reduce the cost of sensors), the whole network has to be connected and the whole surface of the Earth has to be covered.



(a) sensors01.txt



(b) sensors02.txt

Figure 1: Locations of the sensors

2 Connectivity

TODO: VR complex, increasing r until we get 1 component.

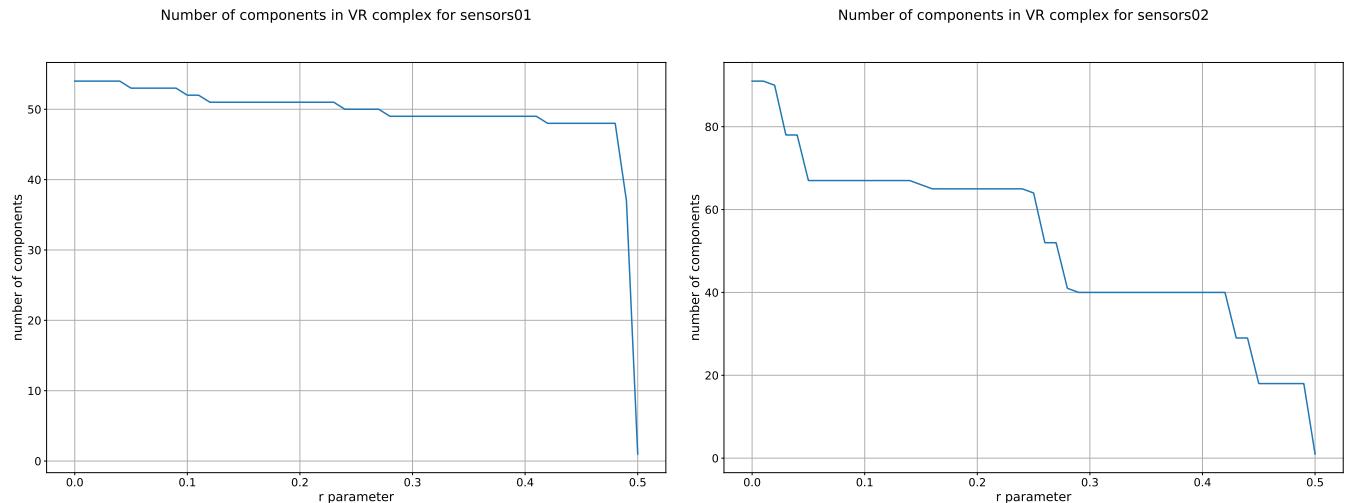


Figure 2: Number of components as we increase the r parameter

TODO: malo komentarja na graf

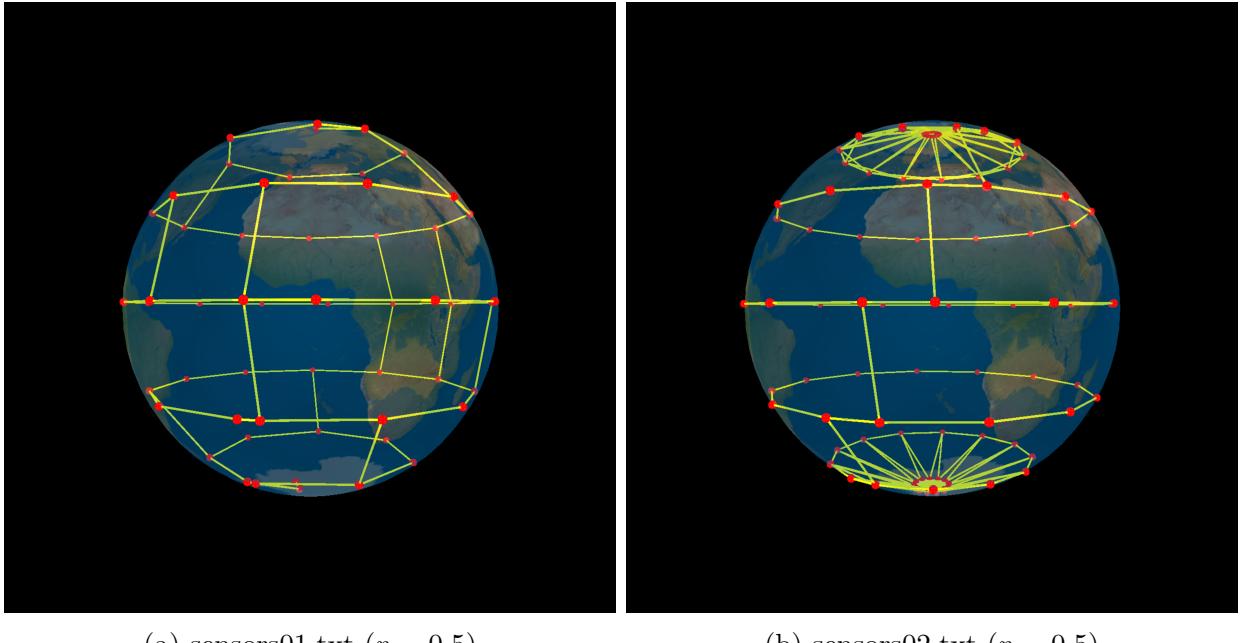


Figure 3: Connections between sensors

3 Coverage

TODO: Čech complex, increasing r until Betti number b_1 is 0 (zero cycles/holes). plots (homology, barcode), 3d image

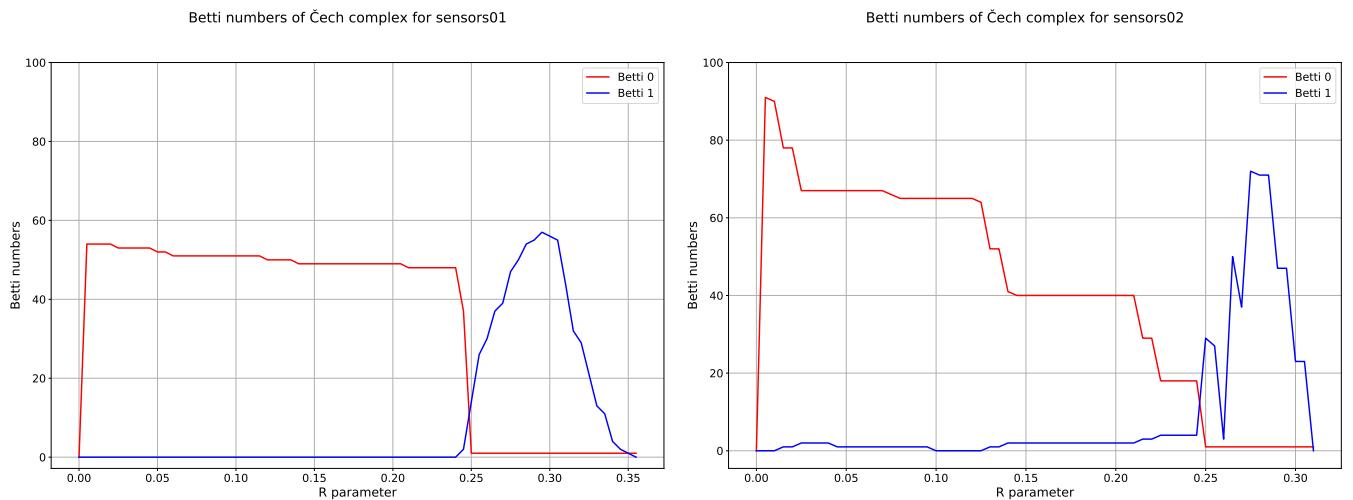


Figure 4: b_0 and b_1 as we increase the R parameter

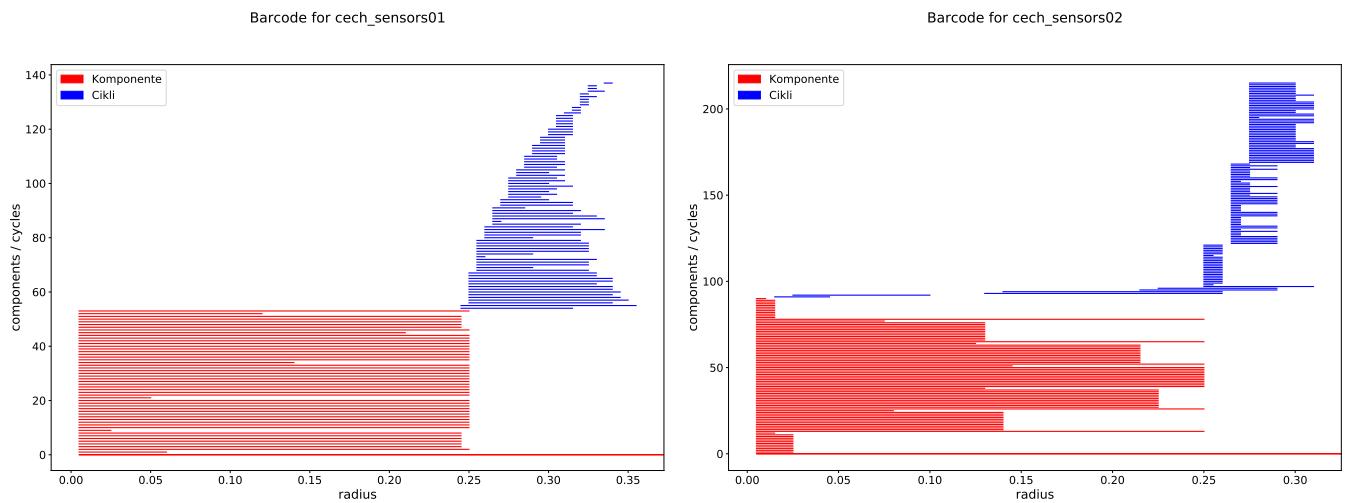
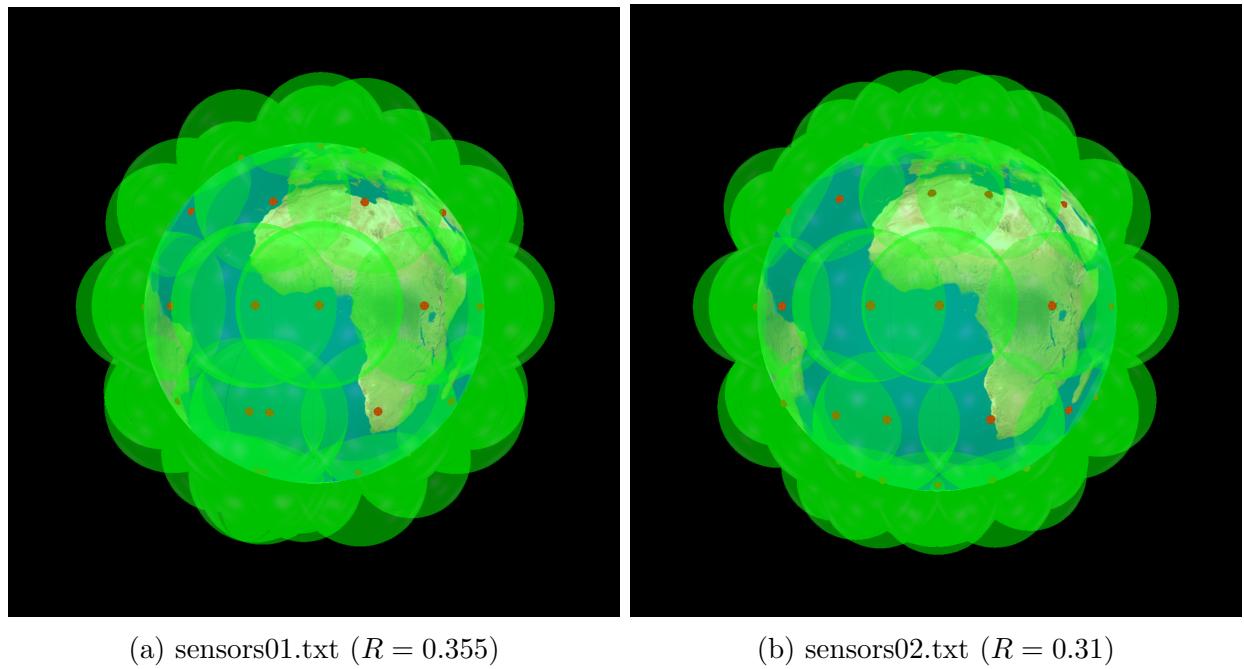


Figure 5: Barcodes for the Čech complex

TODO: malo komentarja na graf



(a) sensors01.txt ($R = 0.355$)

(b) sensors02.txt ($R = 0.31$)

Figure 6: Connections between sensors

4 Data generator

TODO: data generator

5 Redundant sensors

TODO: how we remove the sensors which are not needed

6 Conclusion

TODO

7 References

Mogoce napiseva samo nestandardne libraryje? dionysus, miniball, vpython Pa link na github