



UAS-Based LiDAR Mapping

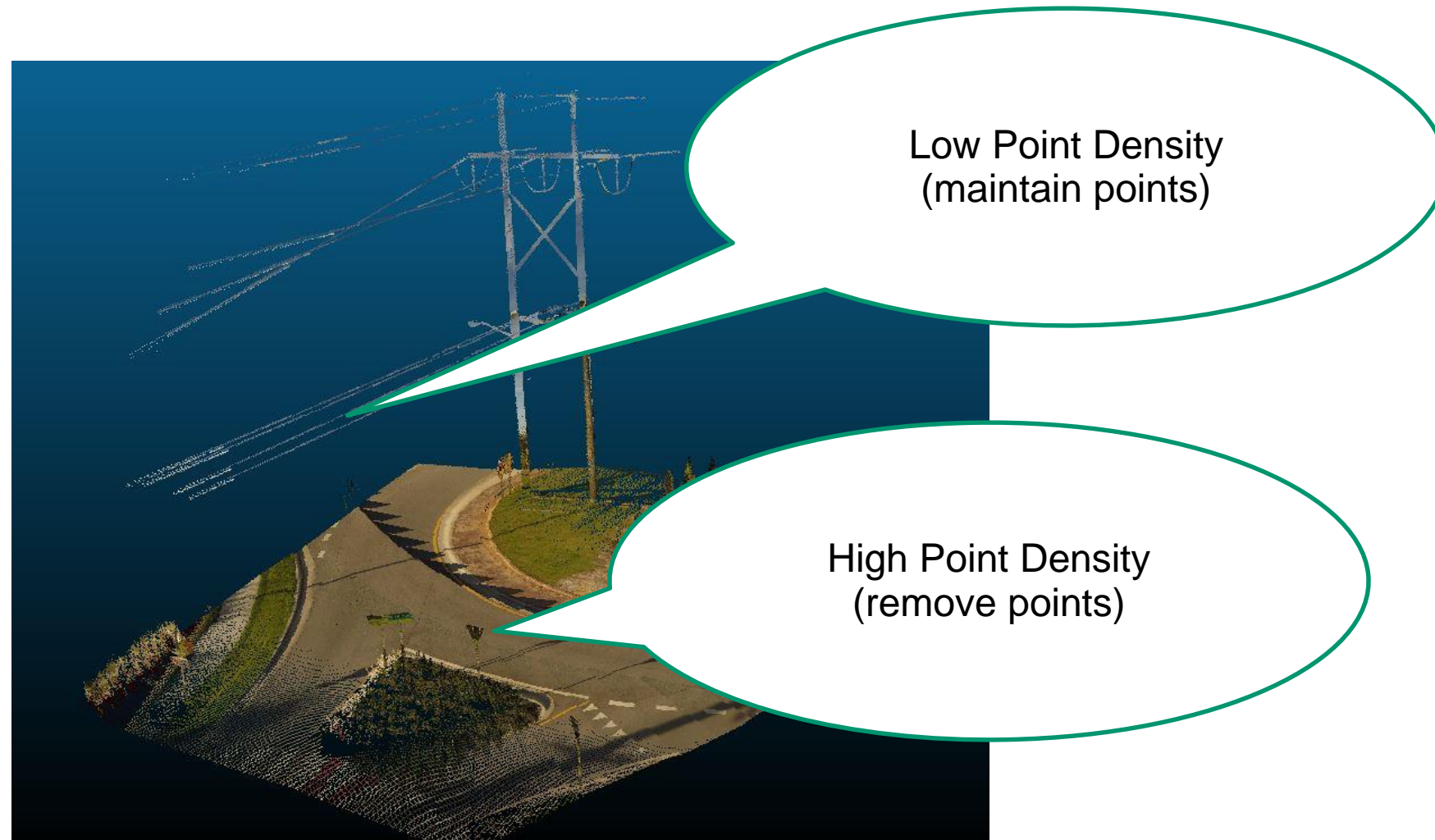
Video G-I



LiDAR Data Downsampling

LiDAR Data Downsampling: Introduction

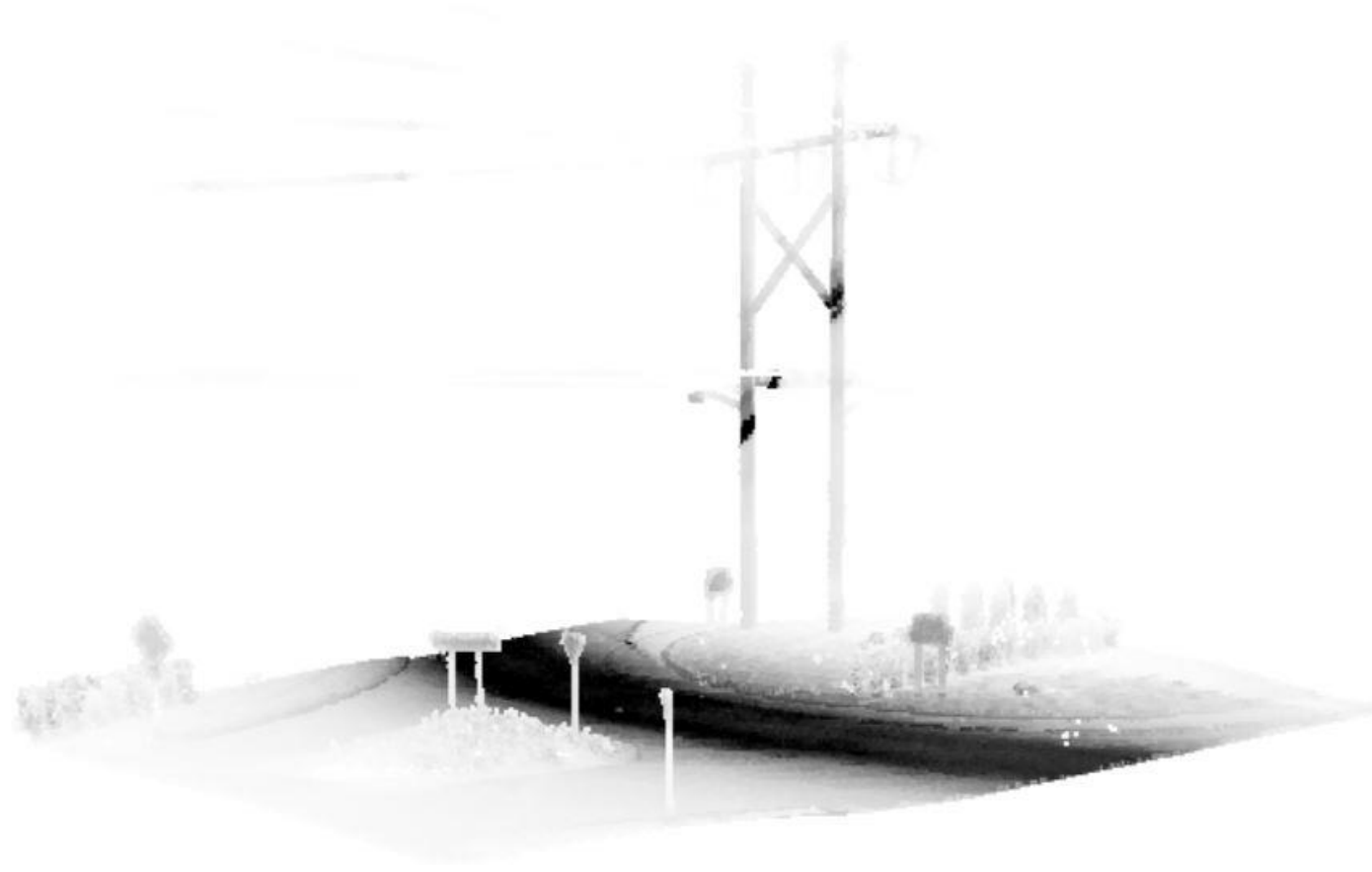
- LiDAR data downsampling while maintaining the information content



LiDAR Data Downsampling: Introduction

- LiDAR data downsampling while maintaining the information content

Original Data

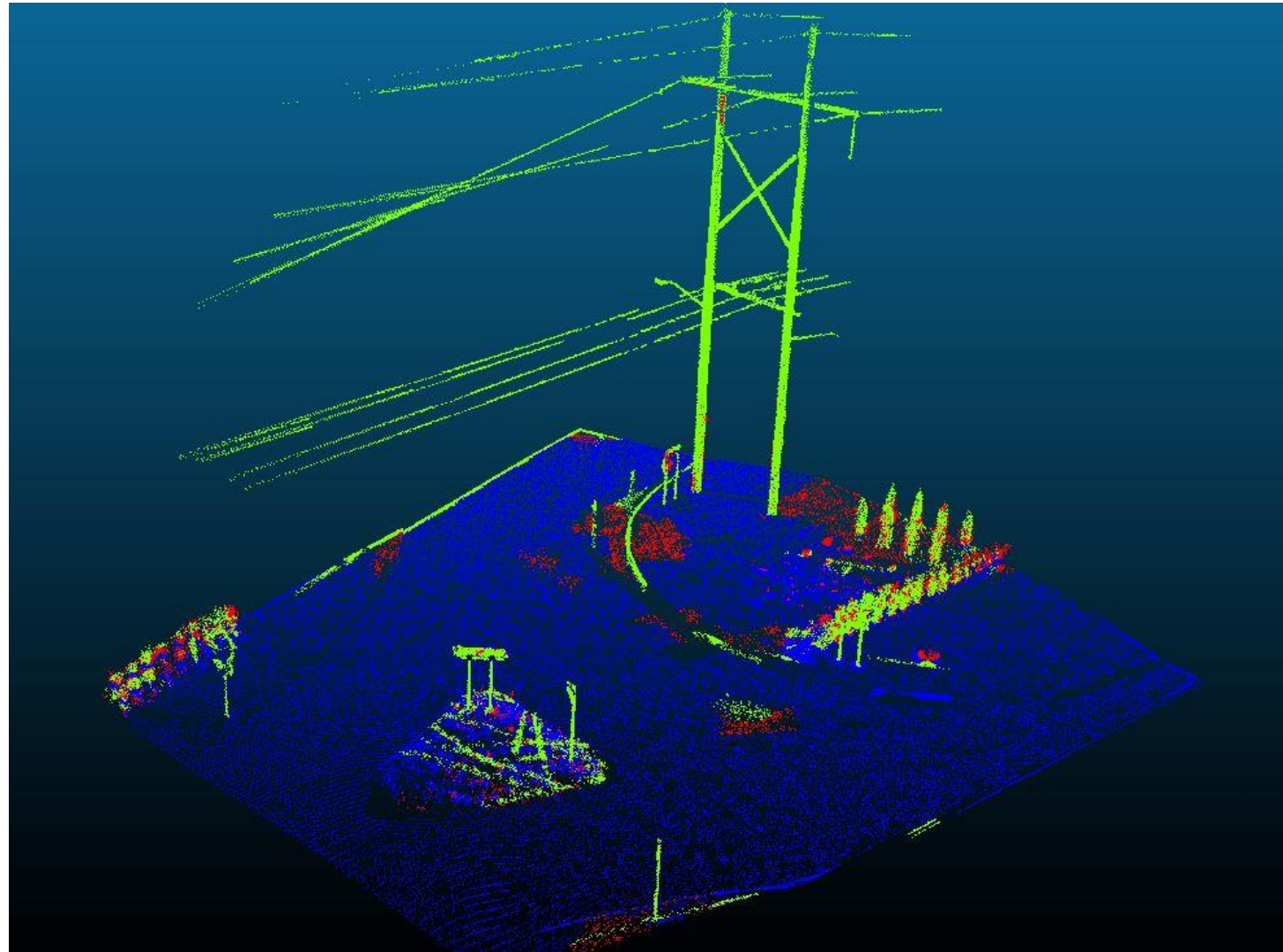


Darker points correspond to higher point density.

LiDAR Data Downsampling: Introduction

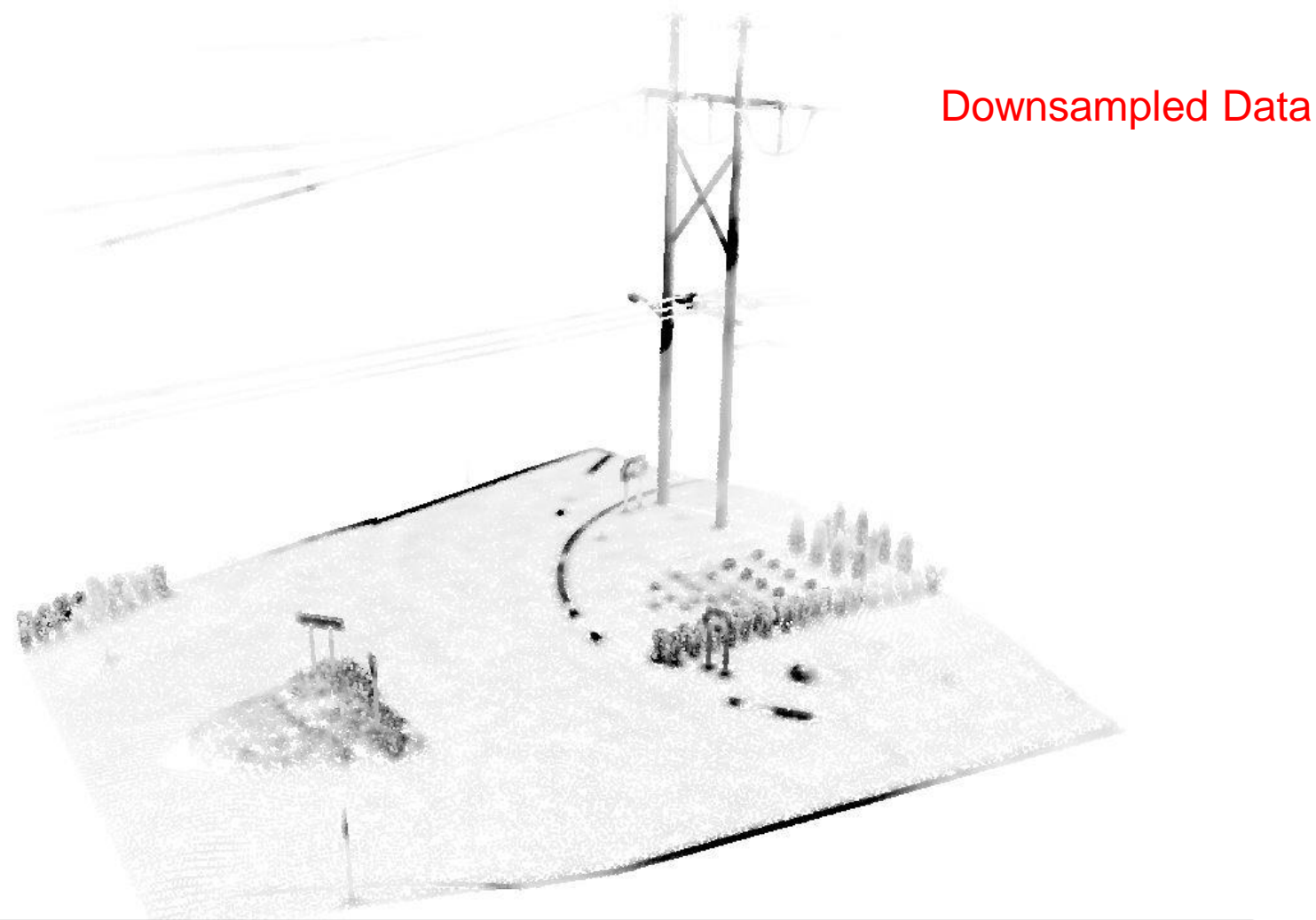
- LiDAR data downsampling while maintaining the information content

Original Segmented Data



LiDAR Data Downsampling: Introduction

- LiDAR data downsampling while maintaining the information content

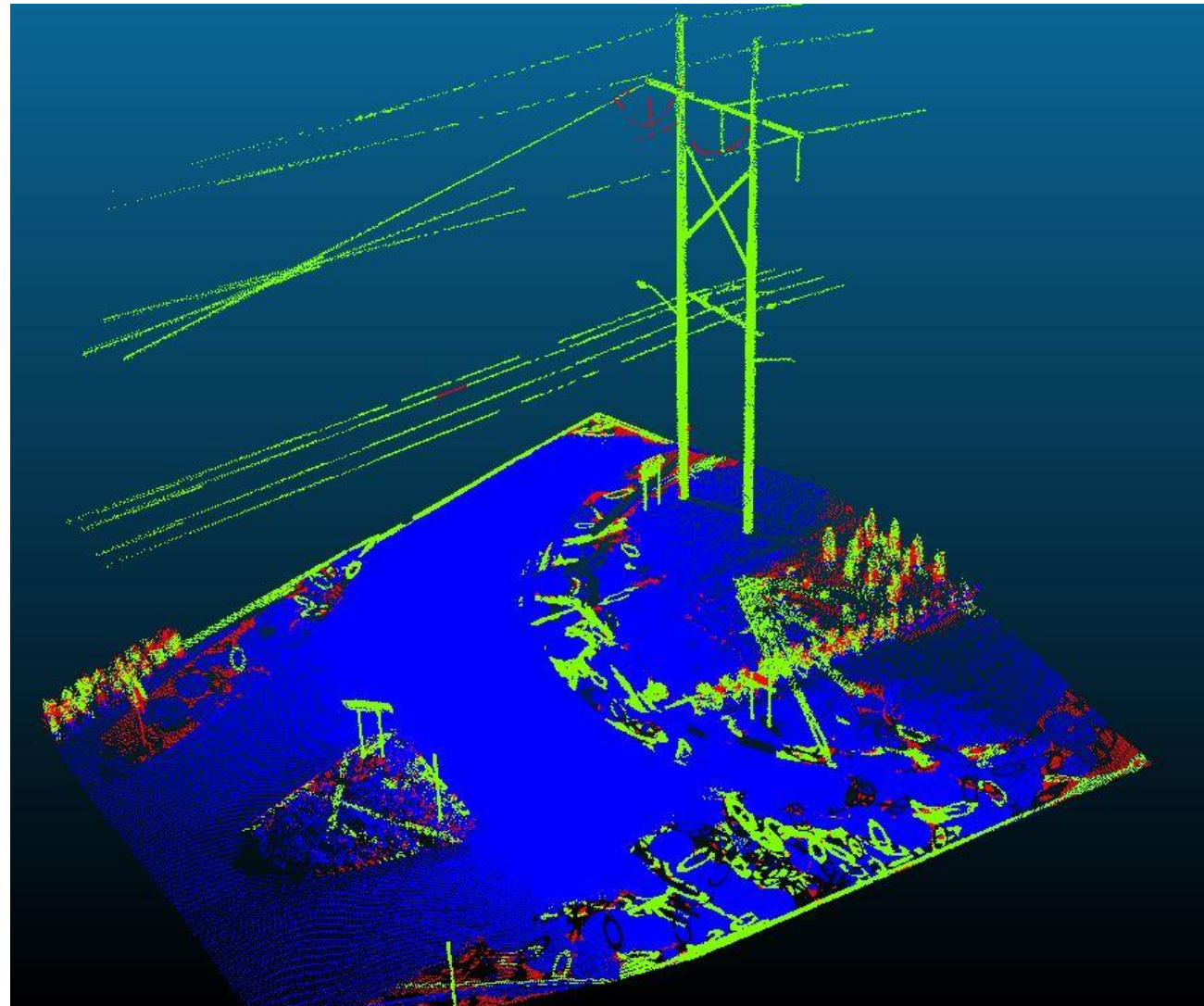


Darker points correspond to higher point density.

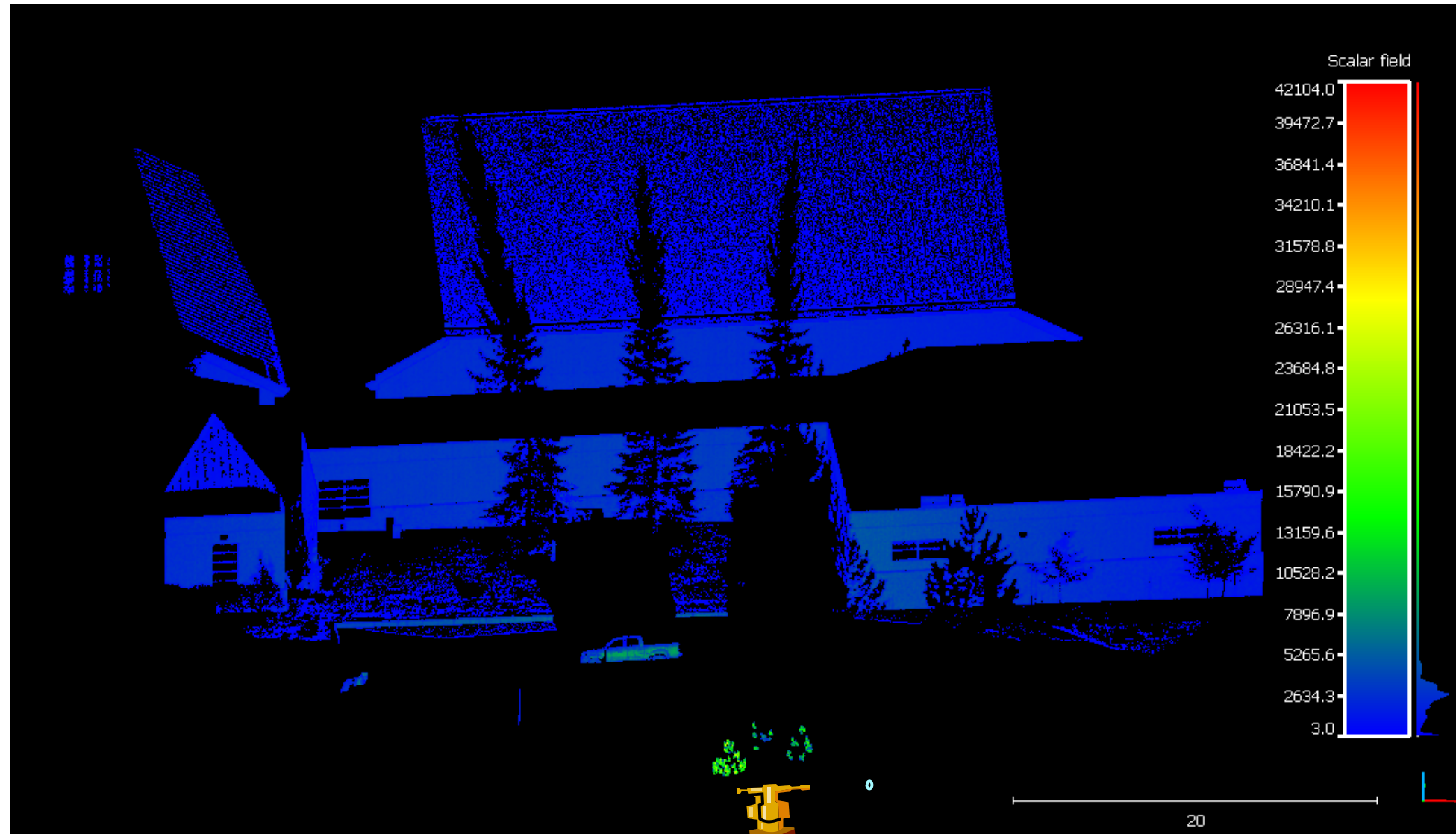
LiDAR Data Downsampling: Introduction

- LiDAR data downsampling while maintaining the information content

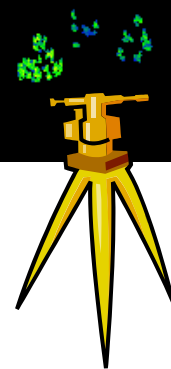
Segmented Downsampled Data



LiDAR Data Downsampling: Introduction



Density range up to 6000 pts/m²



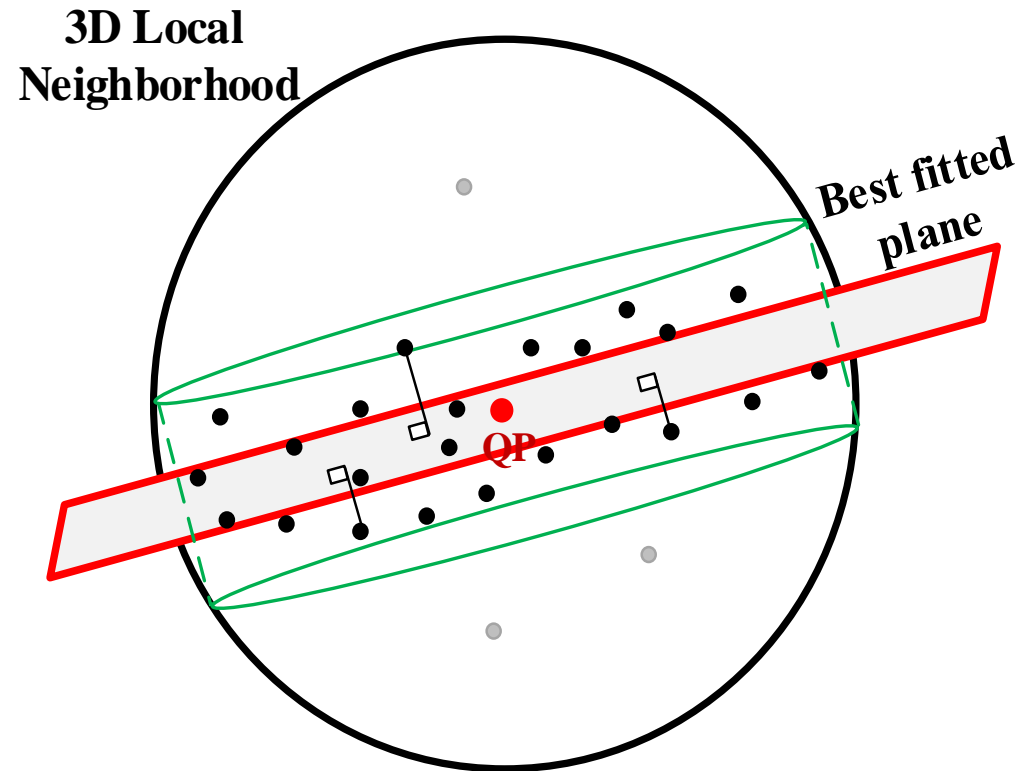
LiDAR Data Downsampling: Motivation & Objectives

- A downsampling process can help in reducing the segmentation execution time.
- An inappropriate downsampling might compromise the segmentation results.
- Some approaches do not consider the characteristics of the physical surface during the downsampling process:
 - Uniform downsampling
 - Distance-based downsampling
- **Objective: Propose an adaptive downsampling procedure that only removes redundant points.**
 - More points are removed in areas with high point density.
 - The majority of points will be maintained in areas with less point density.
 - The downsampling should consider the nature of the encompassing physical surface.

Adaptive Downsampling: Methodology

- **Purpose:** Remove points in high density areas and keep the points in low density areas.
- **Procedure:**
 - Calculate the point density
 - Adaptive downsampling

- **Local Point Density (LPD) Estimation:**



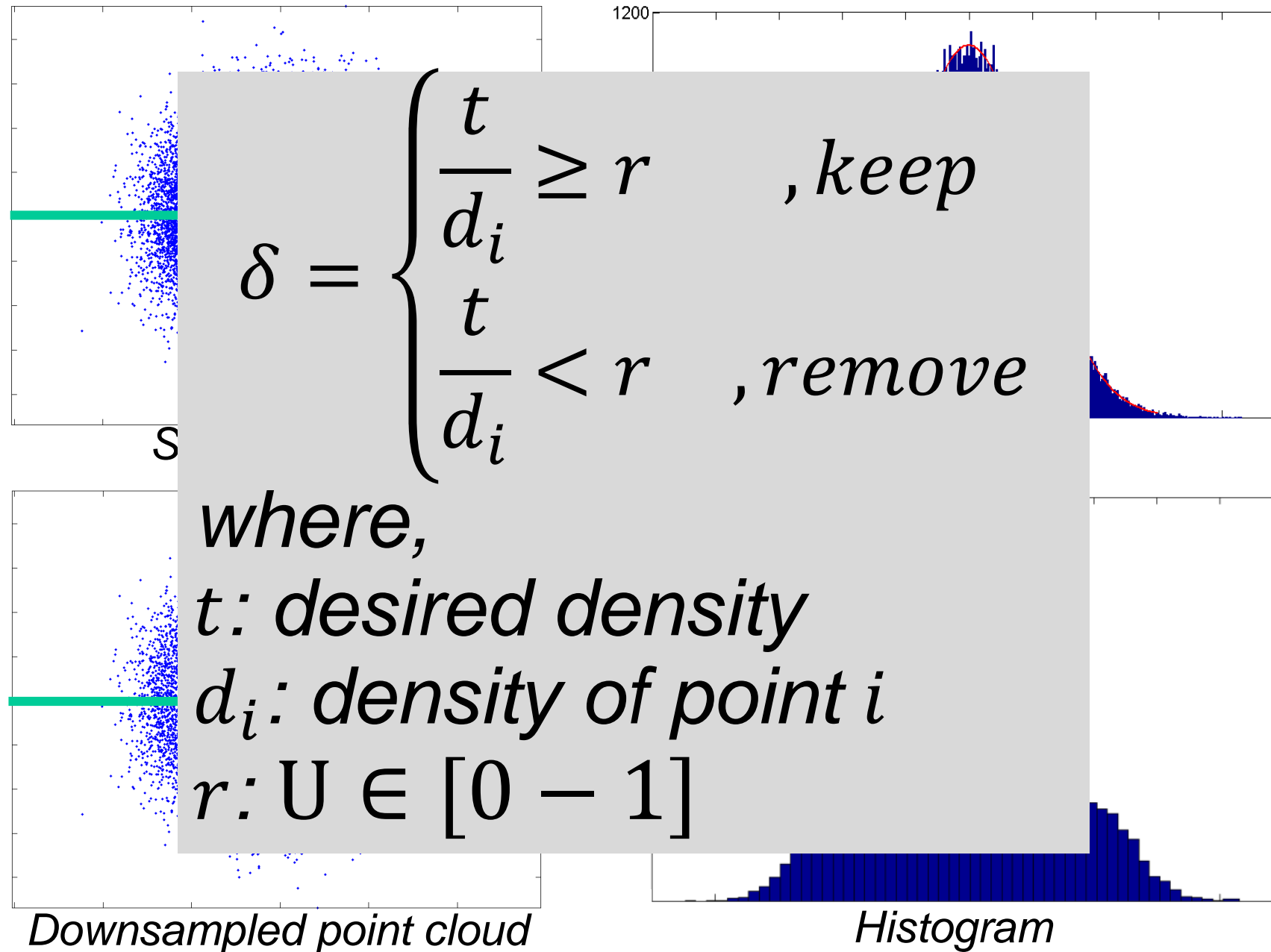
The points within the established 3D neighborhood are considered for local point density estimation if:

- They belong to the derived adaptive cylinder.

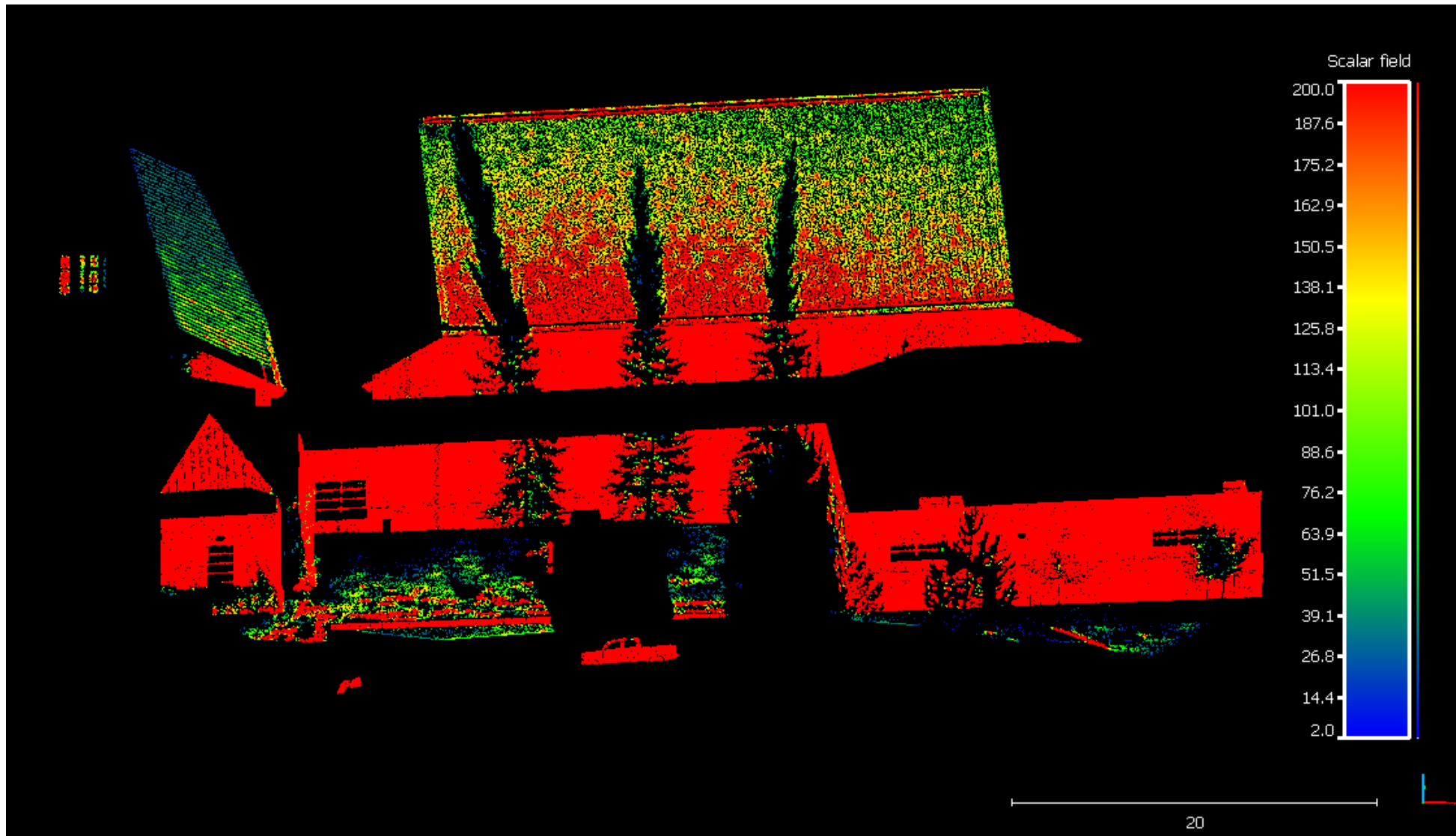
$$LPD \text{ (pnts/m}^2\text{)} = \frac{k}{\pi r_n^2}$$

k	Number of points within the adaptive cylinder
r_n	The distance between the POI and its n^{th} -farthest neighbor

Adaptive Downsampling: Methodology



Adaptive Downsampling



Density range up to 200 pts/m²