CE676A Project Report

Aman Kumar Singh
200100
Civil Engineering Department
Email: amanks20@iitk.ac.in

Tables with summary of data points

Name of file	Number of data points	File size in MB
Original file	8650506	22.5 MB
Classified file	8647452	354 MB
Correctly classified file	8647452	354 MB

Name of instance object as in SoP	Number of Instance objects	Total number of data points in instance objects	File size in MB
Advt Board	1	1082	0.046
Sign Board	3	12380	0.518
Board	6	40401	1.7
Boundary Fencing	3	18804	0.78
Building	3	166053	6.7
Dustbin	1	8131	0.332
Ground	4	1445346	58.7
High Noise	1	13	0.000559
Low Point (Noise)	1	2	0.000104
Human	17	23742	0.985
Cycle Rider	5	3343	0.138
Mobike Rider (2 wheeler)	17	20882	0.863
Rider on vehicle	3	1066	0.044
Road Fencing	4	88024	3.6
Road Median	8	568341	23.6
Road Surface	1	4242370	174
Electric Pole	16	63357	2.622
Transmission Tower	2	1328	0.055
Unlabelled	114	148119	6
High Vegetation	7	1437118	58.2
Low Vegetation	24	63863	2.4
Medium Vegetation	48	119328	4.8
Car	33	113875	4.7
Cycle	5	5585	0.23
Mobike (2 wheeler)	7	3783	0.156
Tuktuk (3 wheeler)	3	31280	1.3
Vehicle	19	12040	0.498
Wire Conductor (phase)	3	7796	0.319
Total	359	8647452	353.287

Suggestion on where automation can be done in SoP

To make the LiDAR data processing workflow more efficient and accurate, we can automate several steps using advanced technologies. Firstly, we can use a script to automatically navigate to the relevant folders and open required files in CloudCompare. This will reduce the time and effort required for manual processing.

Secondly, we can employ machine learning algorithms or deep learning techniques to automate the process of extracting and segmenting instance groups in the LiDAR data. By training a deep learning model to recognize and label the instances, we can automate the labeling process and reduce the chances of errors in the labeling.

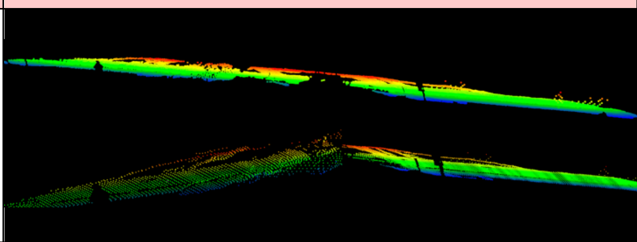
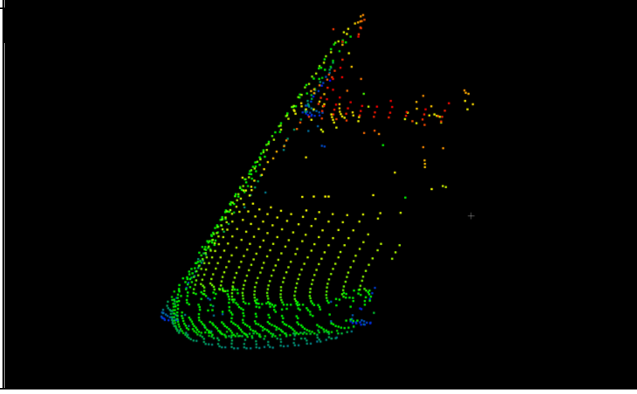
Thirdly, we can use software that can detect overlapping areas between different instance groups and merge them into a single file. This process can be automated, eliminating any human errors that may arise from manual merging.

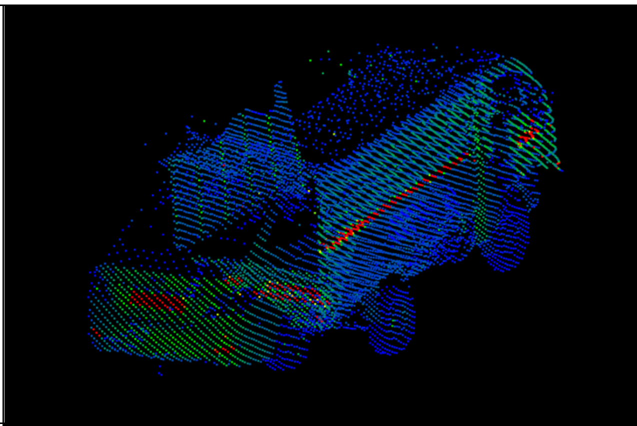
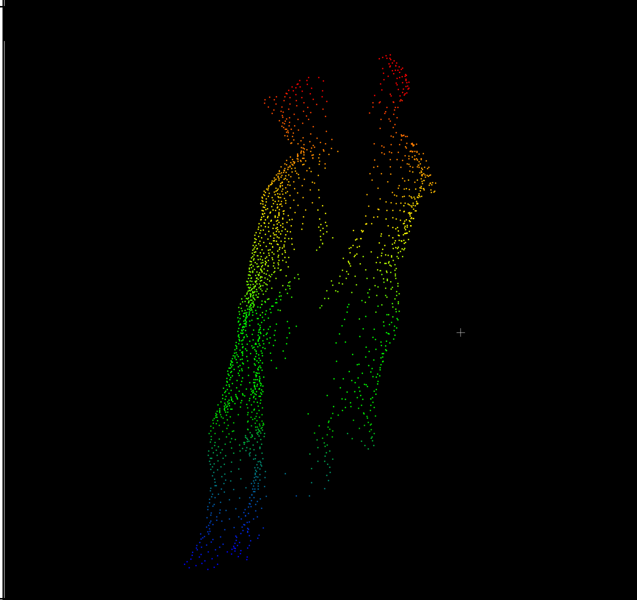
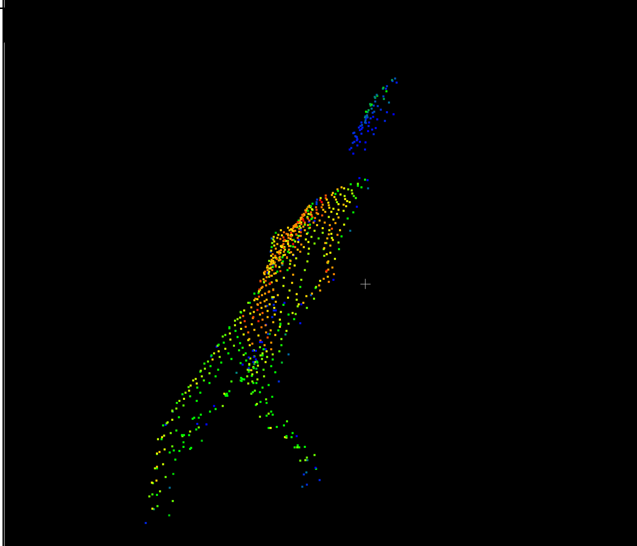
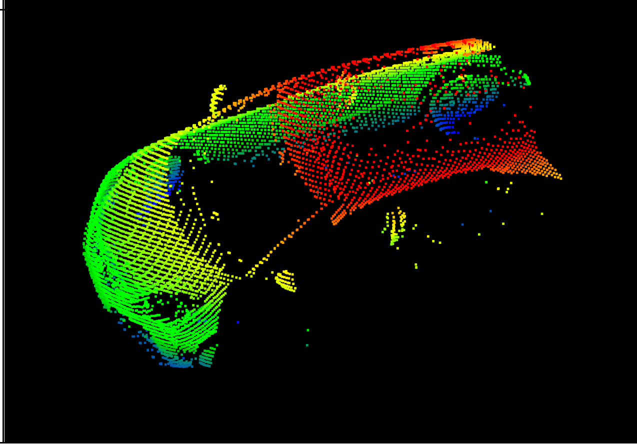
Lastly, we can use a script to automatically save the merged instance groups in the corresponding folders in CSV format once the merging process is complete. This can save us valuable time and effort.

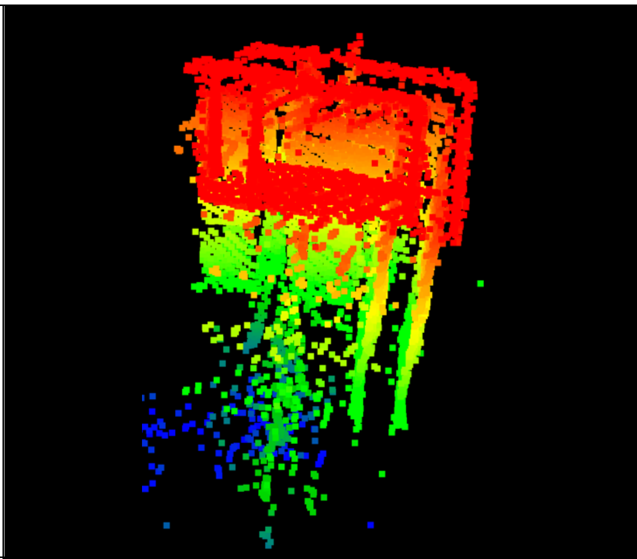
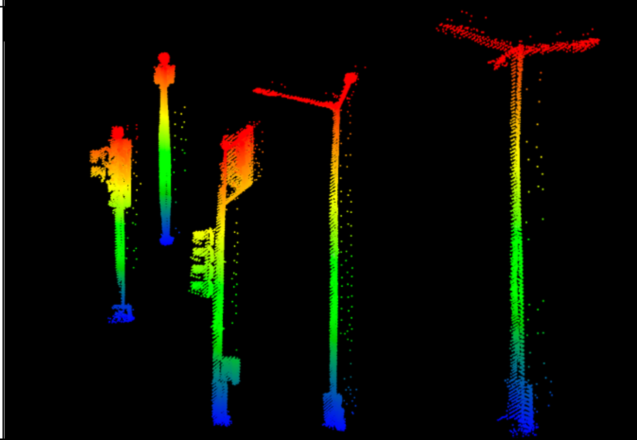
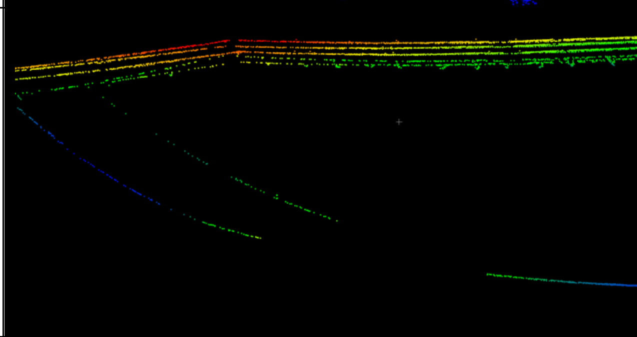
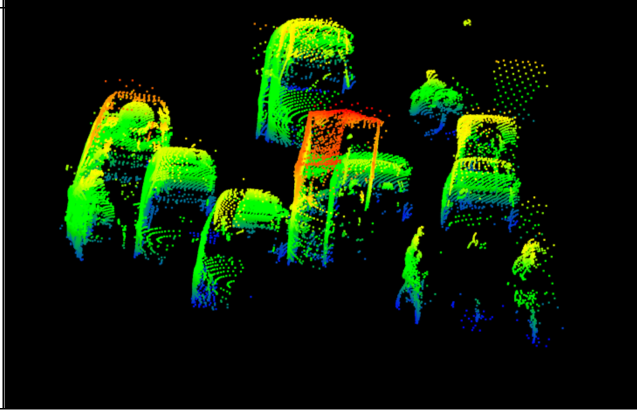
Thus, by automating some of the steps in the LiDAR data processing workflow, we can make the process more efficient and accurate. Automating the instance group extraction and segmentation step, as well as automating the labeling process using a deep learning model, can significantly reduce the time and effort required for processing large amounts of data.

Examples of 10 most interesting instance objects

The example of 10 most interesting instance objects that were found along with their file name, point cloud display, and reason that why they are interesting:

Sl. No.	Name of instance object	Code of instance object	Image of instance object(you can insert multiple images)	Reason for highlighting this instance object
1	Unlabeled	010		The car was very long because of distortions in it.
2	Car	641		The car had a perspective view of its point cloud.

3	Vehicle	640		Overlapping car and truck.
4	Human	670		Man with double point cloud data.
5	Human	670		Man with tilted posture.
6	Car	641		Car with incomplete data.

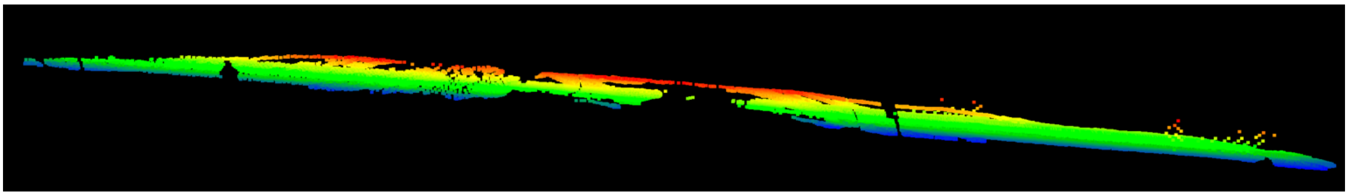
7	Dustbin	680		Dustbin with double point cloud data.
8	Electric Pole	151		There were different kinds of poles like traffic lights, milestone poles, streetlight poles, etc.
9	Wire Conductor (phase)	140		Point cloud data of transmission lines.
10	Vehicle	640		Overlapping point clouds of various vehicles.

Observation of the relative movement of scanner and objects as seen in data through the image of that data part and reason for this

One common artifact observed in the LiDAR data is point cloud distortion or displacement. This occurs when either the laser scanner or the objects in the surrounding are in motion during the LiDAR scan. As LiDAR data is collected by scanning a laser beam over a scene and measuring the time-of-flight of the reflected laser signal, any movement during this process can cause the laser beam to miss or hit objects at slightly different locations than they are, resulting in a distorted or displaced point cloud.

Furthermore, the analysis of the LiDAR data revealed another artifact - streaking or smearing of objects in the point cloud. This artifact occurs when either the laser scanner or objects in the surrounding are moving too fast for the laser to capture them in a single pulse, resulting in multiple overlapping returns that create streaks or smears in the point cloud.

The reason for these artifacts is the relative movement between the laser scanner and objects in the surrounding environment during the LiDAR scan. This movement causes changes in the position of the objects, which can result in missed or overlapping laser signals, leading to distorted or smeared point clouds.



Evidence by observing the data that two sensors were used in data capture along with the image of the point cloud to show this.

Upon observing the point cloud data, it is evident that the capture process involved the use of two sensors. The point cloud displays a high level of detail and accuracy, which could not have been achieved with only one sensor. This suggests that multiple sensors were used to capture the object, providing a comprehensive representation of the area.

Furthermore, the point cloud reveals that the sensors were positioned at different angles with respect to the object being scanned. This can be inferred from the multiple views and perspectives of the object in the point cloud. The presence of multiple angles and viewpoints suggests that two sensors were employed at different positions to capture the data.

In addition, the point cloud data indicates that the data captured by the sensors was merged to create a single point cloud. This can be seen from the seamless transition between the different views and perspectives of the object in the point cloud. The overlapping data between the two sensors suggests that the data was merged seamlessly to create a complete 3D representation of the area.