PROJECT
LIDAR DATA COMPARISON

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1 INTRODUCTION

The defined goal of the project is to accomplish the comparison of the given data set of Lidar(Light detection and Ranging) sensors Velodyne and blickfeld cube by analyzing the movements of the car as it moves forward or backward. The data recollected from the sensors are in the form of a point cloud, hence to access the point cloud of the car, a 3d-bounding box is provided and this helps to isolate the car data apart from the environment point cloud. The points of the car can be obtained by finding the maximum and minimum points of the bounding box, a center point is given as a reference.This provides a clear picture to compare the two different cloud points i.e., Velodyne and Blickfeld.

Keywords : Lidar,Velodyne,Blickfeld cube

2 Methodology

2.1 Flowchart

The bounding box represents the location and typical structure of the vehicle in a cube manner. The flow chart shown below helps to visualize the process of calculating the points which lie inside the bounding box.

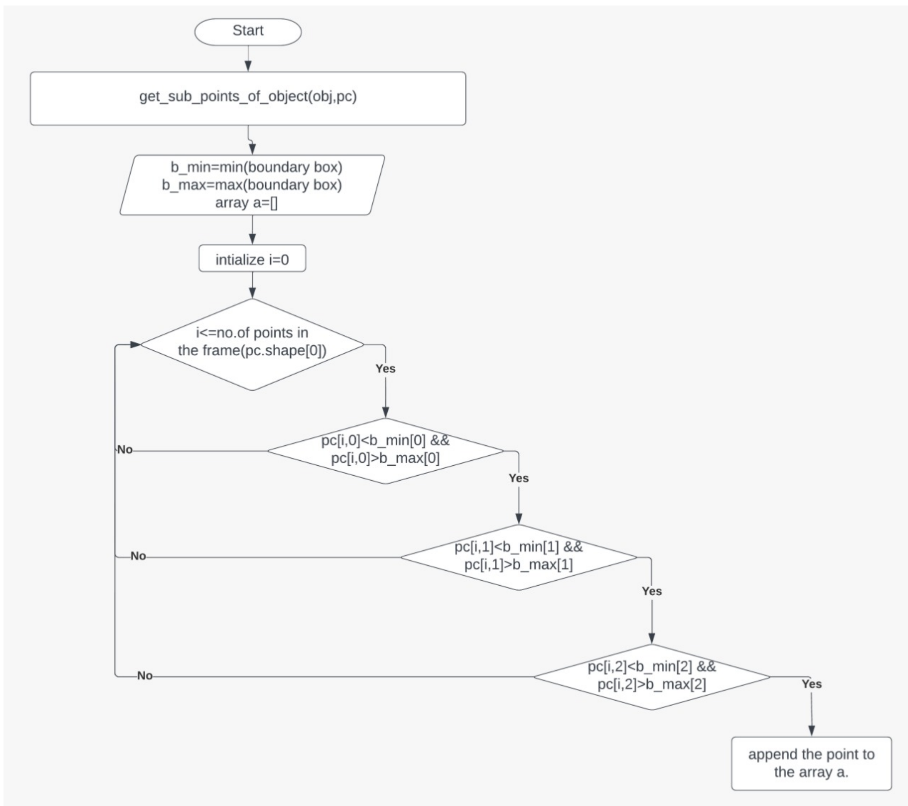

Figure 1: Flowchart

The "get sub-points of object" is a function that can be called from anywhere inside the program. It performs specific tasks which help to find the sub-points which are inside the bounding box for each frame. To find out the sub-points, first, we need to find out the dimensions of the bounding box. We calculated the dimension of the bounding box by using the data given in the record files.

The corner points of the bounding box provide the least area of the spectrum where the sub-points lie. The inbuilt math.min and math.max functions are used to find out the minimum and maximum points of the bounding box corners. These points will help us to find out the sub-points of the bounding box. By iterating from the first point to the last point of each frame and comparing each point coordination with the maximum and minimum point of the bounding box corner. The iteration is carried out through the for loop and comparison is done with the help of if statements. The sub points are stored in an array named 'a'.

3 Data Visualization

The visualization of the data plays a vital role in comparing the two different sensor point clouds. A 3d-bounding box is provided to get the sub-points of two different sensors and these sub-points can be obtained by comparing with the maximum and the minimum points of the bounding box corners.

3.1 Blickfeld Cube :

The cube version is a 3d-lidar sensor that has the flexibility to configure the pattern of scanning and mainly served the purpose of recognition software and is implemented in many applications. We visualized the sub-points in the bounding box by the position of the car either moving forward or backward by considering frame 60 and frame 120 respectively. These frames were loaded individually onto the program and each of the individual recordings gave a different value of the cloud points because when we change the frame id the position of the car also changes and hence the data recorded by the sensor also changes.

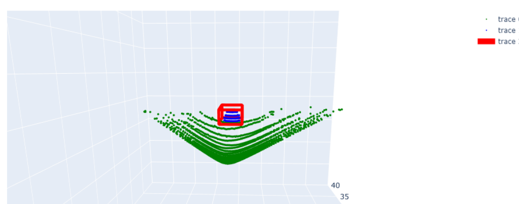

Figure 2: View of the blickfeld frame 60

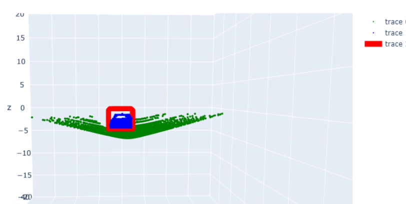

Figure 3: View of the blickfeld frame 120

Figure 4: blickfeld cube 3d diagram

3.2 Velodyne Sensor :

Velodyne sensor has the ability to provide a surround view and generate a reliable data set. The cloud points of the Velodyne sensor have also been taken using a similar process to the blickfeld. The sub-points has been recorded from the data set for the same frame 60 and frame 120, hence there are two different number of sub-points for each of the frame respectively. This recording helps in the comparison of the cloud points and gives a better understanding of the two sensors in terms of data accumulation and range.

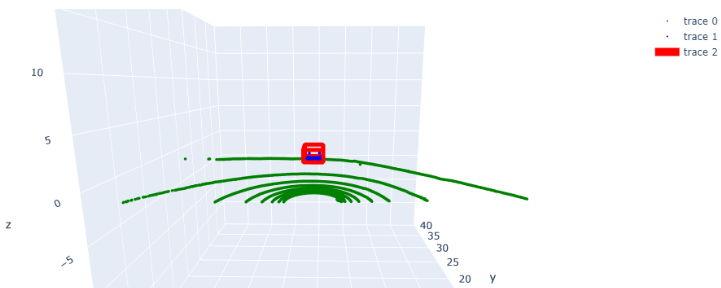

Figure 5: View of the velodyne frame 60

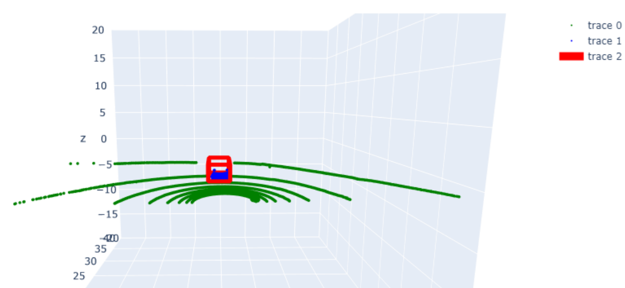

Figure 6: View of the Velodyne frame 120

Figure 7: Velodyne 3d diagram

4 Comparison

4.1 Blickfeld Cube :

To plot the graph we used the in-built plot function, the plot is for all the points, and the graph is for all the frames. When the distance was less than five meters approximately more than two thousand points were recorded alone as the car moved away from the sensor the data recorded by the sensor got decreased. When the car moved further more than 10 meters the cloud points recorded were approximately less than 500 points. For frame 60 there were 100 sub-points inside the bounding box as the car was a little far away and for frame 120, the sensor recorded 642 points. As a result, when the car moved slowly away from the sensor the data points collected is being reduced.

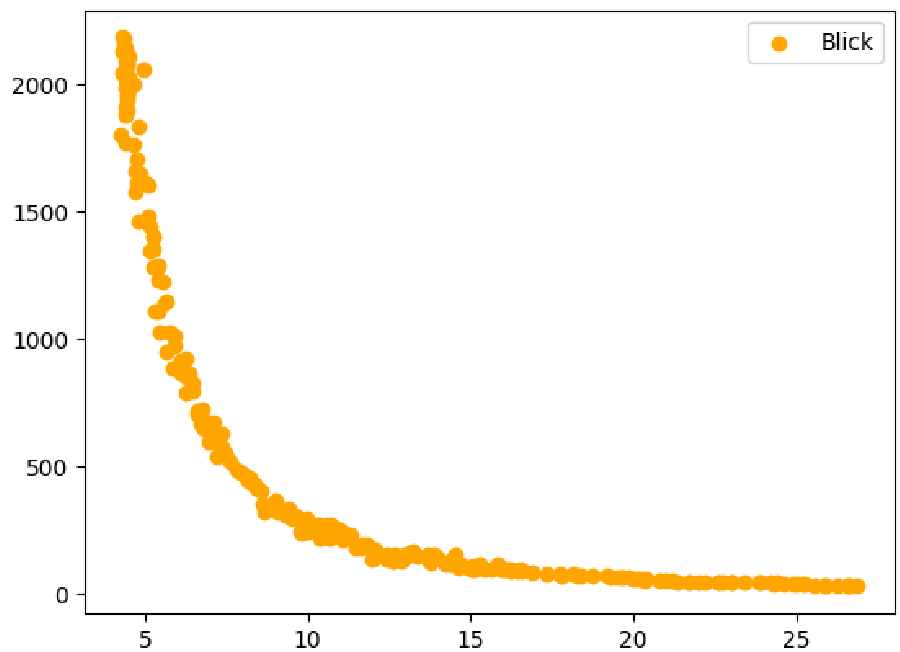

Figure 8: Blickfeld Graph

4.2 Velodyne :

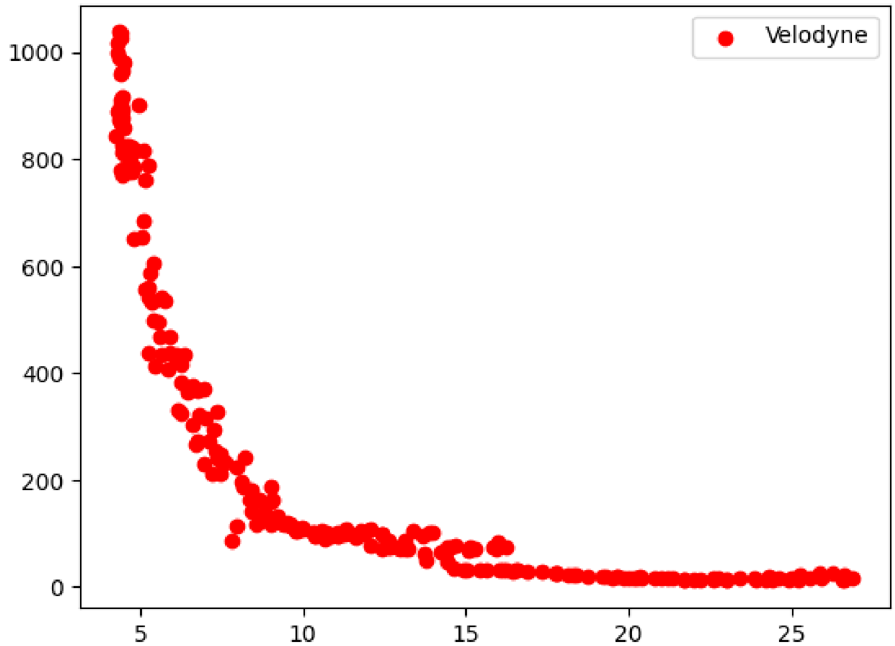

Figure 9: Velodyne Graph

The same approach was also used to retrieve data and plot the graph for all the frames. When the car is near the sensor dense cloud points was recorded and the points were approximately more than a thousand. For frames 60 and 120, almost 74 and 315 points were collected by the sensor. Once we have evaluated all the frames of both sensors after visualizing we get two different graphs for each of the sensors respectively. These sensors provide a different record of cloud points for each different frame of the car, as the bounding box of the car moves away from the sensor when they are visualized. Blickfeld has recorded more points when the car is near and also more points are recorded when the car is away from the sensor when compared to Velodyne.

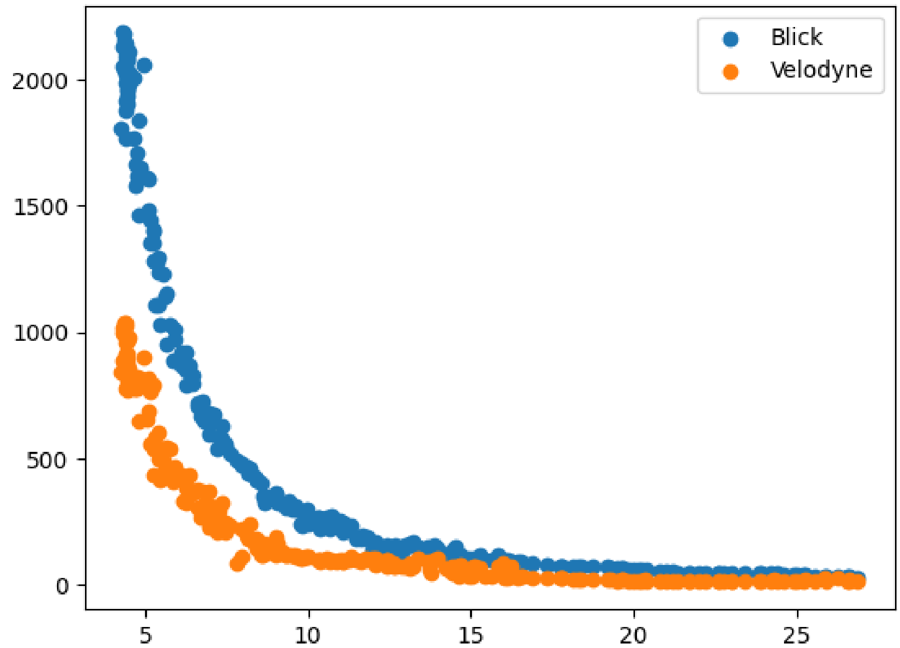

Figure 10: Velodyne Graph

From the above graph, we can observe that blickfeld sensor has more data points than the Velodyne, also greater the movement of the car forward lesser the points, and these points are almost approaching zero. For this particular case the car is moving forward and backward, hence blickfeld has a field view of 70°*30° so the data collected by the sensor is more though Velodyne has a 360° field view.

5 Conclusion

To compare the Blickfeld and Velodyne sensors we were given data set of both the sensors which recorded forward and backward movements of the car.The comparison is made between two sensors and after evaluating both of these from , we could conclude that blickfeld cube has a more range which eventually results in more points being collected even when the car is away from the sensor. Velodyne has lesser range compared to blickfeld cube and it collects more points when the car is extremely near and collects lesser points when the car is too far from the sensor the data collected is less.Comparison is purely made on the cloud points and the range of the both sensors.

Bibolography :

1.Prof.Dr.Stefan Elser - Presentations followed class lectures.
2.Mr.Felix Berens-Hands on Source code