GENERATING DENSITY HEAT MAP FROM POINT CLOUD

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ABSTRACT:

We have been provided with the LiDAR data of an area. We are required to generate the heat map of the area which is based on local point density values. A heat map is a representation of data with different colours, as per the numerical value of the underlying value (point density in our case). In order to do this, localized point density in a small neighbourhood for each point, and correspondingly colour each point based on the density value. We need to generate a heat map following the colour scheme (blue-green-yellow-orange-red) from low to high. We performed the exercise with different values of search radius ranging from very low to very high.

1. INTRODUCTION

1.1 Lidar

The popularity of LIDAR in Photogrammetry and Remote Sensing is constantly increasing as it allows for direct acquisition of three-dimensional (3D) dense information of the earth surface. Extremely dense 3D recordings of point clouds and a very reliably technology are highlights of LIDA.

Lidar uses ultraviolet, visible, or near infrared light to image objects. It can target a wide range of materials, including non-metallic objects, rocks, rain, chemical compounds, aerosols, clouds and even single molecules.

1.2 Las File

The LAS file is contain LIDAR point data cloud. Different LIDAR hardware and software tools output data in this common open format. The data is generally be put into this format from software which combines GPS, IMU, and laser pulse range data to produce X, Y, and Z point data. This format is binary consisting of a header, Variable Length Records, and point data.

1.3 Visualisation

Visualisation can be achieved by converting the point cloud to various types of raster images, but it is also possible to browse through 3D point clouds and visualise them using point-based rendering techniques like point splatting. Airborne laser scanning data or data from a single terrestrial scan can, however, be considered as 2.5D and be converted to height or range imagery.

The creation of a height image from a point cloud consists of three steps:

1) definition of the image grid;
2) determination of the height for each pixel
3) Conversion of the height to a grey value or color.

2. SOFTWARES/DATA USED

1) Matlab
2) Cloud Compare
3) lab_11 data

3. METHODOLOGY

1) Read the Las file and store the values in variable.
2) Compute density around each point using for loop (nested).
3) Density can be computed using calculating the no of points lying inside that point.
4) Note density vector of each point.
5) Create heat map using the data of xyz and density.

4. RESULTS

Heat Map is made up of 20000 points for less computation. Here color bar shows value of point density

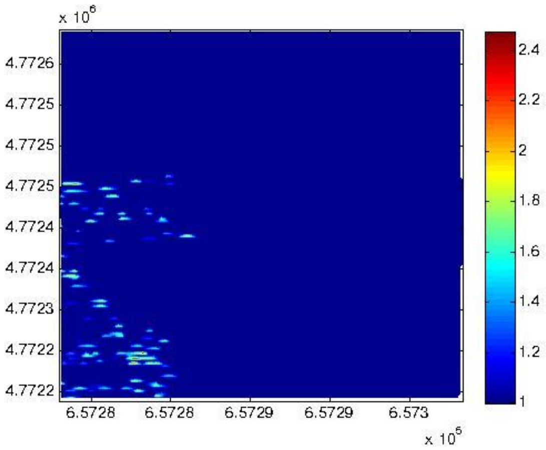

Figure 1 Radius 0.2 m - Maximum value 3 min 1

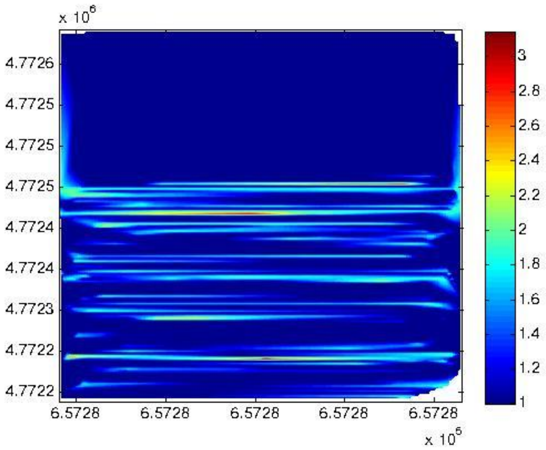

Figure 2 Radius 0.5 m - Maximum value 4 min 1

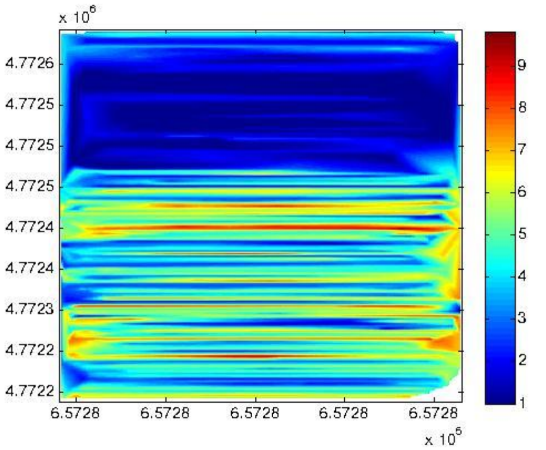

Figure 3 Radius 1 m - Maximum value 11 min 1

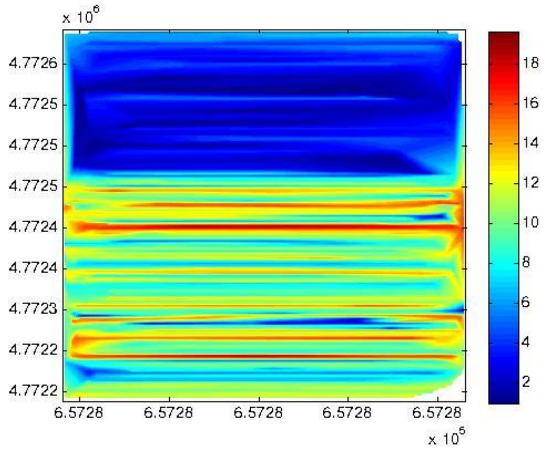

Figure 4 Radius 2 m - Maximum value 21 min 1

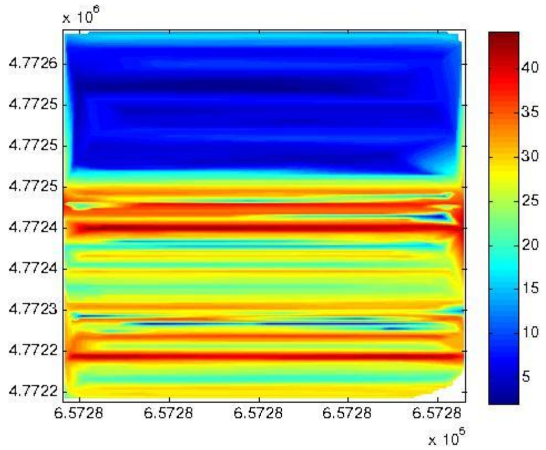

Figure 5 Radius 5 m - Maximum value 45 min 1

5. CONCLUSION

- If we increase radius it is obvious data no. of points is increased.
- If there is shadow or no data capture is occurred due to malfunctioned of software than it effects the data density
- There are also other factors effecting point density.

6. REFERENCES

[1] Lohani, B., R. K. Mishra, 2007. Generating LiDAR data in laboratory: LiDAR simulator. International Archive of Photogrammetry and Remote Sensing, vol. XXXVI (3).

[2] Axelsson, P., 1999. Processing of laser scanner data - algorithms and applications. ISPRS Journal of Photogrammetry and Remote Sensing, Vol. 54 (2), pp.138-147.

7. APPENDIX

```
% Ayush Aggarwal
% Lab 11
% 11177
% Heat map by density calculation

% Reading Lidar data
D = dlmread('lab_11.txt','',1,0);

D = sortrows(D);

% taking XYZ
X = D(1:20000,1);
Y = D(1:20000,2);
Z = D(1:20000,3);

% density
size = 2;

% for heat map
densitycount=zeros(20000,1);
count=0;

for l=1:1:20000
count=0;
fprintf('density %d \n',l);
    for k=1:1:20000
        if ((X(l)-
size)<X(k))&&(X(k)<(X(l)+size)) &&
((Y(l)-size)<Y(k))&&(Y(k)<(Y(l)+size))
&& ((Z(l)-
size)<Z(k))&&(Z(k)<(Z(l)+size))
        count=count+1;
        end
    end
densitycount(l)=count;
end

% heatmap

x=linspace(min(X),max(X),150);
y=linspace(min(Y),max(Y),150);
[X1,Y1]=meshgrid(x,y);
F=TriScatteredInterp(X,Y,densitycount)
;
contourf(X1,Y1,F(X1,Y1),100,'LineColor
','none');
colorbar;
```