Assignment 3 Report

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Abstract

This assignment will implement two different functions to compute the slope (maximum gradient) of a raster, compare their outputs, and understand the impact of raster parameters on the outputs.

1 Task 1

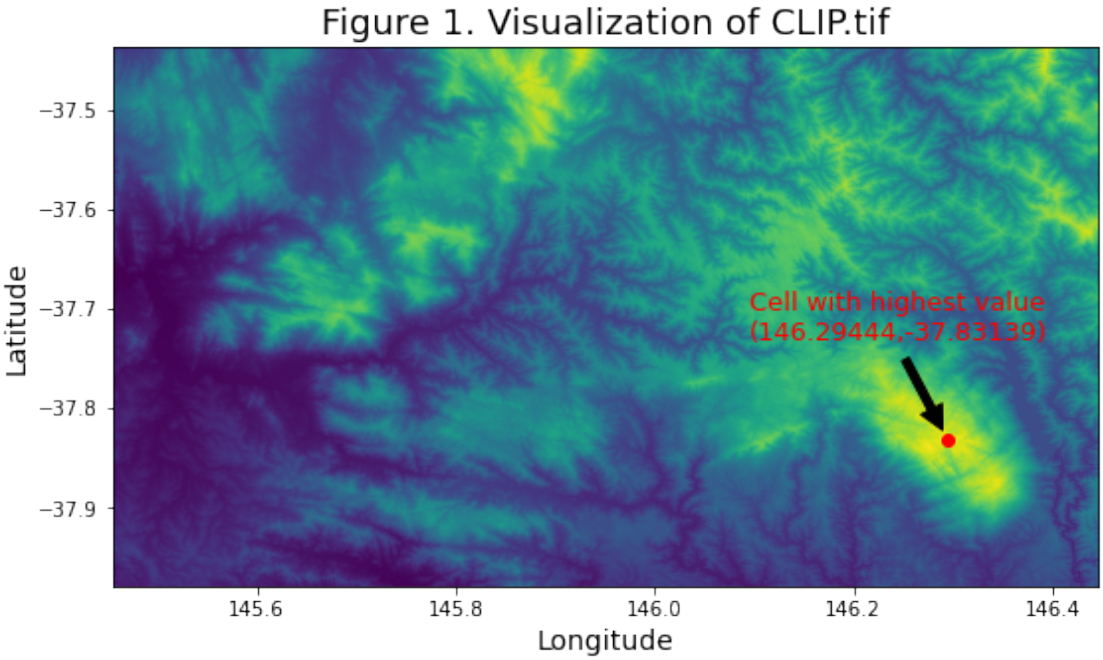
1.1 Task 1.1-1.2

The following table summarizes the information about the raster data(CLIP.tif).

Parameter	*Value*
Filename	CLIP.tif
Coordinate system	4326 [EPSG]
Min x, Min Lon	2539962.688 metre, 145.455 degree
Max x, Max Lon	2627972.335 metre, 146.446 degree
Min y, Min Lat	2390417.722 metre, -37.979 degree
Max y, Max Lat	2451433.293 metre, -37.437 degree
Width, Height, Cell Size	3569 columns, 1951 rows, 0.000278*0.000278 degree
NoData	-3.4028234663852886e+38
Min value, Max value	70.187 metre, 1563.100 metre

1.2 Task 1.4

Figure 1 shows a visualization of raster data(CLIP.tif) and highlights the cell with the highest value in the dataset, the geographic coordinates of this cell is (146.294, -37.831).



2 Task 2 Processing a raster DEM

2.1 Task 2.1

2.1.1 Reproject

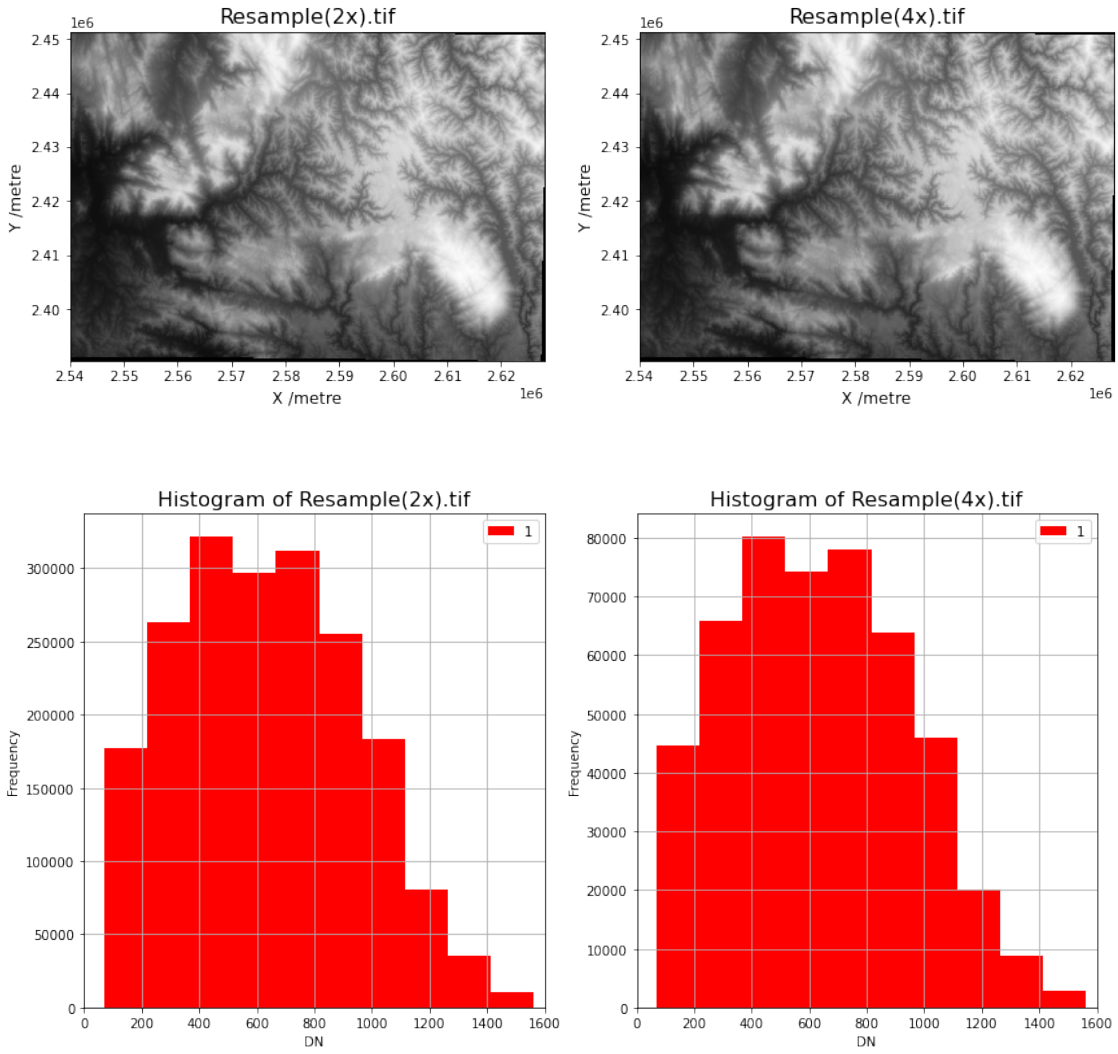
The following table summarizes the information about the reprojected raster dataset, which transfer the CRS from epsg:4326 to epsg:3111. Since the image will be distorted after reprojection, the data in the table below is slightly different from before. Besides, for the convenience of calculation, the value of Nodata is set to -1.

Parameter	*Value*
Filename	Reproject.tif
Coordinate system	3111 [EPSG]
Min x, Min Lon	2539962.688 metre, 145.452 degree
Max x, Max Lon	2627979.462 metre, 146.457 degree
Min y, Min Lat	2390416.330 metre, -37.987 degree
Max y, Max Lat	2451433.293 metre, -37.429 degree
Width, Height, Cell Size	3374 columns, 2339 rows, 26.086773*26.086773 metre
NoData	-1.0
Min value, Max value	70.254 metre, 1562.754 metre

2.1.2 Resample

Figure 2 show the visualization of the datasets with cell sizes of 2x and 4x the cells size and their histograms, which resampled by bilinear interpolation.

Figure 2. Visualization of Resampled dataset and Histogram



The following tables summarizes the information about the resampled raster datasets.

Parameter	*Value*
Filename	Resample(2x).tif
Coordinate system	3111 [EPSG]
Min x, Min Lon	2539962.688 metre, 145.452 degree
Max x, Max Lon	2627979.462 metre, 146.457 degree
Min y, Min Lat	2390416.330 metre, -37.987 degree
Max y, Max Lat	2451433.293 metre, -37.429 degree
Width, Height, Cell Size	1687 columns, 1169 rows, 52.173547*52.195862 metre
NoData	-1.0
Min value, Max value	70.572 metre, 1561.288 metre

Parameter	*Value*
Filename	Resample(4x).tif
Coordinate system	3111 [EPSG]
Min x, Min Lon	2539962.688 metre, 145.452 degree
Max x, Max Lon	2627979.462 metre, 146.457 degree
Min y, Min Lat	2390416.330 metre, -37.987 degree
Max y, Max Lat	2451433.293 metre, -37.429 degree
Width, Height, Cell Size	843 columns, 584 rows, 104.408984*104.481101 metre
NoData	-1.0
Min value, Max value	71.378 metre, 1559.235 metre

2.2 Task 2.2-2.4

Figure 3 and Figure 4 shows the distribution of slope values computed by different algorithms. In this assignment, I choose 2FD and Maximum max to estimate the slope because these two algorithms are implemented by different ways, which are quite representative.

Figure 3. Second-order finite difference 2FD

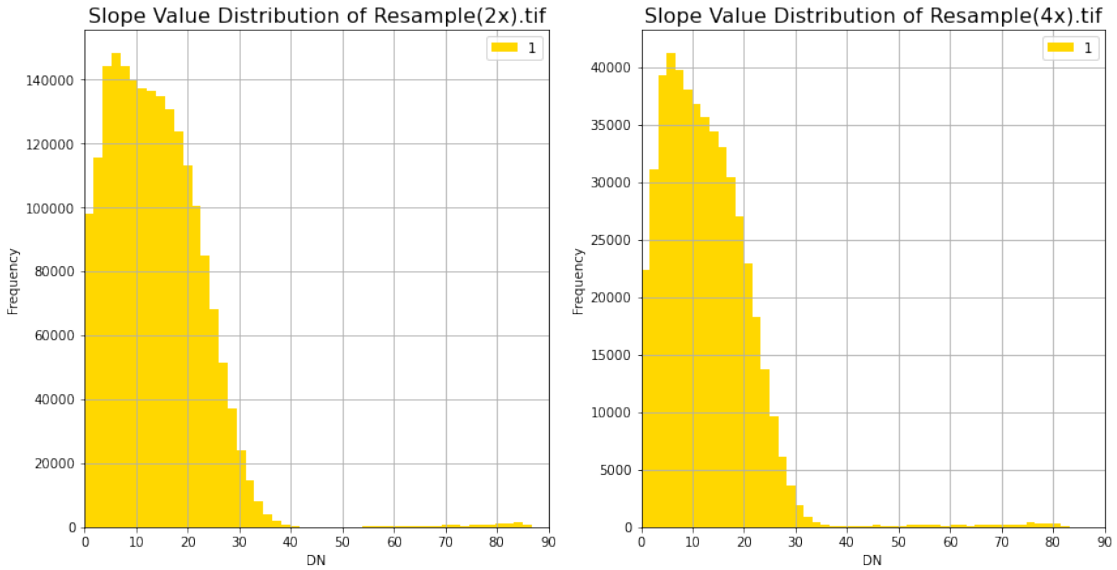
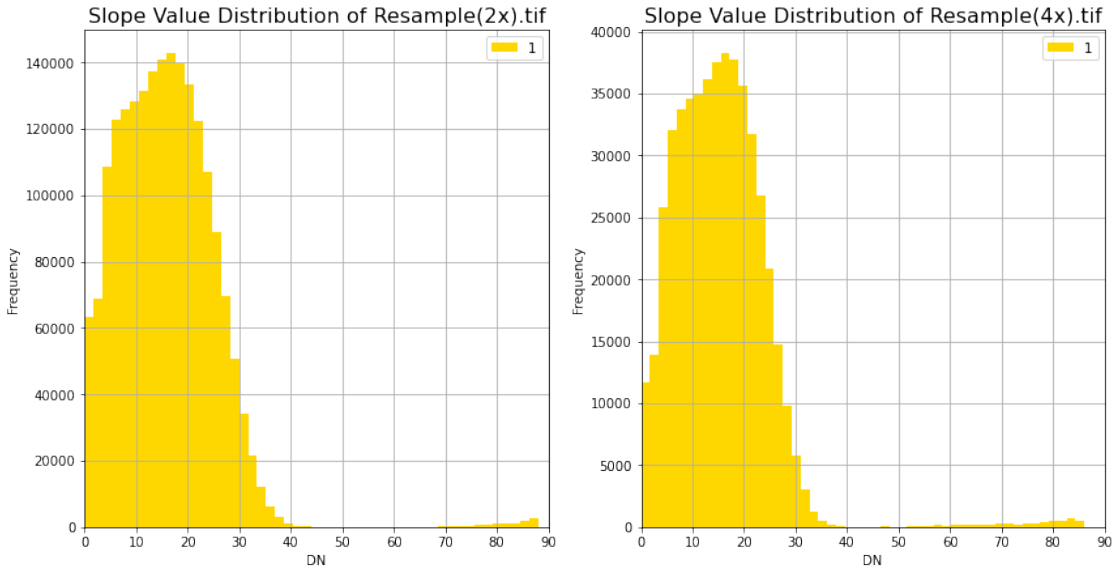
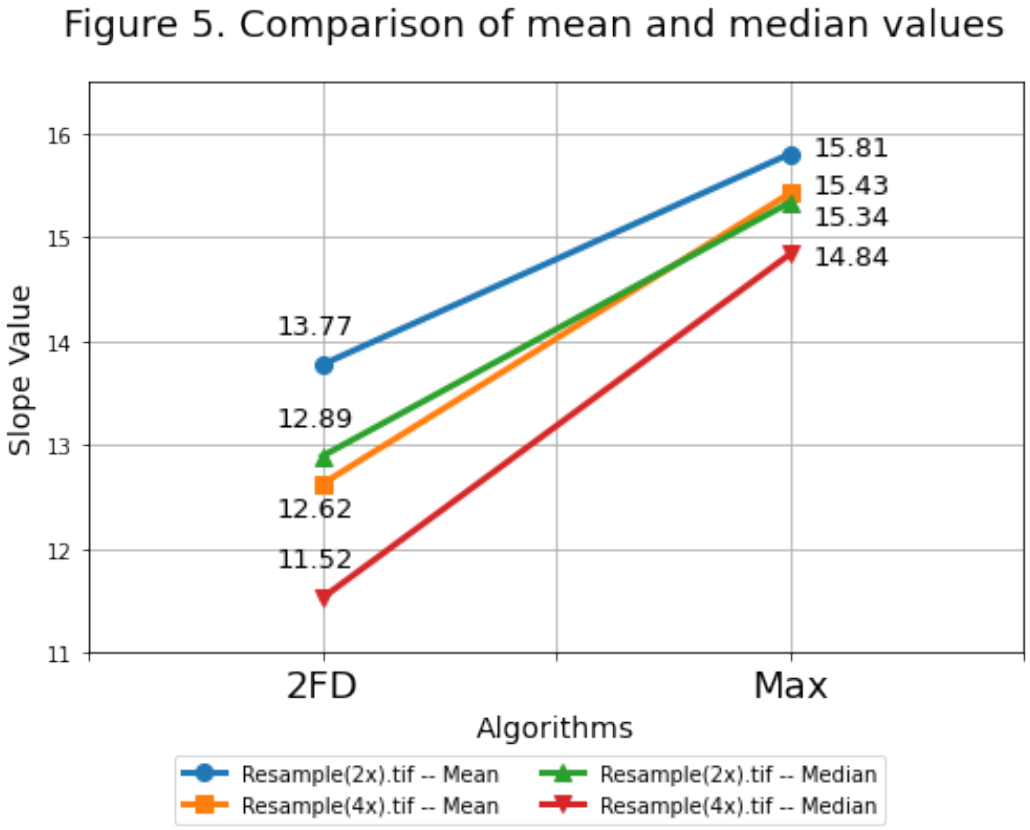


Figure 4. Maximum Max



By comparing the slope histograms obtained by the two algorithms, it can be seen that the distribution of slope values with different resolutions calculated by the same algorithm is approximately the same. For different algorithms, the mode of the histogram calculated by 2FD (5~8°) is smaller than that calculated by Maximum Max(15~18°).

Figure 5 shows the differences in mean and median values for the different tested algorithms.



The mean and median value comparison provides the general analysis on the difference of slope estimation algorithms, mean value is decribing the average estimated level while median value is representing the 50th percentile. Visual interpretation of Figure 5 indicates that Maximum Max methods always shows the higher mean and median values, considerably different to 2FD. Generally, the mean and median values are reflecting the whole dataset, so the comparison of them shows the differences between 2FD and Maximum max, i.e. Maximum max is overestimated compared to 2FD. However, due to no actual "true" values of slope, the accuracy of different methods can not be determined. Thus, different algorithms are most probably suitable for different applications on different scales.

Impact of coarsening on the data

Coarsening affects the accuracy of data and produces errors. It can be seen from the above results that the mean and median of the data set become smaller after coarsening, this is because the size and number of cells have changed during the resampling process, and after using the interpolation to assign values to the new cells, cell value will alter. Therefore, coarsening will affect the accuracy of the data. However, coarsening reduces the number of cells in a raster dataset, so it is possible to reduce the amount of calculation and the speed of calculation when using raster data for calculation. In conclusion, within the allowable range of error, coarsening the data can improve the efficiency of the work.