A Robust Gradient based Method for Building Extraction from Remotely Sensed Data

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The proposed Gradient-based Building Extraction(GBE) method uses the derived image from LiDAR points to reduce the LiDAR height errors. Actually, the derived image is generated by overlaying a grid on the non-ground LiDAR points in a prominent building directions. Later, the mean height of the LiDAR points in each cell of the grid is assigned as the image pixel of that grid. The Mean value reduces the height variation on a transparent building and this helps in extracting the transparent building pixels. Later, the gradient is calculated using the derived image in two defined direction in order to evaluate if there is a constant change of the pixel values. The constant change in pixel value determines the building regions (planes). The proposed GBE method uses variance, local colour matching and shadow analysis to remove the trees and keep the small buildings. The complete steps of GBE method are as follow:

1. Input Image, DEM and LiDAR data.
2. Extract 2 meter long non-ground edges from an input Image using canny edge algorithm and find their orientation.
3. Define the range threshold Rt = ±5.625.
4. Find a prominent building edge angle L.
5. Extract all the edges of an angle laying within the range L ± Rt.
6. Calculate the mean of edge angles in a group and denoted by M.
7. Generate grid along direction of M, where the grid size is set to twice of LiDAR point spacing.
8. Find the number of LiDAR points in each grid, and assign the mean of grid points to a grid.
9. Derive height intensity image from LiDAR points.
10. Differentiate gradient function in both axes (i.e. dx and dy) on a height intensity image.
11. If dx is zero and dy is near to constant, or if dy is zero and dx is near to constant , then the pixels of building mask BM are assigned to building plane pixels .
12. Store a building mask and return to Step 5 until all lines orientation have been used.
13. Add all building mask at different angle of Grid.
14. Remove the noise from the final building mask.
15. Refine the extracted building by applying the variance, local colour matching, and shadow analysis to remove trees.