Using Spline Curve Fitting to Extract Feature from Full-waveform LIDAR Data

Yi hsiu Cheng [1]   Fuan Tsai [2]

[1] Department of Civil Engineering, National Central University, No.300, Jhongda Rd.,
Jhongli City, Taoyuan County 32001, Taiwan,
craig200277@hotmail.com

[2] Centre for Space and Remote Sensing Research, National Central University,
No.300, Jhongda Rd., Jhongli City, Taoyuan County 32001, Taiwan,
ftsai@csrsr.ncu.edu.tw

ABSTRACT:

Full-waveform LIDAR is an emerging technique recently in the remote sensing domain because of its high potential for many applications. Compared to the tradition LIDAR, full-waveform LIDAR records not only the range (or coordinates) and intensity, but also the entire signal of each laser pulse. Therefore the physical properties of the surface can be derived base on abundant wave information. In addition, more spacial information can be extracted by wave detection and analysis. The research developed an approach by integrating spline curve fitting and derivative-based analyze to extract full-waveform LIDAR features.

During the data acquisition, there will be some noises caused by the background radiation. In order to remove the noise, the mean filter and the threshold were used to perform the data pre-processing. After eliminating the background noise, the analysis of the full-waveform LIDAR data can be divided into three steps. First, the spline is used to fit the waveform according to the waveform geometry. And the second part is utilizing the second derivative method and searching the local minimum value to detect the peak of the wave. According to the location of the peak, the feature such as width, amplitude and backscatter cross-section can be extracted from the waveform by full width at half maximum (FWHM) and waveform decomposition. The experimental result shows that the noise can be successfully removed and the spline fitting combined with the peak detection can extract more information which can help the object classification under the study framework.

KEY WORDS: Full-waveform, LIDAR, Spline, Curve fitting, Peak detection