UNIVERSITI TEKNOLOGI MARA

MODELLING OF LiDAR RETURN ON SURFACE OBJECT REFLECTED AS SPECULAR AND DIFFUSE COMPONENTS

NORAAIN BINTI MOHAMED SARAF

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ABSTRACT

The useful of LiDAR data in the industry necessitate user the ability of managing LiDAR data according to their purpose, for example in 3-D mapping. Dealing with 3-D mapping, features information of LiDAR data (e.g building and tree) have been tremendously useful. This research intent to investigate the characteristics of LiDAR return pulses coming of specular (building) and diffuse (tree) objects from LiDAR derived surface models of the urban study site in Ampang, Kuala Lumpur. Contour, slope and aspect are three of those products that could be derived from LiDAR data. The data were initially checked and verified accordingly. Digital models (DEM and DSM) were generated based on this LiDAR data involving classification, filtering and masking. A normalized DSM was extracted to separate the buildings from other spatial features. Slope and aspect analysis were conducted based upon segmentation on the rooftop. Furthermore, height of building and tree were estimated. Hence, an error assessment was done and findings were highlighted and documented. The result of LiDAR verification certifies that the data is reliable and useable where the Root Mean Square (RMS) error obtained is within the tolerance value of vertical accuracy (z), which is 0.096m. Thus, specular and object extraction were conducted with error assessment less than 10 percent. The segmentation applied based on contour, slope and aspect analyses indicate that the approach can derive the reliable and accurate 3-D building. The finding from this study demonstrates the capability and the effectiveness of LiDAR data.

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TABLE OF CONTENTS

CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND

There are many types of geospatial data collections involved in geomatics based on the airborne, space borne or field based observations. Some examples of the modern and recent are Light Detection and Ranging (LiDAR), Radio Detection and Ranging (RADAR), Unmanned Aerial Vehicle (UAV) photogrammetry, Global Positioning System (GPS) technology and many more. A variety of geospatial data collection methods is used to gather information for many applications including topographic mapping. LiDAR is one of the technologies that can be used to map Earth's surface targets, which consist of features or objects that have smooth and rough surface.

Smooth surface objects would reflect the signal sensed from a remote sensing sensor in a normally single direction, known as specular reflection. Rough surface objects would reflect back the LiDAR segments in various directions, termed as diffuse reflection. Surface objects when LiDAR pulses hit can be trees (in a forested area or urban area) and/or building's rooftops, which are either regular or irregular.

The task of identifying and segmenting the LiDAR returns to classify them to their respective surface feature classes is not an easy one and at most of the time, cumbersome and daunting. Thus, the result of LiDAR mapping mission over an area consisting of various land cover targets over an area surface shall involve intelligent processing to remove noise from the signal by filtering out the unwanted noise component in the signal. Once all the returns are properly processed, these returns need to be modelled by classifying which of these returns belong to the terrain or ground. This would involve the generation of the Digital Surface Models (DSM) and the Digital Terrain Models (DTM). When we are able to segment and classify according to the surface models that we need, then they could be used further in the reconstruction of those surface features. Of course it is essential to verify these generated models accordingly.