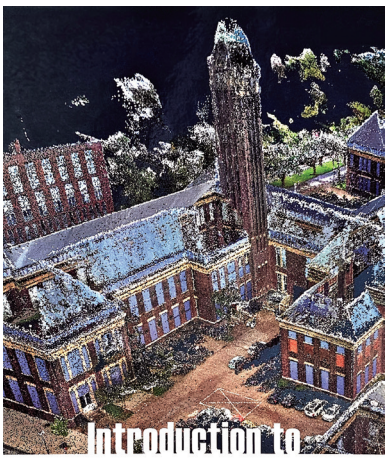

Introduction to Pointcloudmetry

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Introduction to Pointcloudmetry, is as a geometrics reference book for point clouds derived from both lidar and multi-view photogrammetry. This book is structured as a textbook and covers electromagnetic energy, principles of light, photogrammetry, and lidar followed by the applications of point clouds to the geometrics discipline. Various software, interpolation, filtering, and visualization methods are then introduced and build upon the previously introduced concepts. The book title term "pointcloudmetry" is introduced as a "subbranch of geomatics" and the author asserts that this term "encompasses the technologies for obtaining accurate and detailed information about earth related objects, including bare earth surface, by acquiring and processing point clouds."

Chapters one through three deal with the electromagnetic spectrum, laser light, and the sources and characterizations of point clouds. The properties of lasers including divergence, reflectance, and refraction are covered, as are various contemporary uses for point clouds. These first three chapters are useful for establishing a basic understanding, and for those already familiar with these areas, these chapters serve as an excellent reference.

Chapters four through seven focus on the acquisition of point clouds. Chapter four focuses entirely on point clouds created through multi-view or photoscanning photogrammetry. It explains how software uses different types of image mapping to create three-dimensional coordinates from a series of photographs with varied camera coordinates. The author notes that "Usually, commercial software appears to be a black box, and reading the manual alone is not enough." The principles of photogrammetry are covered including feature-based image mapping, and least-squares image matching. Chapter five focuses on aerial lidar and covers various sensor types, multi-beam systems, georeferencing, point density, and how systematic errors can be accounted for and largely eliminated. Chapter six focuses on terrestrial laser scanning (TLS), or ground-based lidar, and mobile laser scanning (MLS). The difference between pulse based and phase shift scanners is discussed, targets for scan registration and simultaneous localization and mapping (SLAM). Automatic classification of points is also covered including a benefit comparison of point-based and segmentation-based classification methods. Chapter seven covers geodata acquisition, ground sample distance (GSD) for photoscanning photogrammetry with drones, and differences and potential pitfalls for lidar based point cloud density vs. sampling intervals. Validation and accuracy of digital elevation models (DEM) are also discussed.

Chapters eight through ten focus on DEMs, interpolation, and filtering. Chapter eight focus on the importance of DEMs and their uses, how they are derived from point clouds, taxonomy, triangular irregular networks (TINs), and sampling. Chapter nine deals with the importance of interpolation, and various methods of interpolation including, spatial, spline, TIN, bilinear, natural nearest, local polynomial, Gaussian, and interpolation weights. Chapter ten focuses on ground filtering, how filtering is used for point cloud classification, the complexity of non-ground classes, the reconstruction of a ground surfaces, and quality measures.

Chapters eleven through thirteen are focused on the three-dimensional mapping of point clouds as opposed to the 2.5D mapping in chapters eight through ten. Chapter eleven covers feature detection or automated detection of interest points in both imagery and point clouds. Concepts covered in this chapter are directly related to chapter four and include least-squares adjustment, edge detection, and operators that have been developed to aid in computer vision applications, and machine learning. Chapter twelve covers contemporary software used for processing point clouds including software for point clouds generated through lidar, photoscanning photogrammetry, feature extraction, and

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various applications. Chapter thirteen covers pilot studies for various applications including road maintenance and inventorying, railway inspections and mapping, power line mapping, cultural heritage, mining, forestry, fire monitoring, and even gaming. It also covers the idea of integrating both lidar from TLS and UAS photogrammetry.

While this book focuses on point clouds as related to geomatics and delves into the specific benefits and uses in certain fields, other disciplines may also find inadvertent benefit. Professionals in industries that currently utilize point clouds such as aerospace, architecture, construction, crime investigation, forensics, and medicine may also see the application of various filtering, feature detection, and processing methods presented.

There is an ever-changing, driven, and competitive group of software and hardware manufactures, and developers that surround both point cloud generation and processing. The constant growth in this area can make up-to-date resources difficult to find. *Introduction to Pointcloudmetry*, Point Clouds from Laser Scanning and Photogrammetry, serves as a needed resource. Readers may look for future versions of this book to cover these technological advances with updated materials.

Introduction to Pointcloudmetry, is well-organized and covers point cloud data collection, processing, and application from beginning to end. This structure makes it well suited as a foundational resource for GIS students and professionals looking to better understand the power of point clouds, how they are derived, and to incorporate newer software, filtering, and processing methods.