LASER SCANNING AND PHOTOGRAMMETRY

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Introduction to Photogrammetry; Photogrammetric terms; applications; advantages; limitations and a brief history; Types of cameras: metric vs. non-metric; types of photogrammetry. Aerial Photogrammetry; Geometry of vertical/near-vertical aerial photographs: Orthographic vs. perspective projection, Map vs. Photograph, Scale of photograph, estimate the scale, Relief displacement and its determination, Parallax in photographs and measurement; stereoscopy. Transformation between image and object space, collinearity equations; Interior & exterior orientation; Space resection; Space forward intersection and limitations; Aerial triangulation and bundle block adjustment. Ortho-photo and DTM generation; Terrestrial photogrammetry; computer vision approach; DLT; Epipolar geometry; Image matching methods: SURF, RANSAC etc; Structure from Motion (SfM) (Introduction and brief). LiDAR: Introduction, Laser characteristics, laser interaction with objects; Types of LiDAR systems: Terrestrial, airborne, static and dynamic; Altimetric LiDAR: topographic and bathymetric, single and multiple return, full waveform digitization. Components of a LiDAR system, INS/GNSS/LiDAR integration, system calibration, Kalman filter (brief); LiDAR geo-location; accuracy of LiDAR components; error propagation and error analysis; Airborne LiDAR surveys: Flight Planning, survey execution; Examples and applications of integrated LiDAR systems: MMS, Airborne LiDAR systems, UAVs. Integration of LiDAR with spectral data (camera); LiDAR data classification techniques, raw data to bald earth DEM processing, applications of return intensity and full waveform in information extraction; LiDAR applications: building, tree, powerline extraction. Integrated systems (UAV, Car, Aircraft etc).: Applications and some case studies: Mining, Exploration, SLAM.