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Opinion Article

A Short Note on LiDAR Remote Sensing

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DESCRIPTION

Remote sensing advanced technologies like aerial and satellite imagery are generally mentioned as passive technologies because they estimate how radiation from sunlight reflects off an object. Aerial and satellite images are widely used in the natural sciences and since the launch of Landsat 1 in the 1970´s. The usage of satellite and aerial imagery are extensive and not covered in this guide. Whereas satellite and aerial imaging are considered passive, processed techniques like Light Detection and Ranging (LiDAR) and radar are assess active, as they are independent on sunlight but rather discharge radiation of their own and then measure how this radiation reflects from a target on the basis. Radar is an acronym for radio detection and ranging and it is a mode based on discharging radio waves and then measuring their reflection. It uses a laser to produce and emit pulses of light and measures the time period it takes for a reflection of this vibration to return. Most commonly, the Light Detection and Ranging (LiDAR) system is carried by a fixed wing airplane and in addition to the laser emitter receiver scanner, Light Detection and Ranging (LiDAR) systems are also interconnected to a Global Positioning System (GPS) and an Inertial Measurement Unit (IMU). The GPS constantly estimate the place of the laser scanner, which is vital for knowing the location where the light pulses are discharged from.

Lidar works on the life of a single emitted pulse of light. The pulse of light is a group of time stamped photons discharged with known directionality. As this pulse contacts a surface a portion of those photons are returned back towards the laser. The laser emitting device recognizes these time stamped, reflected photons and estimates the time between their initial emission and their reflected return, on the other hand called their echo. Next, the device estimate the location from where the echo originated.

Lidar data can come in two forms, seperated return and full wave form data. Where as many of the principles are covered in this guide apply to both types of data, this guide mainly focuses exclusively on individual return data because they are the most common publicly available datasets. In the collection phase of discrete return data, the system counts an echo only if the incoming echo exceeds a pre-defined threshold of strength. In practice, this has the effect that echoes reflected from certain objects, for example a single tree branch, may not provide sufficient intensity to be stored in discrete return data. Discrete return data records information only from targets that yielded a strong enough return. This intensity threshold can be modified. In contrast, in full wave form data the whole wave form is practically digitized, regardless of intensity or strength.

In order to estimate, for example, meaningful metrics of vegetation structure, the Z-coordinates in lidar point clouds need to be scaled to above ground level. This can be achieved by first creating a terrain model from the ground echoes and then utilizing this terrain model to re-scale the echo heights. In practice, this is usually achieved by differentiating the ground echoes from the other echoes and then inserting a Digital Terrain Model (DTM) from them. Digital terrain models are frequently rasters, wherein every cell's fee denote its elevation. The subsequent step includes subtracting. The next step involves subtracting digital terrain model value from the other echoes by identifying the digital terrain model cell within which the Light Detection and Ranging (LiDAR) echo falls and subtracting the digital terrain model cell's z value from the light detection and ranging echo z value. What remains is the metric variation in z between the cell and the light detection ranging echo and this value depict the height of our light detection and ranging echo above ground level.

Lidar applications are mainly used in forestry, vegetation structure. In many countries light detection and ranging is already in functional use in the forestry sector, agricultural where it is used for forest and agricultural inventory purposes.

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