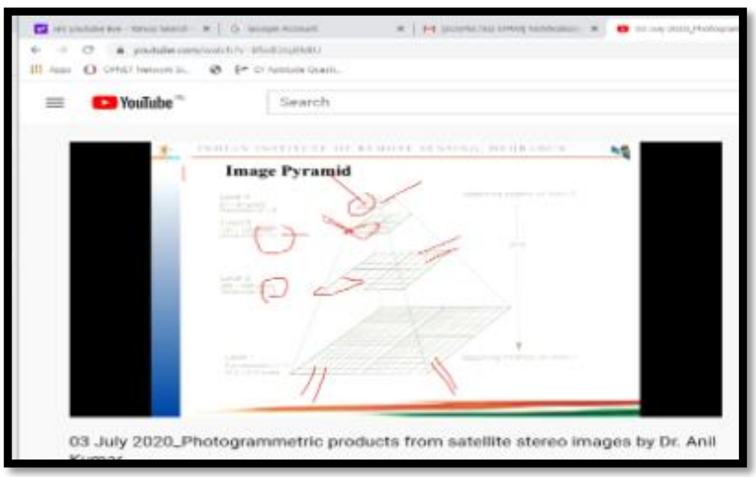
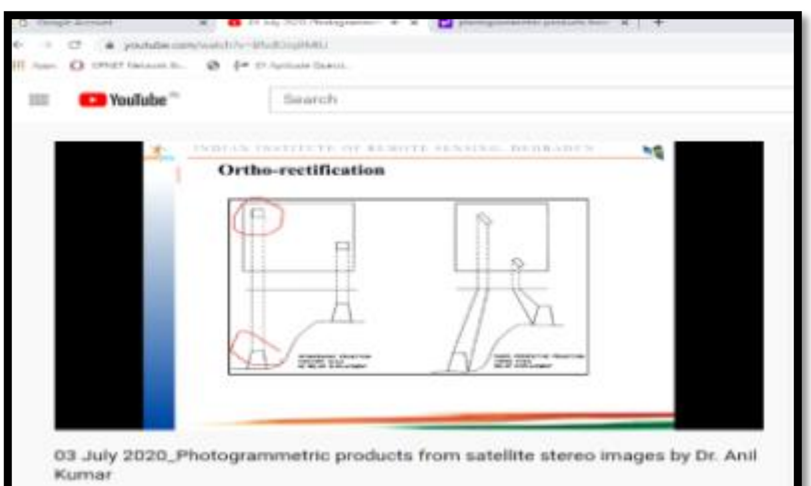
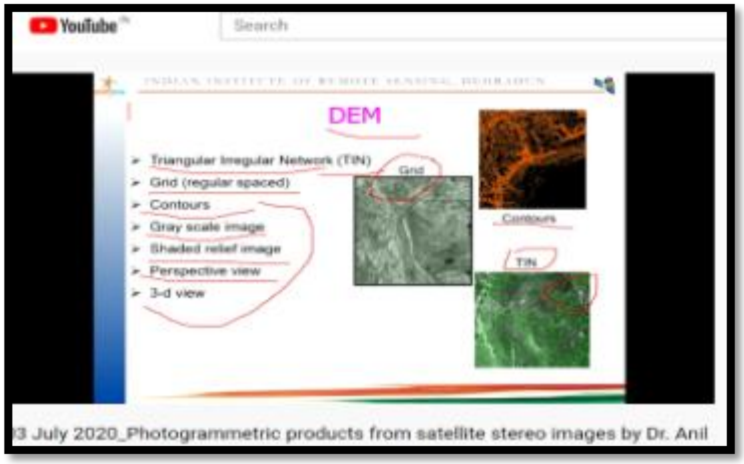
DAILY ASSESSMENT

Date:	**03/07/2020**	**Name:**	**Davis S. Patel**
Course:	**IIRS Outreach Programme on "Satellite Photogrammetry and its Applications"**	**USN:**	**4AL16EC045**
Topic:	**Photogrammetric products from satellite stereo images (DEM and derivatives & Orthoimage)**	**Semester & Section:**	**8th - A**
GitHub Repository:	**Davis**		

AFTERNOON SESSION DETAILS
Image of session







REPORT –

A Digital Elevation Model (DEM) is a representation of a land surface in a 3 dimensional space with elevation as the third dimension along X (horizontal coordinates) and Y (vertical coordinates) dimensions. DEM is a useful data source in hilly areas terrain analysis; DEM plays an important role in various areas like disaster management, hydrology and watershed management, geomorphology, urban development, map creation and resource management etc. Cartosat-1 or IRS P5 (Indian Remote Sensing Satellite) is a state-of-the-art remote sensing satellite developed and launched by ISRO (May 5, 2005). It has been designed for terrain modeling and large-scale mapping applications. This high resolution stereo data has great potential to produce high quality DEM. The high resolution Cartosat-1 stereo image data is capable to provide significant impact in topographic mapping and watershed applications. The objective of the present study is to generate high resolution DEM (10 m and 30 m) and ortho-rectified image through Cartosat-1 stereo pair, quality evaluation in different elevation strata, generation of terrain parameters. Aglar watershed in Tehri-Garhwal and Dehradun district has been used as the test site. The present study reveals that DEM generated (10 m and 30 m) using CARTOSAT-1 stereo pair is of high quality. The derived terrain parameters like slope, aspect, drainage, watershed boundaries etc., are also of good quality. A comparison of the DEM and the parameter derived from it reveals significant improvement in the quality as compared to the freely available DEM in internet.

Optical satellites are now able to collect very high-resolution imagery over large land areas with a high level of detail, and the spectral and spatial resolutions of satellite data play a significant role in ensuring the accuracy and reliability of the derived maps.

For instance, the GeoEye, WorldView and Pleiades satellites provide imagery with a ground sampling distance (GSD) of approximately 50 cm in panchromatic mode. Moreover, during 2014, a few satellite companies received permission to collect and sell imagery at up to 25 cm panchromatic and 1.0 m multispectral GSD.

For decades, aerial imagery had been the only approach available for generating digital elevation models (DEMs) over large areas. Although airborne photogrammetric flights with new digital aerial cameras make it possible to capture highly detailed imagery, the drawback is that they require “ad hoc” photogrammetric flights at detailed scale and the handling of a high number of frames.

The filtered point cloud was transformed from Geographic coordinates to UTM coordinates for further processing. The filtered point was then interpolated into a raster of required grid size using a planar interpolation in which a plane was fitted to the neighbors of each grid point. To compare the computed DEM with other reference DEMs such as ALOS or LiDAR DEM, the two DEMs should be registered to each other. For this purpose, a Least Squares Matching (LSM) approach was performed on the two DEMs to register them together. During the evaluation, it was observed that a shift in 3D was not sufficient for fine registration with the reference DEM. Therefore, a six parameter rigid transformation (3D rotation + 3D translation) was estimated and then applied to the Planet Scope DEM for fine registration. On test sites containing glaciers and snow, the glaciated regions were filtered out so that the LSM was only performed using the stable terrain. The outlines of the glaciated areas were extracted from Randolph Glacier Inventory (RGI) .The rasterization of the point cloud and the LSM was performed using software OPALS.

The magnitude of absolute and relative errors of DEMs data has been examined. The absolute accuracy is a measurement of the error between a DEM and the coordinates of the terrain. Accuracy is evaluated by indices such as the absolute mean error (AME), standard deviation (SD) and the root mean square error (RMSE), whereas shape reliability is evaluated through statistical analysis of a parameter set characterizing the spatial properties of a surface such as slope and aspect. Absolute accuracy is expressed as the vertical RMSE, who is an overall error indicator that takes into account both random and systematic errors introduced during the data generation process. The relative vertical accuracy is especially important for derivative products that make use of the local differences among adjacent elevation values, such as slope and aspect. A DEM with good relative accuracy is one that models the shape and dimensions of the terrain accurately, but may not necessarily be accurately registered to real geographic coordinates. The relative accuracy is expressed as the standard deviation of the vertical error [Jung Hum Yu, 2011]. The accuracy of the DEM95 is determined as the difference between the CPs and DEM95 and is denoted as CP - DEM95; similarly, the accuracy of the ASTER and TINITALY is denoted as CP - ASTER and CP - TINITALY. In order to describe and compare the elevation distributions in each DEM, elevations at the locations of CPs have been extracted from all DEMs and compared with the elevations of CPs to determine several descriptive statistic measures.