**DAILY ASSESSMENT FORMAT**

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| **Date:** | **01/07/2020** | **Name:** | **Kirti B S** |
| **Course:** | **IIRS Outreach Program on Satellite Photyogrammetry and it’s Application** | **USN:** | **4AL18EC026** |
| **Topic:** | **Concepts of Satellite Photogrammetry** | **Semester & Section:** | **4th sem ‘A’ section.** |
| **Github Repository:** | **Kirti BS** |  |  |

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| **FORENOON SESSION DETAILS** |
| **Image of session**  **[C:\Users\Pawan\Desktop\R1.PNG](file:///E:\z.docx)**  **C:\Users\Pawan\Desktop\R4.PNG** |
| **In today’s session I have learnt about:**   * **Hardware Components of Digital Photogrammetric workflow:** * **Enabling stereo-viewing** * **Measuring capability** * **Workstation with appropriate processing and storage capabilities** * **Processor:**   **Memory – RAM and Disk space, graphic displays. 2D Persceptive and Anaglyph Display, Stereo Display, Graphic Cards, Stereo Display Monitors, Peripherals.**  **A Digital Photogrammetric system is defined by ISPRS as Hardware and Software designed to derive photogrammetric products from digital imagery using manual and automated techniques.**   * **Software Requirements of a Digital Photogrammetric Worflow:** * **Standard Requirements:** * **Handling image display** * **Measurement :** * **Recording Pixel Coordinates** * **Determination of Orientations :** * **Inner Orientation including Caliberation parameters** * **Relative and Absolute orientations, Bundle adjustment-transformations.** * **Image Processing Functions** * **Image Matching** * **Edge Detection** * **Digital Rectification** * **Visualization** * **Automation:** * **Examples:** * **Commercial off the shelf Photogrammetric software:** * **Leica Geosystems : Leica Photogrammetric suite** * **PCI Geomatica : Geomatics Orthoengine** * **Intergraph : Z/I Imaging Image Station** * **BAE Systems : SOCET SET** * **INPHO** * **Open Source Software enabling Photogrammetric Processing:** * **ILWIS (Integrated Land and Water Information System)-Stereoscopy, Anaglyph and Photogrammetry tools** * **E-foto** * **OSSIM : Open source Software Image Map** * **Digital Photogrammetry:** * **It is applied to digital images that are stored and processed on a computer.** * **It is also called as Softcopy Photogrammetry.** * **The output product are in digital form, such as digital maps, DEM’s and Digital Orthophotos saved on computer storage media.** * **It is fully automated process.** * **Stereo Imaging and Topographic mapping** * **Stereo satellite images are captured –** * **Consecutively by a single satellite along the same orbit within a few seconds** * **The base-to-height ratio should be close to 1 for high-quality stereo model with high elevation accuracy.** * **Optimum base to height ratio is 0.6 to 1.0** * **Atmospheric effects become more significant at higher look angles.** * **Satellites :**   **Cartosat-1, IRS 1C/D, TMC on Chandrayaan IKONOS, World View, Pleiades, EROS-A, ALOS, MOMS-02, SPOT, Terra ASTER etc.**   * **Light Rays in a bundle defined by the sensor are almost paralle;-lessesing the importance of the satellite’s position.** * **The inclination angles of the cameras onboard the satellite become the critical data.** * **Inclination is the angle between a vertical on the ground at the center of the scene and a light ray from the exposure station.** * **The angle defines the degree of off-nadir viewing when the scxene was recorded.** * **The cameras can be tilted in increments of a minimum of 0.6 to a maximum of 27 degrees to the east (negative inclination) or west (positive inclination).** * **Stereo-Coverage :**   **Two possible configurations**   * **Across-track stereo:**   **The pointing of the imaging sensor is oriented off-nadir in the across-track direction.**   * **Advantages:** * **Stable because the view is not changing while imaging.** * **Off-nadir view capability allows a revisit period about 4 to 5 times shorter than the repeatability cycle.** * **Limitations:** * **Radiometry of the two images maybe different.** * **Along-track stereo:**   **Stereo coverage is obtained during the flight along the same orbit either by-**  **Using at least two sensors oriented off-nadir in the along –track directions with different angles of view – that is ore and aft**  **By changing the pointing angle of one sensor along the orbit.**   * **Advantages:** * **Time between the recording of the two images is very short.** * **The illumination conditions are almost identical.** * **Image acquisition methodology:** * **The satellites collects the image by scanning along a line which is called the scan line.** * **Linear sensor arrays that scan an image strip while the satellite orbits.** * **For each line scanned by the sensors of the satellites there is a unique perspective center and a unique set of rotation angles.** * **Each scan lines of the scene has its own set of exterior orientation parameters, principal point in the center of the line.** * **The start position is the projection of the center of row 0 on the ground.** * **Location of the perspective center relative to the scan line is constant for each line as the interior orientation parameters and focal length are constant for a given scan line.** * **Since the motion of the satellite is smooth and linear over the entire length of the scene, the perspective centers of all scan lines in a scene are assumed to lie along a smooth line.** * **Since, the satellite is highly stable during acquisition of the image, the exterior orientation parameters can be assumed to vary in the systematic fashion.** * **Perceptive center:** * **The satellite exposure station is defined as the perspective center in the ground coordinates for the center scan line.** * **The image captured by the satellite is called a scene.** * **Each pixel is defined by a file coordinate-column number and row number.** * **The center of the scene is the center pixel if the scan line. This center is the origin of the image coordinate system.** * **Data Processing:** * **Three empirical laws of planetary motion:** * **Every planet revolves around primary body in the elliptical orbit with sun at one focus.** * **The radius vector sweeps out equal areas in equal interval of time.** * **The period of the orbit squared is proportional to the semi major axis cubed.** * **Orbit Characteristics:** * **Sun-synchronous orbit** * **Descending node** * **Repeatability cycle** * **Revisit** * **Orbital period** * **Path overlap** * **Scene definition** * **Ephemeris Data:** * **The header of the data file of a satellite scene contains ephemeris data, which provides information about the recording of the data and the satellite orbit.** * **The data provided is:** * **Position of the satellite in geocentric coordinates to the nearest second.** * **Velocity vector of the camera.** * **Rotational velocity of the camera.** * **Attitude changes of the camera.** * **Exact time of exposure of the center scan line of the scene.** * **The data obtained is converted to local ground system for the triangulation.** * **Modeling Satellite Sensor Orientation:** * **Defining the camera or sensor model involves establishing the geometry of the camera as it existed at the time of image acquisition.** * **Modeling satellite sensor motion and orientation in space is one of the preliminary tasks that should be performed for using satellite image data for any application.** * **The orientation of the images is a fundamental step and its accuracy is a crucial issue during the evaluation of the entire system.** * **General mathematical models for satellite sensor modeling are used:** * **Rigorous or physical sensor model.** * **Rotational functional model.** * **Direct linear transformation.** * **3D Polynomial model** * **3D Affine model.** * **Physical sensor model:** * **It aims to describe the relationship between image and ground coordinates, according to the physical properties of the image acquisition.** * **Physical sensor model can be formulated using basics of the collinearity equations that describe the relationship between a point on the ground and its corresponding location on the image.** * **Using linear array sensor, the collinearity equations should be written for every scanned line on the image.** * **Rational Functional Model:** * **Generic model** * **Uses ratio of two polynomial functions to compute the x and y coordinate in image.** * **3D Polynomial model:** * **3D Polynomial model is used to model the relationship between the image and the object spaces.** * **Choice of the polynomial order depends on the type of terrain available number of GCP, and the stability of the satellite sensor in space.** * **3D Affine Model:** * **It can be performed by limiting the polynomial model to the first order.** * **3D Affine model has high integrity to represent the relationship between the image and the object spaces, especially when the model is applied to data obtained from highly stable satellite sensors.** * **Interior Orientation:** * **It refers to the sensor elements calibration and the system behind the image plane.** * **In a satellite image the interior orientation parameters are:** * **Principal point on the image.** * **Focal length of the camera.** * **Optics parameters.** * **Exterior Orientation:** * **It describes the location and orientation of the bundle of rays in the object coordinates system with the 6 parameters:** * **Projection center coordinates (X0, Y0, Z0)** * **Rotation around the 3 axis (roll, pitch, yaw)** * **Exterior orientation parameters are:** * **Perspective center of the center scan line.** * **Change of perspective centers along the orbit.** * **Rotation of the center scan line: roll, pitch, yaw.** * **Change of the angle along the orbit.** * **Data Representation:** * **Digital representation of elevation in a region is commonly referred to as a digital elevation model.** * **When the elevators refer to the earth’s terrain, it is appropriately reffered to as a digital terrain model.** * **When considering the elevations of surface at or above the terrain, it can be referred to as a digital surface model.** * **Ortho-Rectification :** * **Process of reducing geometric errors inherent within photography and imagery.** * **General sources of geometric errors:** * **Camera and sensor orientation.** * **Systematic error of the camera.** * **Topographic relief displacement.** * **Earth curvature.** |