DAILY ASSESSMENT FORMAT

Date:	1st July2020	**Name:**	Soundarya NA
Course:	IIRS Outreach Program on Satellite Photogeommetry	**USN:**	4AL16EC077
Topic:	IIRS Outreach Program on Satellite Photogeommetry	**Semester & Section:**	8th - B

FORENOON SESSION DETAILS
Image of session

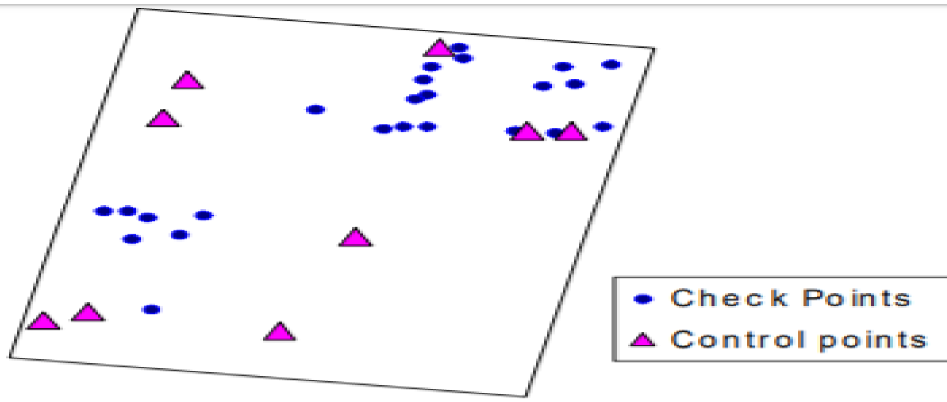
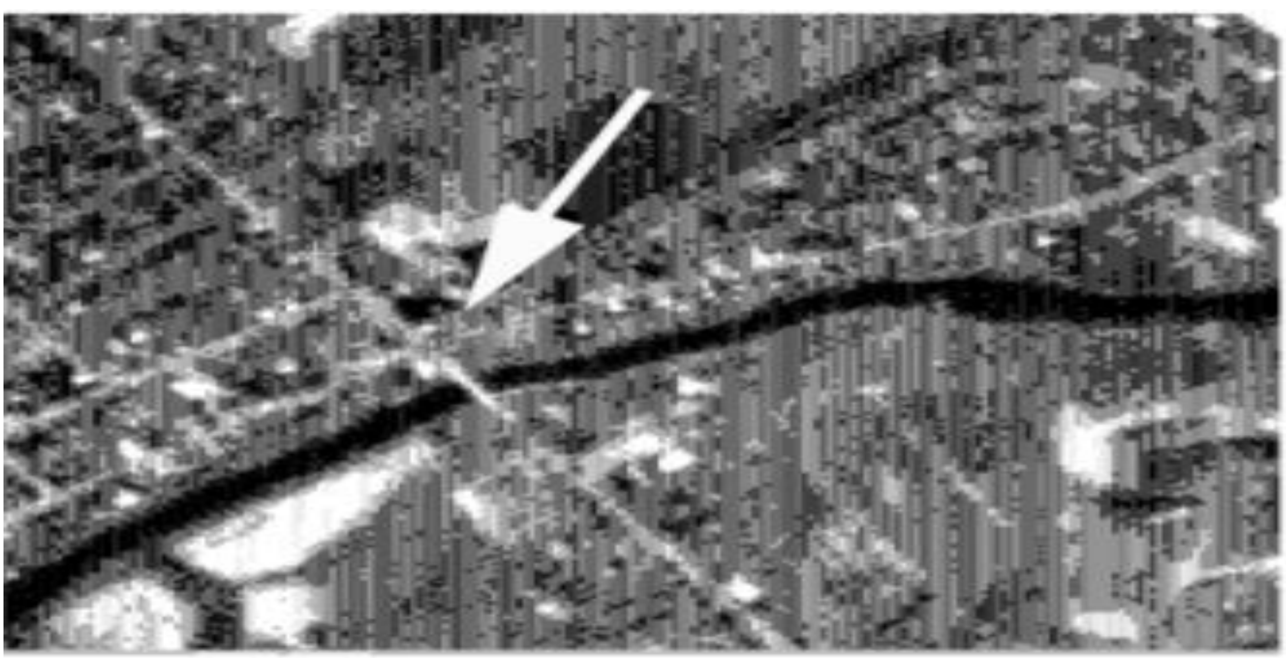


Figure 2: Distribution of control and check points within the test area.



Report:

The stereo-compilation from aerial photographs was and is still the most popular method for 3D topographic data acquisition for production of new and the revision of old inaccurate databases and maps. The situation for updating existing topographic databases is different. For the Canadian context, studies conducted at Geomatics Canada have shown that a suitable method can be the monoscope updating from ortho-images (Armenakis and al., 1995; Savopol, 1994). The data source for the orthoimages can be either digitized aerial photography or satellite imagery with ground resolution of 10m or less, depending on the location of the area of interest, the density of information, the desired content and accuracy of the updated data, and the availability of DEM data.

However, data collection in stereo mode for updating is sometimes the best solution or even the only possible solution especially in areas with only older poor cartographic base and in areas with significant high elevation differences and without accurate existing DEMs. Stereoscopy offers some important advantages in facilitating the identification of features.

The new high-resolution commercial satellites will provide more choices for data sources. This paper describes an investigation conducted at the Centre for Topographic Information (CTI), Geomatics Canada, on the use of the Indian Remote Sensing satellite IRS-1C PAN images for national topographic mapping. For the stereoscopic evaluation of 3D data extraction, two CCD overlapping scenes were restituted using the Direct Linear Transformation (DLT) method.

Satellite stereo-coverage:

Depending on the design of its sensors, a remote sensing satellite with stereo capability is able to capture images in stereo mode using one of two possible configurations: across track or along track. In across track configuration, the pointing of the imaging sensor is oriented off-nadir in the across track direction. The stereo coverage is obtained by recording the same area from one of the neighboring tracks after the sensor orientation has changed for an across track angle in the opposite direction (or for a nadir view). This configuration was used for the design of the SPOT series of satellites and for the two IRS-1 C and D satellites.

The across track configuration was adopted for the design of these two series of satellites probably aiming to increase the ground coverage, as well. In fact, the off-nadir view capability allows a "revisit period" about 4 to 5 times shorter than the repeatability cycle. The "revisit period" is the average time between two possible "visits" of the same site using all across track available angles of view. The repeatability cycle is the time between two passes over the same site. For a satellite using only a nadir angle of view, the revisit and the repeatability periods are equal. In the case of the IRC-1C satellite, the repeatability cycle is 24 days and the average revisit period is approximate 5 days.

In the along track configuration, 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 direction with different angles of view, i.e. fore and aft, or by changing the pointing angle of one sensor along the orbit. The time between the recording of the two images is very short, as in traditional aerial photogrammetry. The illumination conditions are identical, the radiometry of the two images is similar and the stereo observation should be easy.

Description of image data:

Two IRS-1C PAN images of the eastern Ottawa area and their individual CCD array images were acquired for this investigation. The availability of images at the time of image selection was limited. All images were of nadir view, that is, no stereoscopic coverage was available with the PAN camera tilted and thus resulted in weak convergent geometry. Selection of imagery was also limited due to cloud and snow coverage. The first scene, the 287/037, had been acquired on 25/11/96 and the shadow effect was obvious due to low sun elevation. The second scene, the 288/037, was taken on 15/06/96 and was from the neighboring orbit to provide basic stereoscopic coverage. Unfortunately, this image is of a poor radiometric quality but certain linear features, such as roads and road intersections can be distinguished for measurements. In this investigation for the determination of 3D coordinates, the left image of the stereo pair was CCD 3 from the 288/037 scene and the right image was CCD 2 from the 237/037 scene. The centre of the left image is at latitude 45o 32' 40".56N and longitude of 75o 19' 32".90W and the centre of the right image is at 45o 22' 03".36N and 75o 18' 00".35W respectively. This set-up has an unfavourable base-to height ratio of about 0.087. Despite the lack of ideal data it was decided to proceed with the testing of the images, the approach and the systems capabilities. Figure 1 illustrates a schematic diagram of the two images with the CCD sub-scenes and the overlapping area. The test area covers the upper part of the overlapping area with a width of 22km and a length of 24km.

Despite the fact that satellite imagery is almost an orthographic projection at nadir view due to its very high attitude, the stereoscopic 3D determination of topographic features can meet many mapping requirements. The upcoming high-resolution satellites will be on lower orbits and will provide along track stereo coverage. Thus, stereo (and even multi-scene) determination of points is expected to increase. In addition, either the sensor geometry may not be available or the sensor model may not be fully developed for immediate use with the image data. In this investigation both the unknown sensor model and the stereo-point determination were addressed using the existing digital photogrammetric workstation at CTI with the rigorous Direct Linear Transformation for the orientation of the IRS-1C scenes. Initial results obtained with this approach showed that the planimetric accuracy of the stereo-compiled data is in the order of 1 pixel, while the vertical accuracy (about 30m with a very small B/H) depends on the stereoscopic acuity (existence or not of residual y-parallax) and, of course, on the base-to-height ratio. It is anticipated that the results obtained can be further improved if the image pixels are corrected for systematic errors caused by the across track off-nadir viewing and the rotation of the earth before the application of the DLT transformation. Work also continues towards the automatic extraction of control information.