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Geo Spatial Data And it's Quality Assessment

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Abstract – *The Spatial Data Accuracy describes a way to measure and report positional accuracy of features found within a geographic data set. These data Quality provides information on, and a general assessment of, the quality of a data set or information resource. Positional accuracy has always been considered a defining and essential element of the quality of any cartographic product as it affects factors such as geometry ,topology, thematic quality and it directly related to the interoperability of spatial data. This study aims to produce accurate geospatial data from unmanned aerial vehicles(UAV) images. The image is approx. 5 to 6 kilometers area of the Banaras Hindu University campus in Varanasi ,Uttar Pradesh India, was captured using a DJI Mavic Pro Platinum drone. Arc GIS pro and Pix4dmapper programs were used to generate the solution. The horizontal and vertical accuracies were obtained with UAV solution. The analysis of the points of horizontal and vertical points were done as well as the accuracy error shown in the tabulated form. As the error analysis is also shown by the help of the statistical tool.*

Key Words: Unmanned aerial vehicles(UAV), Photogrammetry, GPS, Statistical tool.

1. INTRODUCTION

The quality of data sources for GIS processing is becoming an ever increasing concern among GIS application specialists. With the influx of GIS software on the commercial market and the accelerating application of GIS technology to problem solving and decision making roles, the quality and reliability of GIS products is coming under closer scrutiny. Much concern has been raised as to the relative error that may be inherent in GIS processing methodologies. While research is ongoing, and no finite standards have yet been adopted in the commercial GIS marketplace, several practical recommendations have been identified which help to locate possible error sources, and define the quality of data. The following review of data quality focuses on three distinct components, data accuracy, quality, and error.

The fundamental issue with respect to data is accuracy. Accuracy is the closeness of results of observations to the true values or values accepted as being true. This implies that observations of most spatial phenomena are usually only considered to estimates of the true value. The difference between observed and true (or accepted as being true) values indicates the accuracy of the observations.

There are two components to positional accuracy. These are relative and absolute accuracy. Absolute accuracy concerns the accuracy of data elements with respect to a coordinate scheme, e.g. UTM. Relative accuracy concerns the positioning of map features relative to one another.

Often because GIS data is in digital form and can be represented with a high precision it is considered to be totally accurate. In reality, a buffer exists around each feature which represents the actual positional location of the feature. For example, data captured at the 1:20,000 scale commonly has a positional accuracy of +/- 20 meters. This means the actual location of features may vary 20 meters in either direction from the identified position of the feature on the map. Considering that the use of GIS commonly involves the integration of several data sets, usually at different scales and quality, one can easily see how errors can be propagated during processing.

The first objective is to quantify the difference in accuracy achieved by using some GCPs with respect to the other GCPs. The second objective is to compare different image processing packages to obtain point-cloud information using this system. Two software packages, ArcGis Pro Professional version 1.5.2 and Pix4dmapper, were chosen tocalculate the mathematical solution for the study area. Thepaper first describes the study area, UAV system, flight planning, and GCP coordinate collection methods. The subsequent sections introduce the proposed processing method and discusses the results of the experiment along with the accuracy of the obtained models, drawing comparisons between the different software packages. The final section concludes the work.

1.1 Data Quality Measures

One of the major problems currently existing within GIS is the aura of accuracy surrounding digital geographic data. Often hardcopy map sources include a map reliability rating or confidence rating in the map legend. This rating helps the user in determining the fitness for use for the map. However, rarely is this information encoded in the digital conversion process.

Table1:Data Quality Measures

Category	Sub-category
Completeness	Commission
	Omission
Consistency	Conceptual
	Domain
	Format
	Topological
Positional Accuracy	Absolute or External
	Gridded data
Temporal Quality	Accuracy of a time measurement
	Temporal consistency
	Temporal validity
Thematic Accuracy	Classification correctness
	Non-quantitative attribute correctness
	Quantitative attribute accuracy
Aggregation Measures	Data product specification check

A total number of measures identified as sixty-one out of which twenty-six are observed as essential and thirty-five as optional parameters in the data quality assessment. However, the total number of parameters tested is completely depends on application and the data product specification provided by the organization.

2. Description of the study area

2.1 Study area

The study area is the banaras hindu university in Varanasi district of Uttar Pradesh state of India. It is about 5 to 6 km in covering the area and its error with respect to the other is find and its analysis is done.

Mavic Pro Platinum model has a longer flight time of 30 min, and it is not designed to carry payloads. The flight time of a UAV is highly dependent on the flight speed and wind speed.

Fig.1 Study Area of Banaras Hindu University

3. Methodology

3.1 Images to Ortho photos

The captured images were processed using two software packages: Agi soft Meta shape and Pix4dmapper. An ortho rectified image mosaic was generated after producing a point cloud from the photos using the structure-from-motion (SFM) calculation method employed by both software packages. The standard solution technique for photogrammetry is BBA; an introduction to the BBA is provided by Wolf and Dewitt.

Thereafter, the camera alignment is optimized, and, finally, dense point clouds, DSMs, and ortho mosaics are created.

3.2 Statistical analysis

Accuracy measures are based on the variation between the obtained UAV photogrammetry solution value and the reference value at selected CPs. The reference values were collected by RTK GPS observations before the image-capturing step, and the RMSE was calculated from the differences.The RMSE is frequently used to measure the deviations between the reference data (more accurate) and UAV-derived data.

For the full analysis of the points which are taken is shown by the difference with the help of statistics t- test analysis.

The formula of the paired t-test is defined as the sum of the differences of each pair divided by the square root of n times the sum of the differences squared minus the sum of the squared differences, overall n-1.

Paired t test

$$t = \frac{Xbar_{diff}}{\left(\frac{sd_{diff}}{\sqrt{n}}\right)}$$

$Xbar_{diff}$ = Sample mean of the differences
sd_{diff} = standard deviation of differneces
n = sample size

degree of freedom, $df = n - 1$

Table 2:Paired t-test

4. Results

4.1 Accuracy of X axis data And Y axis both

The X-axis of the data is calculated and the differences is also calculated and it is shown by the paired t-test and the differences is shown as well as the Y-axis of the data is calculated and the differences is also calculated and it is shown by the paired t-test and the differences is shown.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	XYOrtho	3.97385	20	2.535575	.566972
	XYGEarth	4.66660	20	3.926419	.877974

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	XYOrtho & XYGEarth	20	.401	.080

Paired Samples Test

		Paired Differences			
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower
Pair 1	XYOrtho - XYGEarth	-.692750	3.722657	.832411	-2.435007

Table 3:Shows the X-axis and the Y axis of data

Paired Samples Test

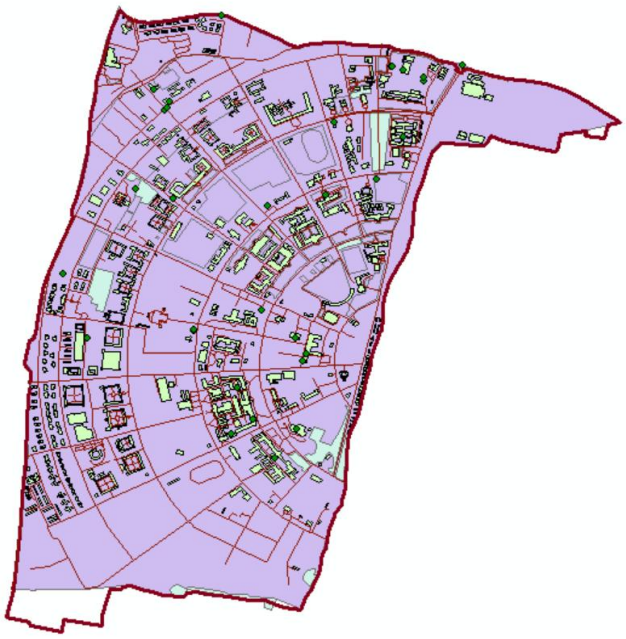
		Paired Differences	t	df	Sig. (2-tailed)
		95% Confidence Interval of the Difference Upper			
Pair 1	XYOrtho - XYGEarth	1.049507	-.832	19	.416

Table 4: X&YAxis result through SPSS

From the table it shows the data which we have observed that its significance difference is the 0.416 hence the null hypothesis is rejected as it is lesser than 0.5.

5. CONCLUSIONS

The overall analysis is done and shown in the mathematical form by the help of the T-test analysis which also helps in the 95% level of confidence checking which shows that the points which we were taken and its differences is shown by the help of Ortho image and Google earth points were differences were shown and its accuracy analysis is done by the statistical way which shows in the X and Y coordinates and its differences is shown in the above table.



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