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USE OF NEW TECHNOLOGIES AS DECISION SUPPORT IN DEFINING MSA

Parametric geocoding of the aerial hyperspectral images of the mine suspected area in mountainous terrain

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Parametric geocoding of the aerial hyperspectral images - implementation

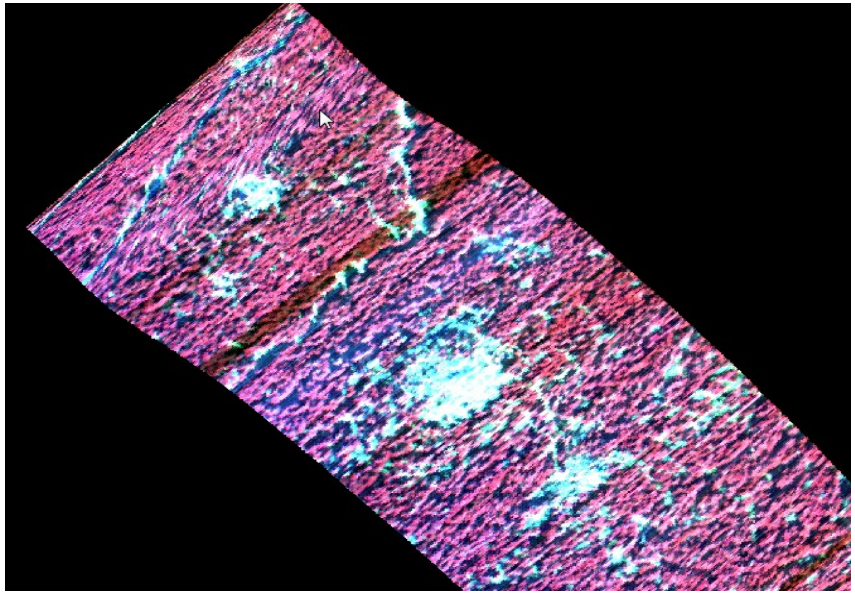
- imaging hyperspectral sensor system
- integration with inertial navigation sytem and GPS
- airborne remote sensing projects
- mountainous terrain

Problem

Solution

Is it posible to improve spatial accuracy of hiperspectral images of mountanius terrain without measureing GCP –s (ground control points) on the field?

- GCP´s coordinates read from DOF
- Geocoded hiperspectral image with spatial accuracy around 2 pixels



Parametric geocoding of hiperspectral images on GCP-s:

the process of projecting the image information at the correct geographical position using multiple parameters.

- **Attitude (INS)**
- **Position (GPS)**
- **Flight altitude**

Due to the uncertainty of extra data (GPS, INS) it is necessary to conduct offset calibration procedure based on GCP-s.

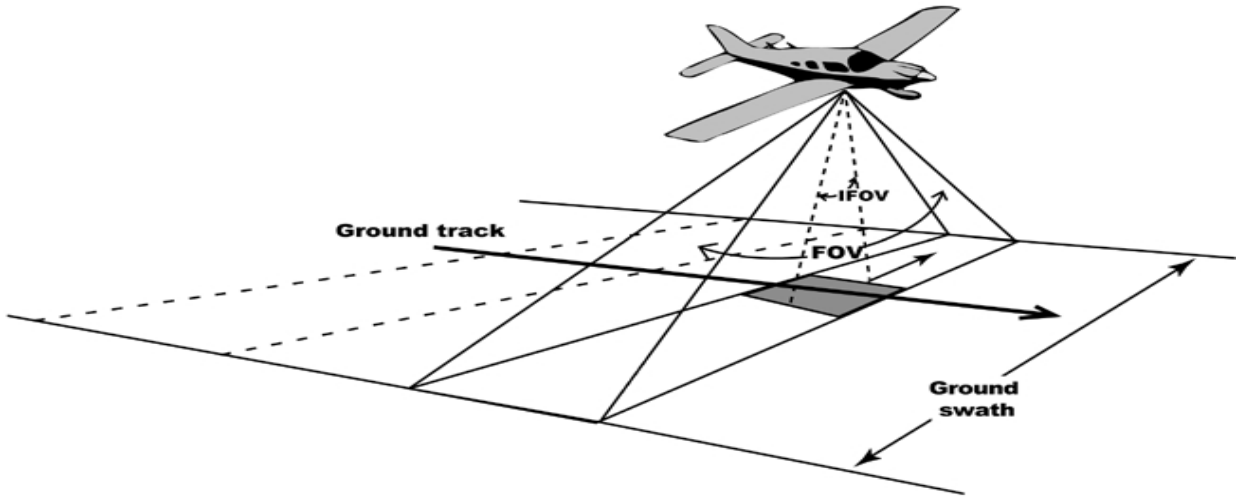
Result

Improved spatial accuracy

Error sources

- variations in terrain
- FOV – field of view
- flight altitude

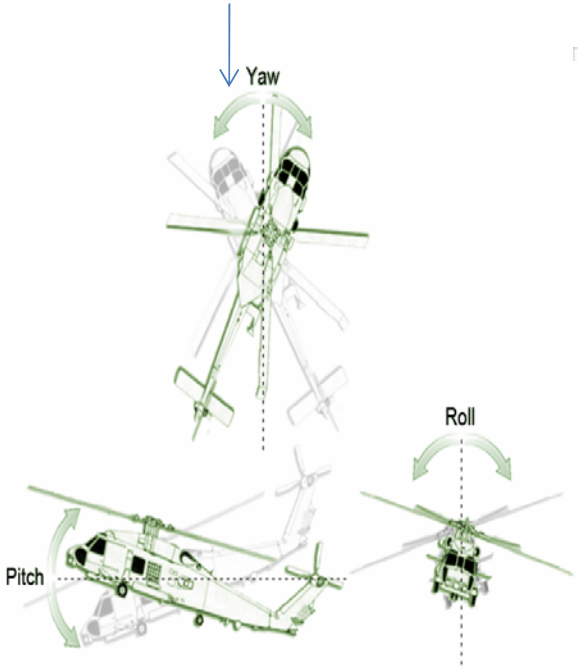
For wide FOV and the lower altitude, very small variations in topography of the Earth's surface will effect the recording geometry, displacement of recorded pixels in relation to the actual position of the pixels on Earth.

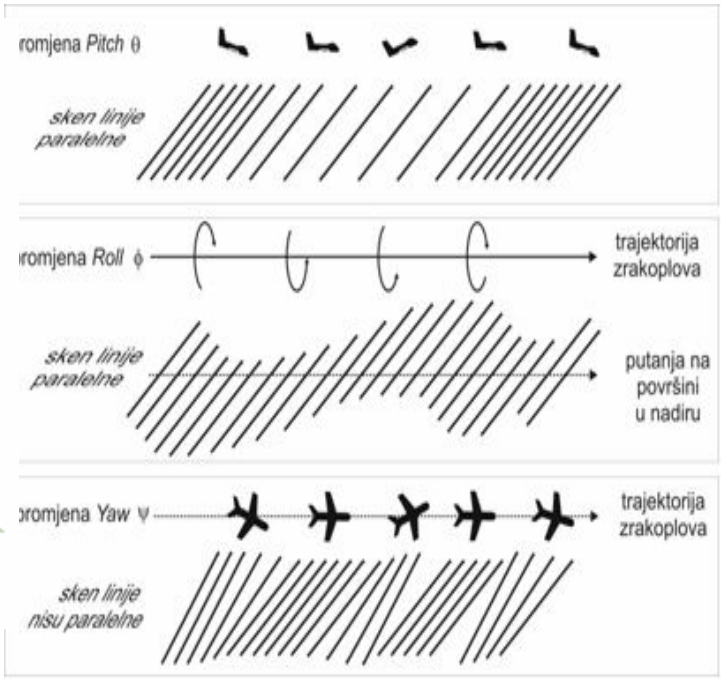


Error sources (2)

- vibration of the platform
- instability of the platform (roll, pitch, yaw)

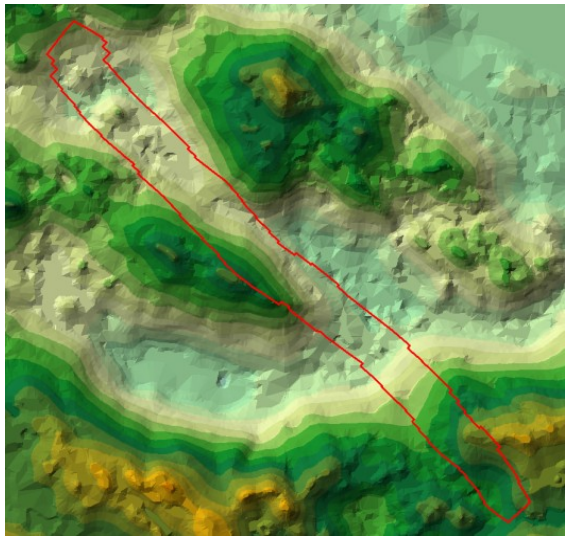
limits the productivity of electrooptical sensors





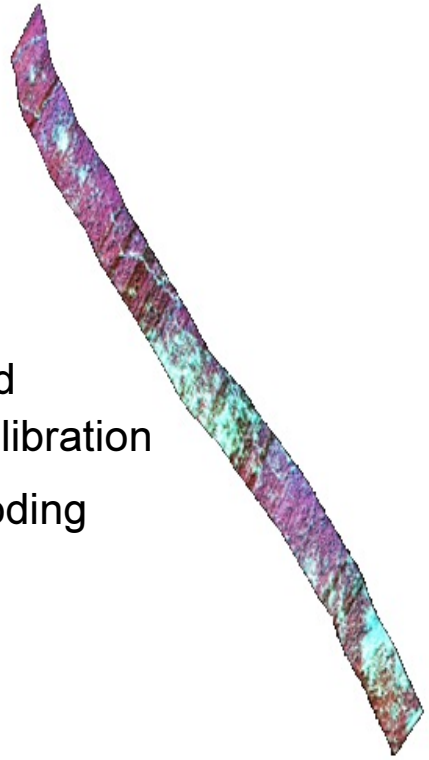
- scanner´s lines spryed
- recorded territory is not fully covered

Project implementation



- selected image - mountainous area around Gospić
- total of recorded dana - 13h, 917GB, 470km2

- created a “theoretical” DEM (pixel 1m)
- spatilal resolutin of only available DEM was too small



- coordinates carefully determined by comparing the raw cube and DOF
- only 5 GCP

- a large part of the area covered by forest
- small number of well-defined geometric objects

Performed:

- offset attitude and offset GPS dana calibration
- parametric geocoding

Statistical analysis

	Coordinate differences			
	Before calibration		After calibration	
GCP	Δ_y [m]	Δ_x [m]	Δ_y [m]	Δ_x [m]
1	36,31	11,04	-3,99	-8,56
2	34,89	25,19	-2,11	-7,01
3	41,23	31,29	1,73	10,29
4	43,47	22,07	5,07	-0,43
5	33,69	33,31	-4,51	7,11
n_y, n_x	37,92	24,58	-0,76	0,28

	Before calibration	After calibration
σ_y[m]	4,23	8,82
σ_x[m]	4,08	8,35
m_y [m]	84,79	1,70
m_x[m]	54,96	0,63
m_p[m]	101,04	1,82

$$n_y(n_x)=\frac{\sum_{i=1}^{n}\Delta y_i}{n}$$

coord. differences mean

$$\sigma_y(\sigma_x)=\sqrt{\frac{\sum_{i=1}^{n}(v_{y_i})^2}{n-1}}$$

standart deviation of coord. axses

$$m_y(m_x)=\pm\sqrt{\frac{\sum_{i=1}^{n}(v_{y_i})^2}{n}}$$

RMS error of coord. axses

$$m_p=\pm\sqrt{m_x^2+m_y^2}$$

RMS position error

Conclusion

- achieved a great improvement of spatial accuracy
- **101** pixels error (before calibration) decreased to about **2** pixels (after calibration)
- achieved value of **1.82** m for geometric measure of geocoding accuracy

The improvement of the spatial accuracy is impressive!
It shows how parametric geocoding on GCP (even without field survey) of mountainous, inaccessible terrain is not only possible but it provides an excellent source map for work on demining.

Thank you!