Old aerial photos

- Main use: For the detection of land use changes over time.
- In Greece the aerial photos of 1945 (historical aerial photos) are used in order the forest land to be defined and protected.

Objective of the project

To address this problem using linear features of arbitrary geometry that tend to persist over time, like road and stream edges (Free Form Linear Features-FFLFs), as Ground Control Information (Ground Control Linear Features-GCLFs)
METHODOLOGY

3D similarity transformation

3D object space

(X, Y, Z)

→

3D model space

(Xm, Ym, Zm)

Iterative Closest Point (ICP) Algorithm

Matching 3D GCLFs

GCLF: Collection of consecutive nodes of no regularity in the two spaces

Proposed procedure:

(i) computation of the closest points
(ii) computation of the georeferencing
(iii) application of the georeferencing
(iv) check of the error against a threshold

Repetition until convergence

APPLICATION TEST

• Study Area: at Polygyros, Chalkidiki region, Northern Greece

• Datasets:
  1. aerial photos taken in 1945 (scale 1:42,000),
  2. stereo pair of satellite Cartosat-1 panchromatic images (GSD=2.5m), captured in August 2006, and
  3. four analogue sheets of the national-wide medium scale topographic maps (scale 1:5,000), compiled in 1980.

Identification and extraction of 15 common linear features (regularly distributed at the study area) from:

- dataset 1, with arbitrary X\text{model}, Y\text{model}, Z\text{model}
- dataset 2 -after georeferencing (Case I)
- dataset 3 (Case II)

Matching of linear features’ edges or axes → Georeferencing of old photos
The distribution of the 15 FFLFs at the Study Area
• **Main Results:**

Evaluation of the achieved georeferencing accuracy with the use of 18 independent Check Points

- Planar accuracy: 10-11 m, Vertical accuracy: 3-5 m
- The best accuracy when the axes of the linear features from the topographic maps were used as reference linear features (Case II)
- In comparison with the use of GCPs, independently from the origin of the reference linear features, better accuracies were achieved. Vertical accuracy 3-4 times better!!!
CONCLUSIONS

- Linear features: appropriate to replace GCPs
  (+) Better georeferencing accuracies
  (+) Easier detection at the old aerial photos
  (+) Cost efficient procedure

However…

(-) Time consuming procedure $\rightarrow$ semi-automated techniques

- Use of the corresponding points of FFLFs as GCPs

- Further investigation on other areas with a variety of characteristics
- Investigation of the impact of self-calibration procedures
- Improvement of the proposed method by calculating the georeferencing parameters by using a network of linear features

THANK YOU FOR YOUR ATTENTION!

VI RINGRAZIO PER L’ATTENZIONE!