



Exercises in photogrammetry using PhoX

Module 1: Camera parameters and image data

Objectives:

- Definition and use of photogrammetric camera data
- Differences between analog and digital cameras
- Loading and management of image data
- Transformations between pixel coordinates and image coordinates
- Measurement of fiducial marks and transformation of interior orientation

Task 1: Using an analog aerial image

Description:

Given an aerial image of a metric camera Wild RC30 that has been digitized by a precision scanner. For the subsequent processes (e.g. map production) the interior orientation of the image has to be conducted, i.e. the transformation between pixel and camera coordinates (image coordinates) has to be determined. This is performed by measuring fiducial marks. A camera file with calibrated coordinates of fiducial marks does not exist.

Processing steps:

- Create a new project (*Project*→*New project*)
- Load the example image "barsinghausen_sw.jpg" (*Images*→*Load image*)
- Create a new camera file with typical values of a metric aerial camera with wide angle lens (*Cameras*→*Camera list*→*New*). Select camera type *Aerial image*. In addition, define reasonable nominal coordinates of the fiducial marks. Save the data to a new camera file.
- Assign the created camera to the loaded image: *Image 1*
- Conduct the interior orientation by measuring the fiducial marks (*Measure*→*Interior orientation*).
- Calculate the transformation with *Calculate* and analyse the output *Protocol*.
- After interior orientation evaluate the following values: mean transformation error, pixel size of image in x- and y-direction (scan resolution), position of image coordinate axes.
- Save your project as archive (*Project*→*Save project as ...* > *project archive*).

Test questions:

1. Focal length of a wide angle lens for an analog aerial camera
2. Focal length of a normal angle lens for an analog aerial camera
3. Maximum imaging angle over image diagonal (in degree)
4. Mean transformation error after measurement of fiducial marks
5. Pixel size of scanned image in x' and y'
6. Amount of image data in Byte

Task 2: Extended experiments

- Repeat the process of interior orientation and exchange two fiducial marks. Analyse the transformation results. Is it possible to detect the error?
- Measure the image coordinates of a well-defined point on the terrain.

- Duplicate the example image (popup menu in project tree: *Duplicate*) and modify the geometry of the duplicated image with *Rectification*→*Image transformation* (e.g. stretching of image in one direction by 10%, rotation of image by 5°).
- Repeat the process of interior orientation (what happens, if you don't do?).
- Measure the terrain point again and compare the image coordinates. What can be observed?