



## Exercises in photogrammetry using PhoX

### Module 4: Plane Rectification

#### Objectives:

- Rectification of an image into a plane object surface
- Measurement of image coordinates
- Definition and input of object coordinates (XY)
- Effect of different 2D transformation functions
- Effect of different resampling methods
- Accuracy analysis

#### Task 1: Plane rectification

##### Description:

The given image was taken by a digital camera Mamiya DCS 645M with 16 Mpixel sensor and 35mm lens. It shows the mosaic of Earl Anton Günter, which is located at the outer facade of the Graf-Anton-Günter-School in Oldenburg. For possible future renovation works the object shall be rectified into a high resolution metric image map.

##### Processing steps:

- Create a new project (*Project*→*New project*)
- Load the example image "mosaik1.jpg" (*Images*→*Load image*).
- Create a new 3D object by *Objects*→*Object properties* or by the popup menu under *Objects* within the project tree (see Module 3).
- The mosaic shall be rectified to an object area of 4.9m width and 5.8m height. Enter object coordinates of the mosaic corners and use the correct metric unit (*Objects*→*Object properties/Object coordinates*).
- Measure image coordinates of control points (*Measure*→*Image coordinates*). Save the project.
- Start the rectification window (*Rectification*→*Image rectification*) and activate the image.
- Select the method *Plane rectification* and the function *Projective*.
- Define the desired object area and the resolution of the rectified image (*Dimensions*).
- Assign (check) image and control points (*Control points*).
- Calculate the transformation with **Calculate** and check for the quality of result.
- Test the **Preview** and create the result image (**Create**).
- Select different resampling and transformation methods (under *Options*) and compare the results.
- Save your project archive (*Project*→*Save project as ...* > *project archive*).

##### Test questions:

1. Number of transformation coefficients and minimum number of control points for
  - a) Plane projective transformation
  - b) Affine transformation
  - c) Polynomial transformation 2. order
2. Mean transformation error [unit]
3. Calculation of resulting lateral error for an object point at image border that has a depth offset of 10mm out of the reference plane.

## Task 2: Extended experiments

- Duplicate the image (Project tree/Popup menu: *Duplicate*).
- Load the related camera file "dcs645.cam", assign it to the duplicated image and measure the image points again. Compare the image coordinates of both images.
- Calculate the rectification under consideration of the camera parameters and compare the result with the first rectification. What do you observe?
- Calculate the exterior orientation of the image (space resection) and rectify the image to the XY-plane.