Thomas Luhmann, Stuart Robson, Stephen Kyle, Jan Boehm
Close-Range Photogrammetry and 3D Imaging
3. edition, 2019
de Gruyter, Berlin

Version: 27.05.2022

Modified pages: 83

Please send comments and error messages to: luhmann@jade-hs.de

Corrections

Only errors in equations, figures and examples are collected here. Usual typing or layout errors are not listed.

---

p. 45 **eq. 2.26**

Old version:

Using homogeneous coordinates the plane projective transformation can be expressed as:

$$\boldsymbol{X} = \boldsymbol{H} \cdot \boldsymbol{x}$$

$$\begin{bmatrix} X \\ Y \\ 1 \end{bmatrix} = \begin{bmatrix} h_{11} & h_{12} & h_{13} \\ h_{21} & h_{22} & h_{23} \\ h_{31} & h_{32} & h_{33} \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ 1 \end{bmatrix} \tag{2.26}$$

This formulation is known as *homography*. Since the matrix $\boldsymbol{H}$ can be scaled without altering its projective properties (see section 2.2.1.1), there are eight degrees of freedom as there are in the plane projective transformation of eqn. (2.21).

Corrected:

Using homogeneous coordinates, the plane projective transformation can be expressed as:

$$\boldsymbol{U} = \boldsymbol{H} \cdot \boldsymbol{x} \qquad \boldsymbol{X} = 1/W \cdot \boldsymbol{U}$$

$$\begin{bmatrix} U \\ V \\ W \end{bmatrix} = \begin{bmatrix} h_{11} & h_{12} & h_{13} \\ h_{21} & h_{22} & h_{23} \\ h_{31} & h_{32} & h_{33} \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ 1 \end{bmatrix} \quad \text{and} \quad \begin{bmatrix} X \\ Y \\ 1 \end{bmatrix} = \begin{bmatrix} U/W \\ V/W \\ W/W \end{bmatrix} \tag{2.26}$$

This formulation is known as *homography*. Since the matrix $\boldsymbol{H}$ can be scaled without altering its projective properties (see section 2.2.1.1), there are eight degrees of freedom, as there are in the plane projective transformation of eqn. (2.21). When seeking a direct solution to $\mathbf{h} = [h_{11}, \ldots, h_{33}]$ the elements should be normalized to deal with this rank deficiency and to avoid the trivial solution $\mathbf{h}=\mathbf{0}$. For example, this can be done by setting $h_{33}=1$ which gives the same result as in eqn. (2.21). It can be numerically advantageous to seek a normalisation via the norm of the vector e.g. $|\mathbf{h}|=1$, which is implicitly the case if a solution is sought via an Eigenvalue or Singular Value Decomposition.

p. 82 **eq. 2.149**

Old version: $a^2 + b^2 + c^2 = 0$

Corrected: $a^2 + b^2 + c^2 = 1$

p. 99 **eq. 2.193**

Old version:

3) $\underset{u,u}{\mathbf{N}} \cdot \underset{u,1}{\hat{\mathbf{x}}} - \underset{u,1}{\mathbf{n}} = \underset{u,1}{\mathbf{0}}$: normal equations (2.193)

where

$\underset{u,u}{\mathbf{N}} = \underset{u,n}{\mathbf{A}}^T \cdot \underset{n,n}{\mathbf{P}} \cdot \underset{n,u}{\mathbf{A}}$: matrix of normal equations

$\underset{u,1}{\mathbf{n}} = \underset{u,n}{\mathbf{A}}^T \cdot \underset{n,n}{\mathbf{P}} \cdot \underset{n,1}{\mathbf{1}}$: absolute term

Corrected: Symbol **1** (one) replaced by symbol **l**

3) $\underset{u,u}{\mathbf{N}} \cdot \underset{u,1}{\hat{\mathbf{x}}} - \underset{u,1}{\mathbf{n}} = \underset{u,1}{\mathbf{0}}$: normal equations (2.193)

where

$\underset{u,u}{\mathbf{N}} = \underset{u,n}{\mathbf{A}}^T \cdot \underset{n,n}{\mathbf{P}} \cdot \underset{n,u}{\mathbf{A}}$: matrix of normal equations

$\underset{u,1}{\mathbf{n}} = \underset{u,n}{\mathbf{A}}^T \cdot \underset{n,n}{\mathbf{P}} \cdot \underset{n,1}{\mathbf{l}}$: absolute term

p. 99 **eq. 2.196**

Old version:

5) $\underset{n,1}{\hat{\mathbf{I}}} = \underset{n,1}{\mathbf{l}} + \underset{n,1}{\mathbf{v}}$: adjusted observations (2.196)

$\underset{n,1}{\hat{\mathbf{L}}} = \underset{n,1}{\mathbf{L}} + \underset{n,1}{\mathbf{v}}$

Corrected: Symbol **I** (eye) replaced by symbol **l**

5) $\underset{n,1}{\hat{\mathbf{l}}} = \underset{n,1}{\mathbf{l}} + \underset{n,1}{\mathbf{v}}$: adjusted observations (2.196)

$\underset{n,1}{\hat{\mathbf{L}}} = \underset{n,1}{\mathbf{L}} + \underset{n,1}{\mathbf{v}}$

p. 326 **Example 4.5**

The specified calculation results refer to a data set that has more decimal places internally than shown here for image coordinates and camera constant. With the data given here, there are slightly different results for the orientation values. Note: the image coordinates are already related to the principal point, i.e. the given principal point coordinates are not necessary here.

Old version:	Base components:	$bx = 1$	$by = -0.0635$	$bz = -0.1280$
	Rotation angles:	$\omega = 1.4513°$	$\varphi = 4.1037°$	$\kappa = 2.5179°$
Corrected:	Base components:	$bx = 1$	$by = -0.0634$	$bz = -0.1280$
	Rotation angles:	$\omega = 1.4493°$	$\varphi = 4.1055°$	$\kappa = 2.5182°$

p. 343 **Example 4.8, last paragraph**

Old version: The result shows that point P_1 lies beneath the left-hand camera at a distance of 4.08 m. Point P_2 is located to the right and above the left camera at a distance of 58.49 m and with a smaller image scale.

Corrected: The result shows that point P_1 lies beneath the left-hand camera at a distance of 3.88 m. Point P_2 is located to the right and above the left camera at a distance of 69.23 m and with a smaller image scale.

p. 357 **Table 4.1, Example 3**

Old version: Wrong cross-reference for example 3

	Example 1	u	u_{total}	Example 2	u	u_{total}	Example 3	u	u_{total}
	aerial set-up (**Fehler! Verweisquelle konnte nicht gefunden werden.**)			closed loop set-up (**Fehler! Verweisquelle konnte nicht gefunden werden.**)			test field calibration (Fig. 7.21)		

Corrected:

	Example 1	u	u_{total}	Example 2	u	u_{total}	Example 3	u	u_{total}
	aerial set-up (**Fehler! Verweisquelle konnte nicht gefunden werden.**)			closed loop set-up (**Fehler! Verweisquelle konnte nicht gefunden werden.**)			test field calibration (Fig. 7.32d)		