Satellite Photogrammetry HW7

assigned Friday 14 April, due Fri. 21 April 2017

Summary of replacement model:

$$r_n = \frac{\sum_{i=1}^{20} P1_i \cdot f_i(P,L,H)}{\sum_{i=1}^{20} P2_i \cdot f_i(P,L,H)} = \frac{Q_1}{Q_2}$$

$$c_n = \frac{\sum_{i=1}^{20} P3_i \cdot f_i(P,L,H)}{\sum_{i=1}^{20} P4_i \cdot f_i(P,L,H)} = \frac{Q_3}{Q_4}$$

$P = (\phi - \phi_{offset}) / \phi_{scale}$

$L = (\lambda - \lambda_{offset}) / \lambda_{scale}$

$H = (h - h_{offset}) / h_{scale}$

$r_n = (l - l_{offset}) / l_{scale}$

$c_n = (s - s_{offset}) / s_{scale}$

$f_i(P,L,H) = 1, L, P, H, LP, LH, PH, L^2, P^2, H^2, PLH, \ldots, H^3$

$l = r_n \cdot l_{scale} + l_{offset}$

$s = c_n \cdot s_{scale} + s_{offset}$) add adjustable parameters

$$\begin{bmatrix} l = r_n \cdot l_{scale} + l_{offset} + a_0 + a_1\phi + a_2\lambda \\ s = c_n \cdot s_{scale} + s_{offset} + b_0 + b_1\phi + b_2\lambda \end{bmatrix}, \quad \phi, \lambda : \text{decimal degrees}$$

$$l + v_l = r_n \cdot l_{scale} + l_{offset} + a_0 + a_1\phi + a_2\lambda$$
$$s + v_s = c_n \cdot s_{scale} + s_{offset} + b_0 + b_1\phi + b_2\lambda$$

$$v_l - a_0 - a_1\phi - a_2\lambda = r_n \cdot l_{scale} + l_{offset} - l$$
$$v_s - b_0 - b_1\phi - b_2\lambda = c_n \cdot s_{scale} + s_{offset} - s$$

$$\begin{bmatrix} v_l \\ v_s \end{bmatrix} + \begin{bmatrix} -1 & -\phi & -\lambda & 0 & 0 & 0 \\ 0 & 0 & 0 & -1 & -\phi & -\lambda \end{bmatrix} \begin{bmatrix} a_0 \\ a_1 \\ a_2 \\ b_0 \\ b_1 \\ b_2 \end{bmatrix} = \begin{bmatrix} r_n \cdot l_{scale} + l_{offset} - l \\ c_n \cdot s_{scale} + s_{offset} - s \end{bmatrix}$$

$V + B\Delta = f$

$r_n = Q_1/Q_2 \quad c_n = Q_3/Q_4$

refine replacement model

1. Make LS estimate of adjustable parameters $a_0, a_1, a_2, b_0, b_1, b_2$ using 7 GCP's

2. create function $\begin{bmatrix} l \\ s \end{bmatrix} = fg2i\_rm(\phi, \lambda, h, ab)$, $ab = \begin{bmatrix} a_0 \\ a_1 \\ a_2 \\ b_0 \\ b_1 \\ b_2 \end{bmatrix}$

3. re-run orthorectification + vector overlay, with new function
   (results should be ≈ result from physical model)
   compare execution times of 2 models