

jhead.exe

EXIF header
JPEG

$B/H \approx 0.15$

for comfortable stereo
view

static object (no movement)

Keep range \approx equal

bundle block adjustment

simultaneous resection / intersection

any number of images 2 - 1000's

any number of object points

based on collinearity equations

basic $x - x_0 = -f \frac{u}{w}$ $F_x = x - x_0 + f \frac{u}{w}$

$y - y_0 = -f \frac{v}{w}$ $F_y = y - y_0 + f \frac{v}{w}$

x_c	w	x	x_0
y_c	ϕ	y	y_0
z_c	k	z	f

extended Coll. Eqns.

17-3

$$\bar{F}_x: x - x_0 - \frac{(x - x_0)}{r} (k_1 r + k_2 r^3 + k_3 r^5) + f \frac{y}{w} = 0$$

$$\bar{F}_y: y - y_0 - \left(\frac{y - y_0}{r} \right) (k_1 r + k_2 r^3 + k_3 r^5) + f \frac{v}{w} = 0$$

$$U: m_{11} (x - x_c) + m_{12} (y - y_c) + m_{13} (z - z_c)$$

V:

W:

$$V + \left[\begin{array}{cccccc} \frac{\partial E}{\partial x_L} & \frac{\partial E}{\partial y_L} & \frac{\partial E}{\partial z_L} & \frac{\partial E}{\partial w} & \frac{\partial E}{\partial \phi} & \frac{\partial E}{\partial k} \\ \dots & \dots & \dots & \dots & \dots & \dots \end{array} \right] \begin{array}{l} \\ \\ \\ \end{array} \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} \begin{array}{cc} \frac{\partial E}{\partial x_1} & \frac{\partial E}{\partial x_2} \\ \frac{\partial E}{\partial z_1} & \frac{\partial E}{\partial y_2} \end{array}$$

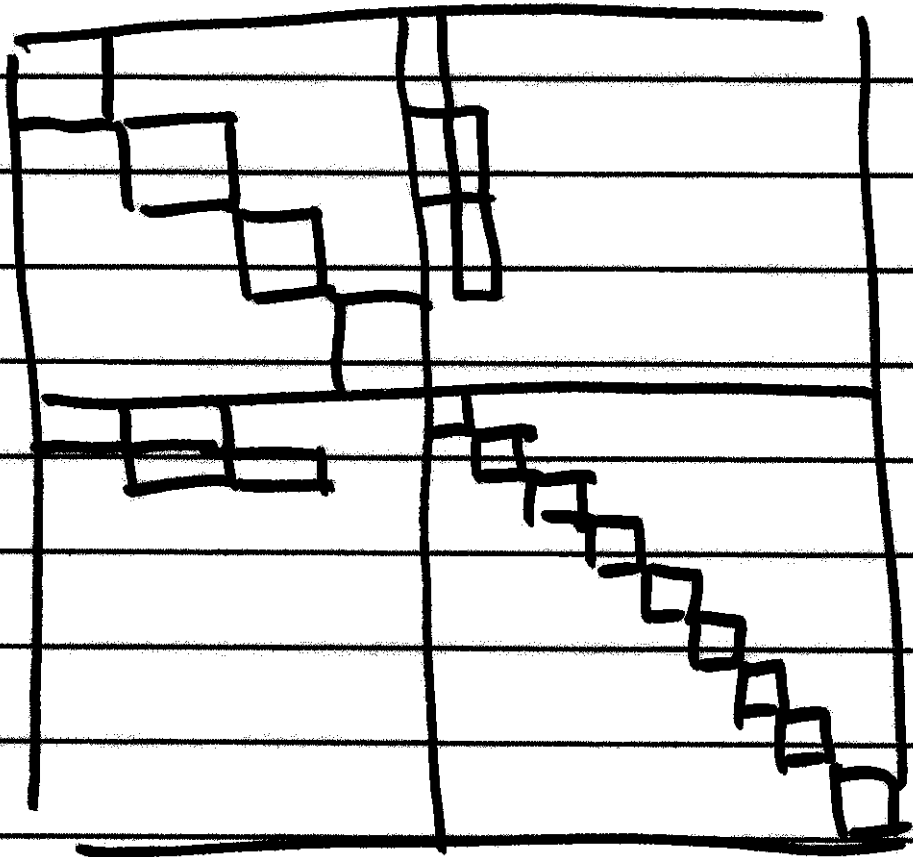
$$\frac{\partial E}{\partial z_2} \dots \frac{\partial E}{\partial x_0} \frac{\partial E}{\partial y_0} \frac{\partial E}{\partial \phi} \frac{\partial E}{\partial k_1}$$

$$\left[\frac{\partial E}{\partial k_2} \quad \frac{\partial E}{\partial k_3} \right] = f$$

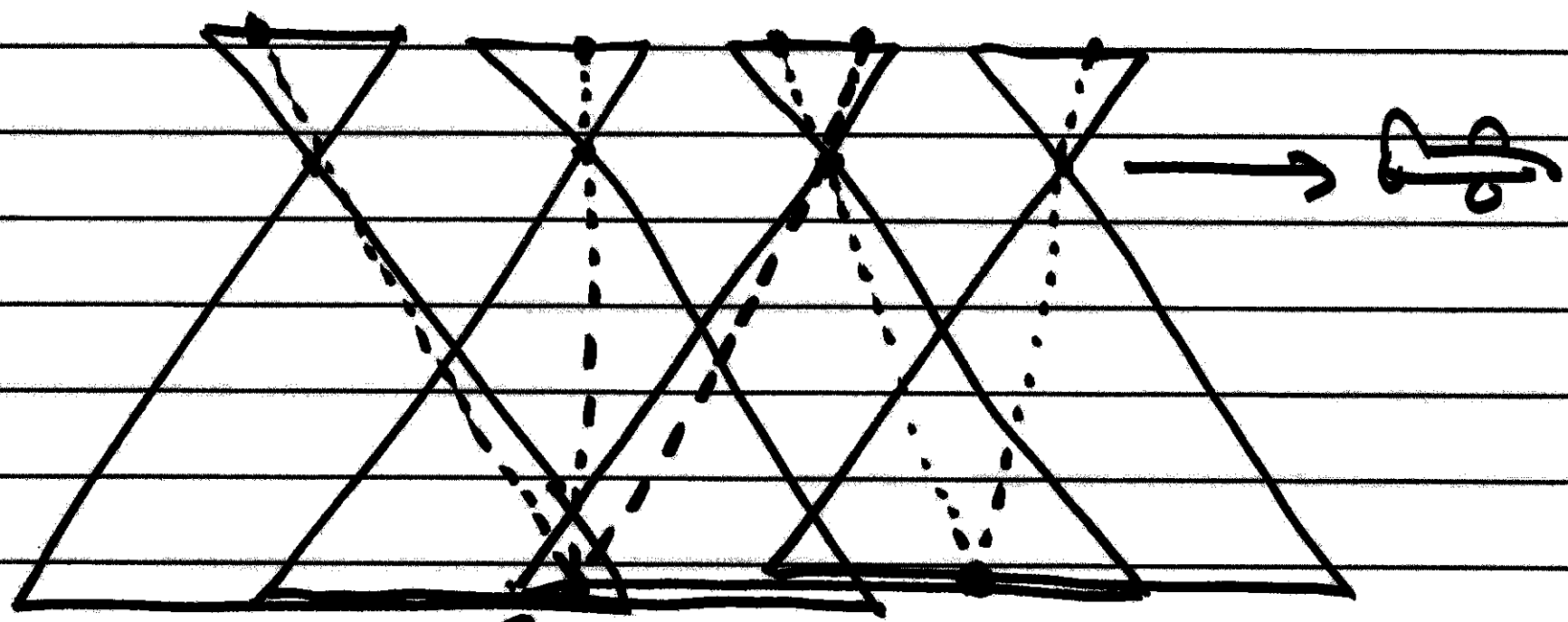
$$V + B \Delta = f$$

$N: (B^T W B)$

$SPY(N)$ 17-5



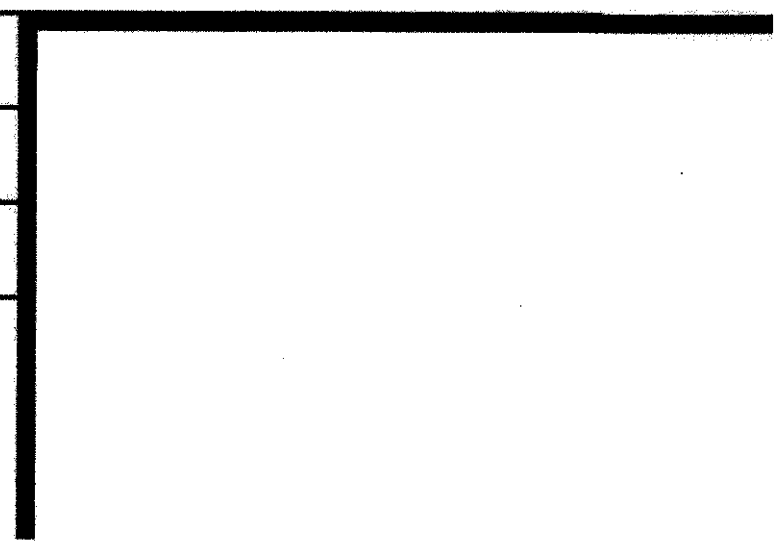
N



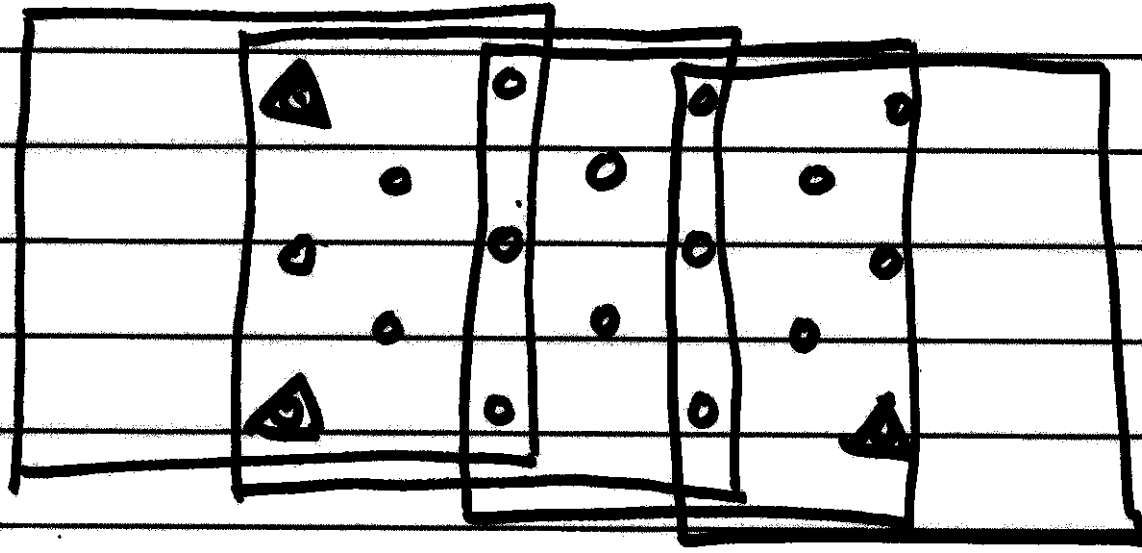
T.O.A.

2 Ray Point

3 Ray Point



60% forward overlap 17-7



○ pass point
(unknown)

△ GCP

Equations

Unknowns

$$6 \times 4 = 24$$

$$3 \times 15 = 45$$

$$\hline 69$$

triple overlap
area

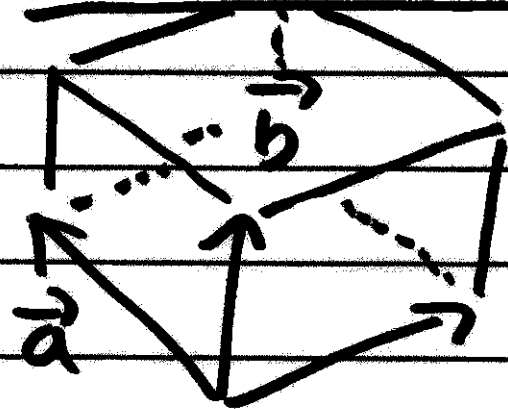
2R $4 \times 12 = 48$

3R $6 \times 6 = 36$

$$\hline 84$$



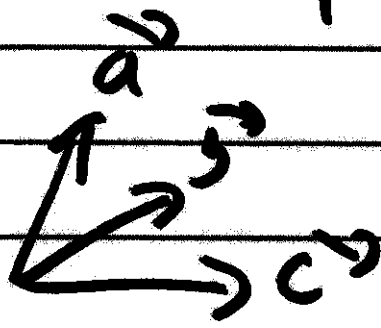
Relative Orientation Coplanarity Equation



parallelepiped

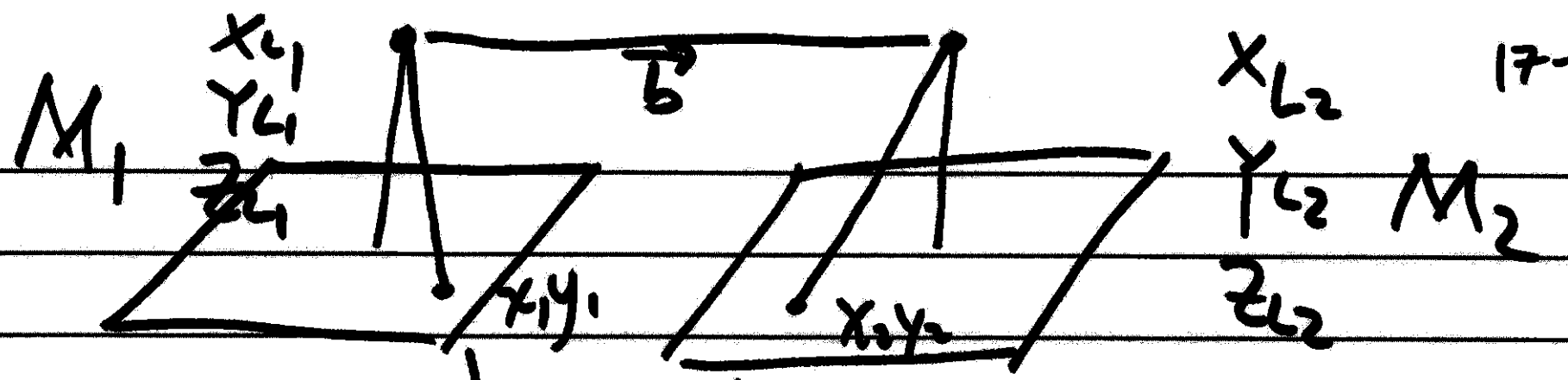
⇒ volume = triple scalar product

$$= \vec{a} \cdot (\vec{b} \times \vec{c})$$



$$\Rightarrow \begin{vmatrix} a_x & a_y & a_z \\ b_x & b_y & b_z \\ c_x & c_y & c_z \end{vmatrix}$$

determinant



$$\vec{b} = \begin{pmatrix} x_{L2} - x_{L1} \\ y_{L2} - y_{L1} \\ z_{L2} - z_{L1} \end{pmatrix}$$

F =

$$\vec{a}_1: M_1 \begin{pmatrix} x_1 - x_0 \\ y_1 - y_0 \\ -f \end{pmatrix} = \begin{pmatrix} u_1 \\ v_1 \\ w_1 \end{pmatrix}$$

$$\vec{a}_2: M_2 \begin{pmatrix} x_2 - x_0 \\ y_2 - y_0 \\ -f \end{pmatrix} = \begin{pmatrix} u_2 \\ v_2 \\ w_2 \end{pmatrix}$$

Coplanarity Equation

17-10

$$F = \begin{vmatrix} b_x & b_y & b_z \\ u_1 & v_1 & w_1 \\ u_2 & v_2 & w_2 \end{vmatrix} = 0$$

$$D = \begin{vmatrix} R_1 \\ R_2 \\ R_3 \end{vmatrix}, \quad \frac{\partial D}{\partial p} = \begin{vmatrix} \frac{\partial R_1}{\partial p} \\ R_2 \\ R_3 \end{vmatrix} + \begin{vmatrix} R_1 \\ \frac{\partial R_2}{\partial p} \\ R_3 \end{vmatrix} + \begin{vmatrix} R_1 \\ R_2 \\ \frac{\partial R_3}{\partial p} \end{vmatrix}$$

$$\frac{\partial F}{\partial x, y, z, w, u, \dots}$$

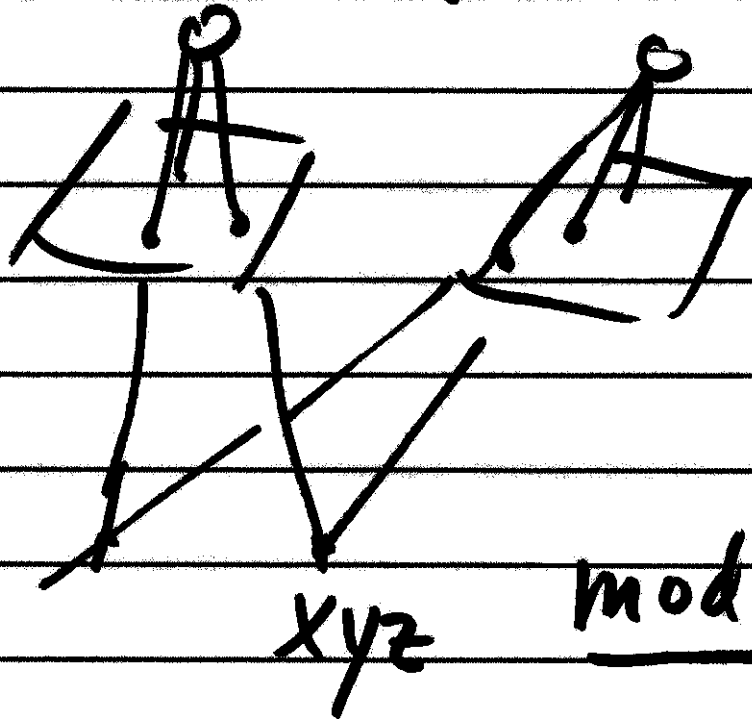
Relative Orientation: 5 unknowns

fix x_1	<u>fix x_2</u>	
y_1	y_2	} unknowns
z_1	z_2	
w_1	w_2	
ϕ_1	ϕ_2	
k_1	k_2	

does not fit into indirect
obs. model

\Rightarrow general LS

Follow R/O with intersection



model coordinates

$$\begin{pmatrix} X \\ Y \\ Z \end{pmatrix} M \longrightarrow \begin{pmatrix} X \\ Y \\ Z \end{pmatrix} \text{Ref.}$$