Optical Flow: Week 4

Jon Harter

University of Central Florida

June 12, 2009

Current Progress and Challenges

Progress

- ▶ Implemented new ego-motion algorithm (Phillip Napieralski)
- ▶ Proved equations presented in Egomotion Estimation do not provide a means to generate synthetic optical flow data, even with the additional knowledge from current setup.
- ▶ Verified Hartley ego-motion equation (new approach)

Challenges

- ▶ Necessary minimization from Egomotion Estimation unideal
- ▶ No specific constraints pertaining to our model

New Related Works

Determine Ego-motion

- ▶ *Using Many Cameras as One*
- ▶ Robert Pless
- ▶ *A linear approach to motion estimation using generalized camera models*
- ▶ Hongdong Li, Richard Hartley, Jae-hak Kim

Contributions

- ▶ Propose new model in which each pixel generates a plücker vector through the center of camera
- ▶ Use Generalized Epi-polar Constraint (GEC) to construct a linear equation from which to retrieve rotation and translation

Plücker Vectors and GEC

Definition

- ▶ Denote line in 3D space
- ▶ For unit vector q and arbitrary point on line P,
  $\langle q, q' = P \times q \rangle$
- ▶ All points on line: $(q \times q') + \alpha q, \forall \alpha \in \mathbb{R}$

Special Property

- ▶ Two lines (a and b) intersect iff. $q_b \cdot q_a' + q_b' \cdot q_a = 0$

GEC

- ▶ $q_2^T R q_1' + q_2^T R [T]_x q_1 + q_2'^T R q_1 = 0$
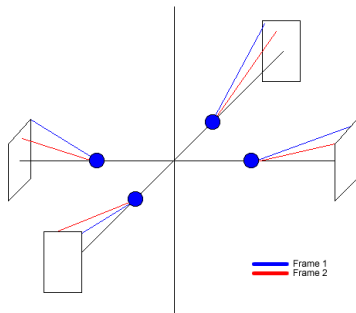
Hartley

Frame 1
Frame 2

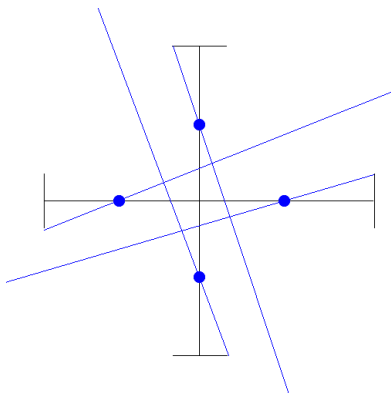Figure: Hartley Model for Ego-motion Estimation

Hartley

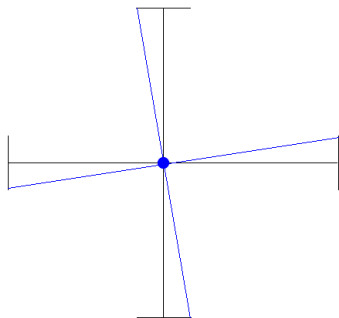Figure: Hartley Model for Ego-motion Estimation (Top Down)

New Model

Figure: New Model Specific to Our System

Future Plans

New Model

- ► Cooresponding pixels from each camera generate intersecting lines through some point
- ► View rotation and translation as movement of intersection point

Uses

- ► Puts constraint on optical flow data
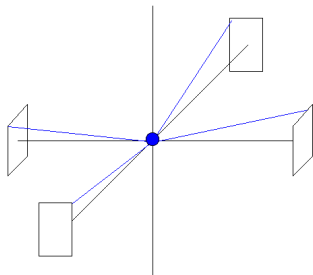- ► More equations to apply GEC

Figure: New Model

Future Plans

- ▶ Hartley Algorithm must be tested against noise in data
- ▶ Filter must be created to ensure only trusted optical flow is used.
- ▶ Possible methods: RANSAC, clustering and comparison of "dominant" clusters