An Implementation of Single-View Metrology

Presentation by Shih-Yu Sun

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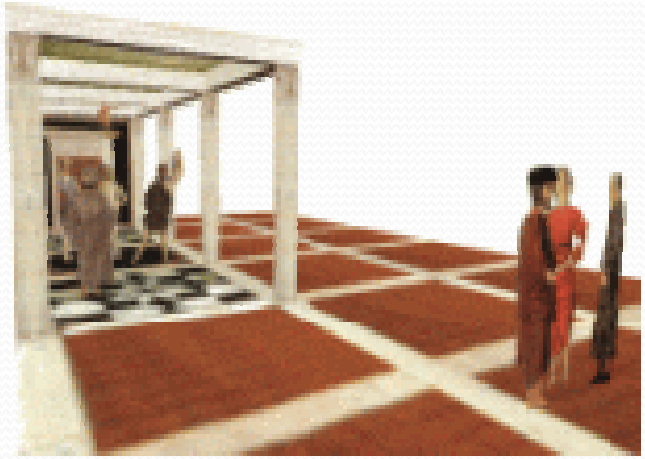
6.869 Final Project

Single-view metrology extracts 3D geometric information from a single image

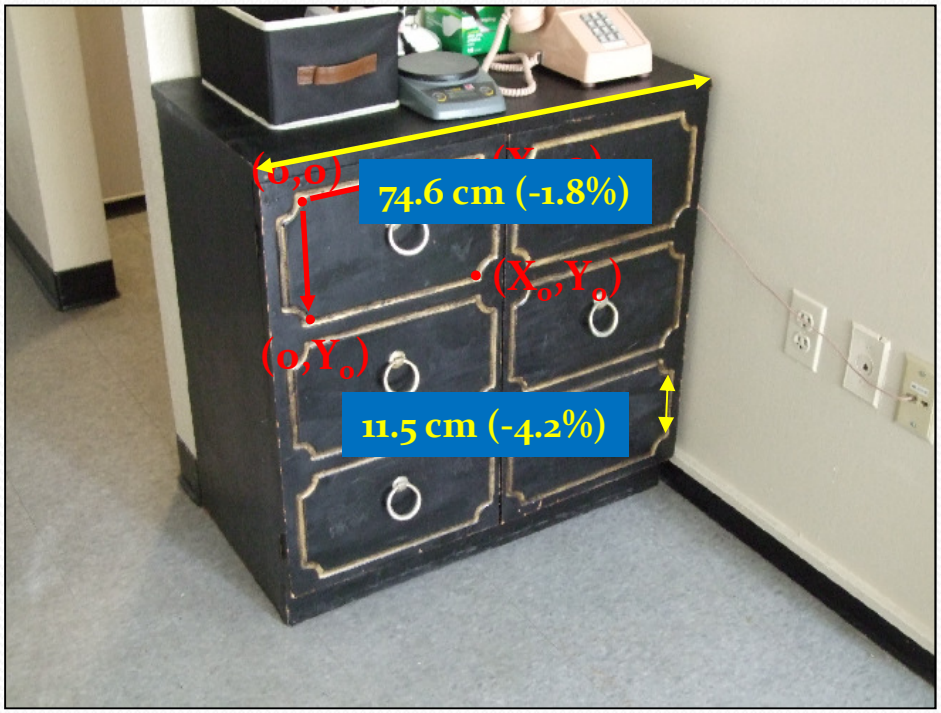


- **Planar homography** gives the positions of the elements
- Heights could be estimated using **vanishing points/lines**

A. Criminisi, I. Reid, and A. Zisserman, "Single view metrology," *International Journal of Computer Vision*, vol. 40, 2000, p. 123–148.

Planar homography can be determined by four correspondences

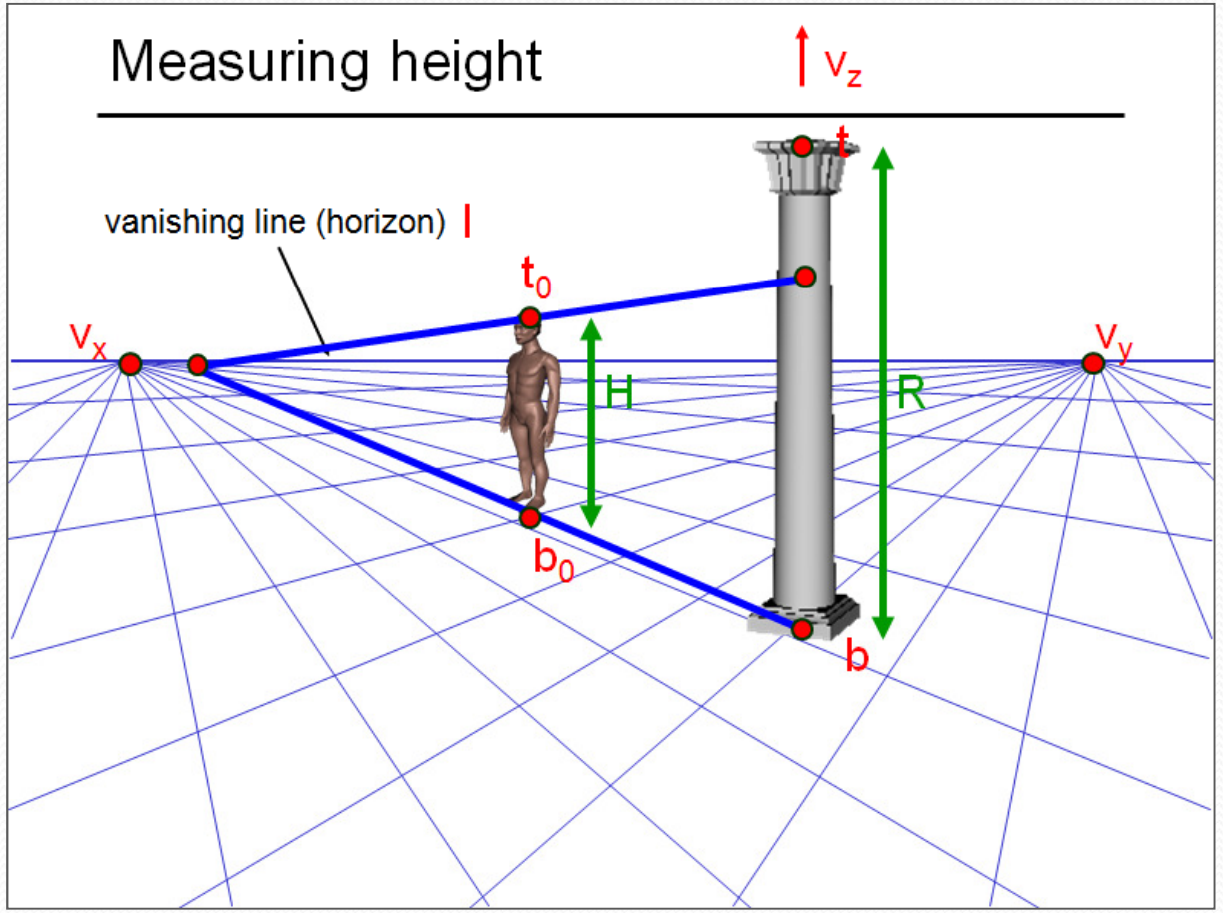
- $[X\ Y\ 1]^T = H\ [x\ y\ 1]^T$
  - *X, Y: world-frame coordinates on the plane*
  - *x, y: image plane coordinates*



Distance from the reference plane could be computed based on vanishing points

$$\alpha R = -\frac{\|b \times t\|}{(l \cdot b)\|v_z \times t\|}$$

$$H = -\frac{\|b_0 \times t_0\|}{\alpha(l \cdot b_0)\|v_z \times t_0\|}$$



6.869 Spring 2011, "Shape-from-X" lecture slide

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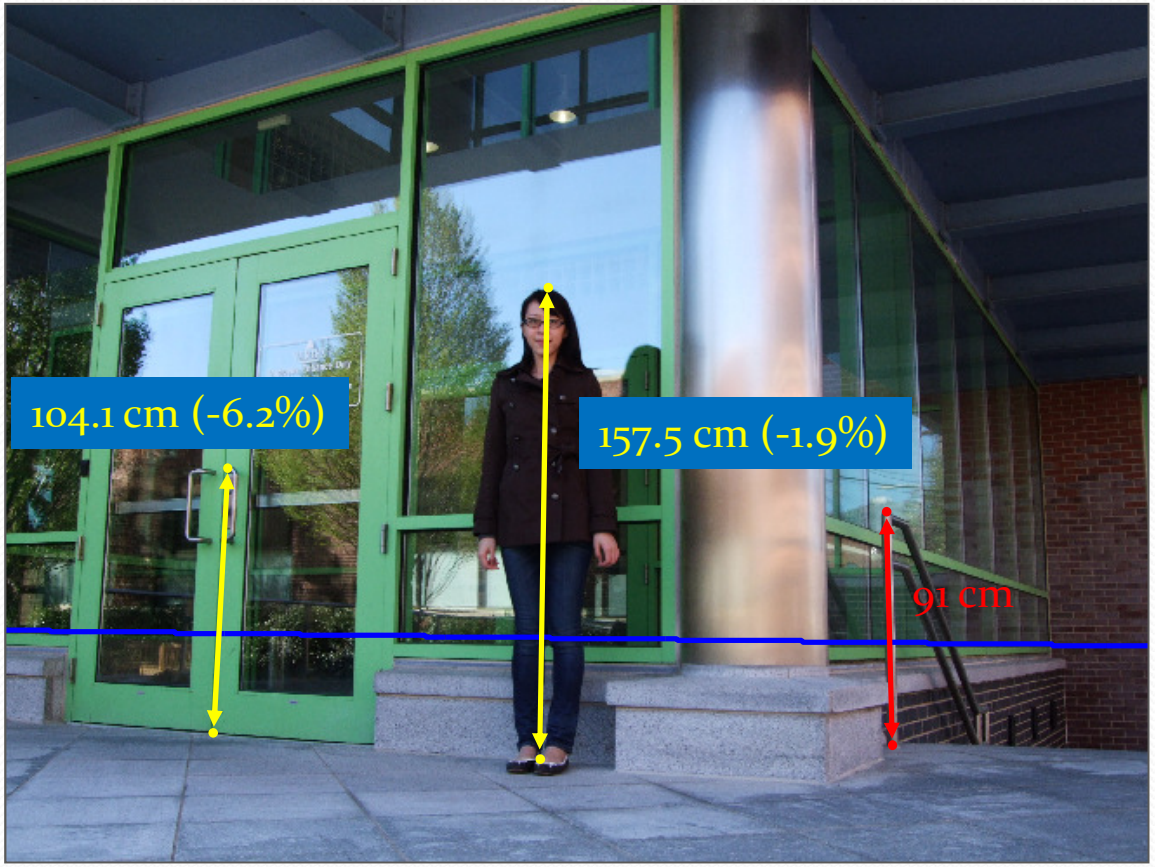
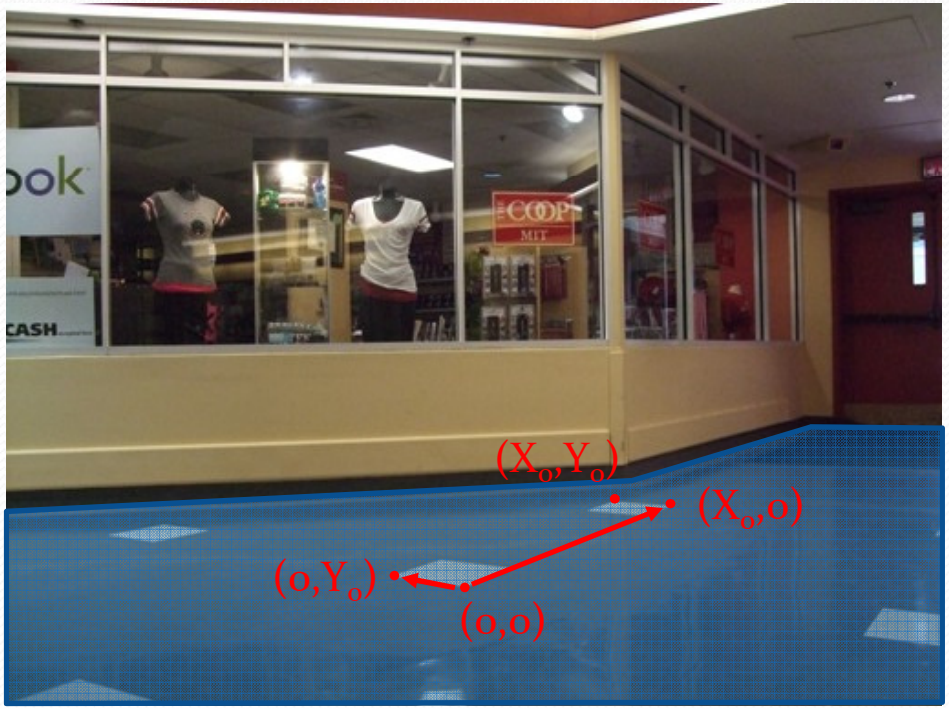
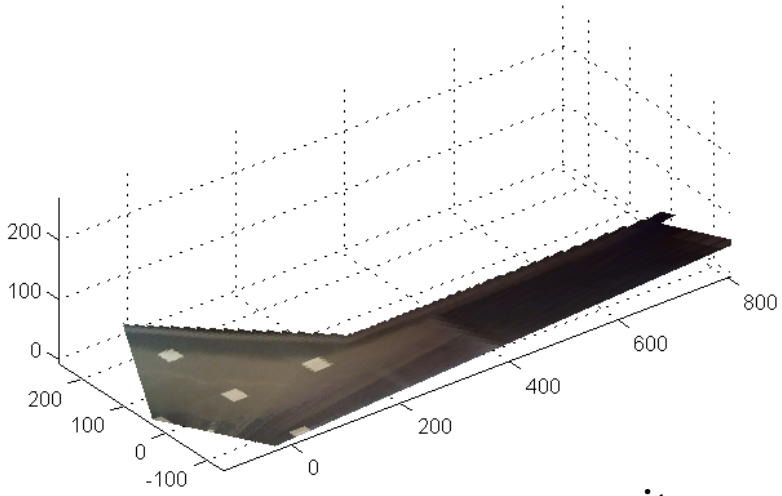


Complete 3D reconstruction of the MIT COOP was performed





unit: cm

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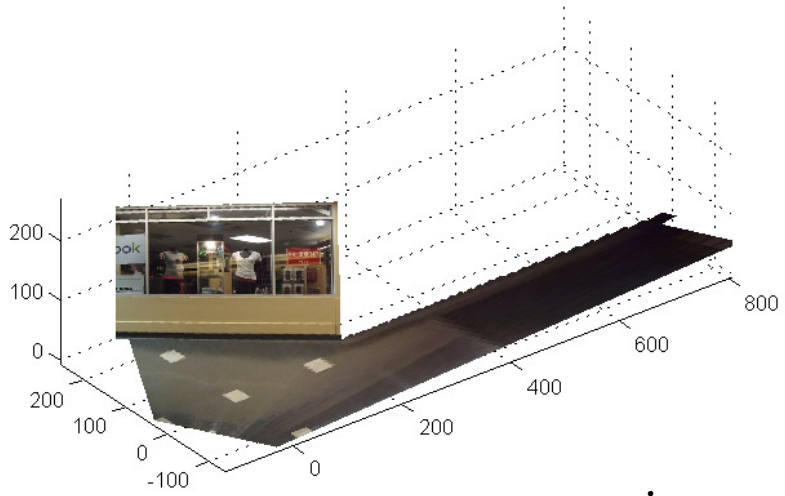

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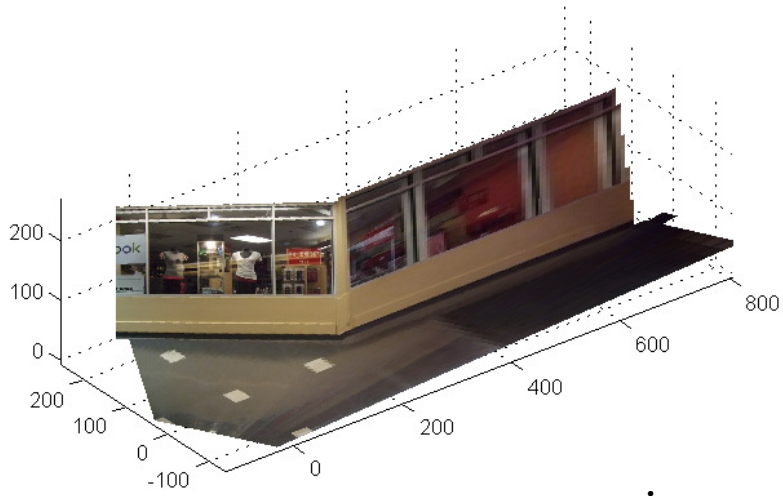

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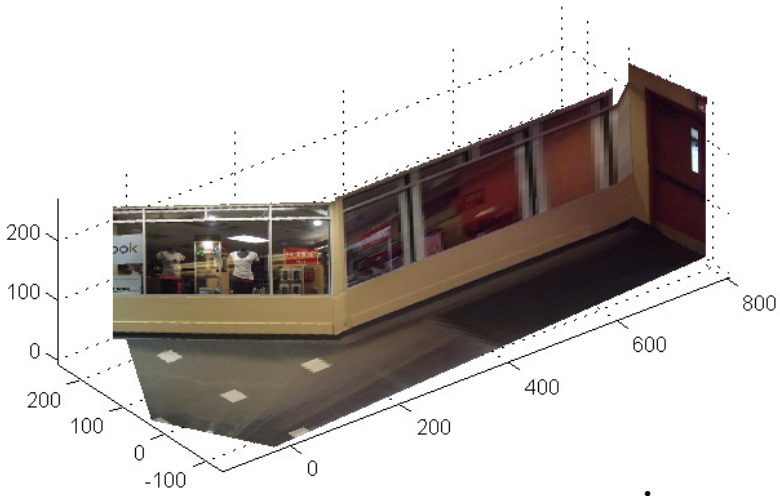

unit: cm

An application of 3D reconstruction in MIT 150 FAST Light