Announcements

- Take-home midterm exam
  - out next Monday (goal: morning)
  - due next Tuesday (night)
Goals

• Be able to interpret the geometry of planar panoramas in terms of a 3D interpretation of homographies.

• Be prepared to implement inverse warping.

• Know how to create 360 degree panoramas by mapping images onto a spherical surface.
Inverse Warping, Revisited

- HW2, Problem 3.6
for y in range(8):
    for x in range(8):
        \[
        \begin{bmatrix}
        x', y', \omega
        \end{bmatrix}
        = \text{np.dot}(\text{np.linalg.inv}(I), \begin{bmatrix}
        x, y, 1
        \end{bmatrix}^T)
        \]
        desc \( (y, x) \) = \text{bilinear}(\text{image}, \begin{bmatrix}
        y', \omega
        \end{bmatrix})
Can we make 360 panoramas?

To answer this, we need to know how these images came to be. Why can we even make any panoramas with homographies?
Projection

CoP

pp
Reinterpreting Homographies

A 3x3 linear transformation, applied to a projection plane.
Reinterpreting Homography-Aligned Panoramas

Several image planes are projected onto a single plane.
Planar Panoramas

We can't make 360 panoramas with homographies.
Spherical Panoramas

Idea: project images onto a sphere instead of a plane.

Example: Google Street View
Unwrapping a Sphere
Spherical Panoramas

What motion model should we use?
Spherical Panoramas

1. Warp planar images onto the surface of a sphere

2. Align with **translational** motion model.

3. Stitch and blend as usual.
Spherical Panoramas

1. Warp planar images onto the surface of a sphere

2. Align with **translational** motion model.

3. Stitch and blend as usual.
Input:

Projection plane

Projection sphere

Inverse transformation

Output:

Unwrapped spherical image

Forward transformation

GOTO notes