CSCI 497P/597P: Computer Vision

Lecture 19

Homographies: 3D Intuition

360 (Spherical) Panoramas

Announcements

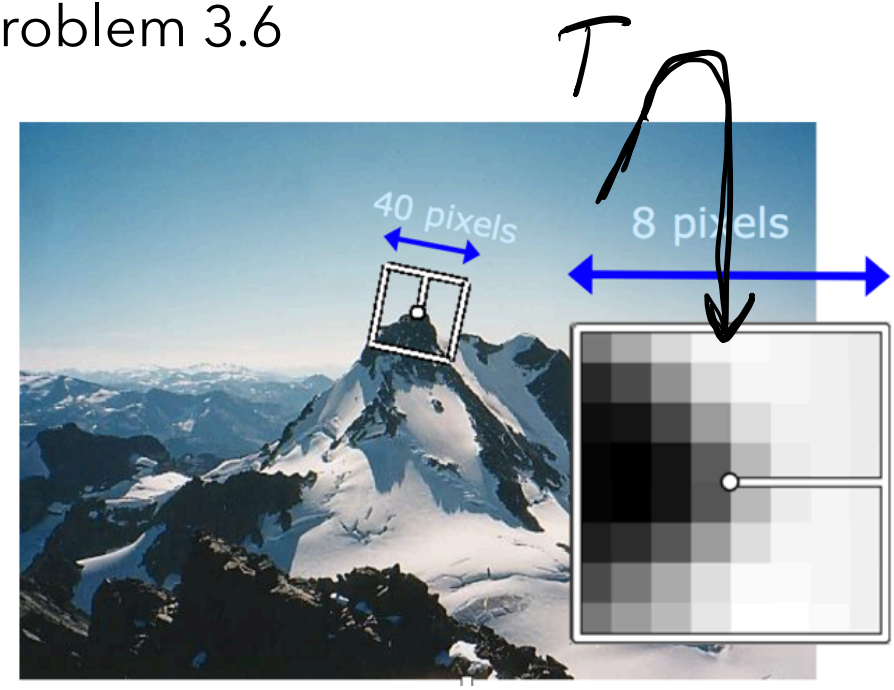
- Take-home midterm exam
  - out next Monday (goal: morning)
  - due next Tuesday (night)

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.

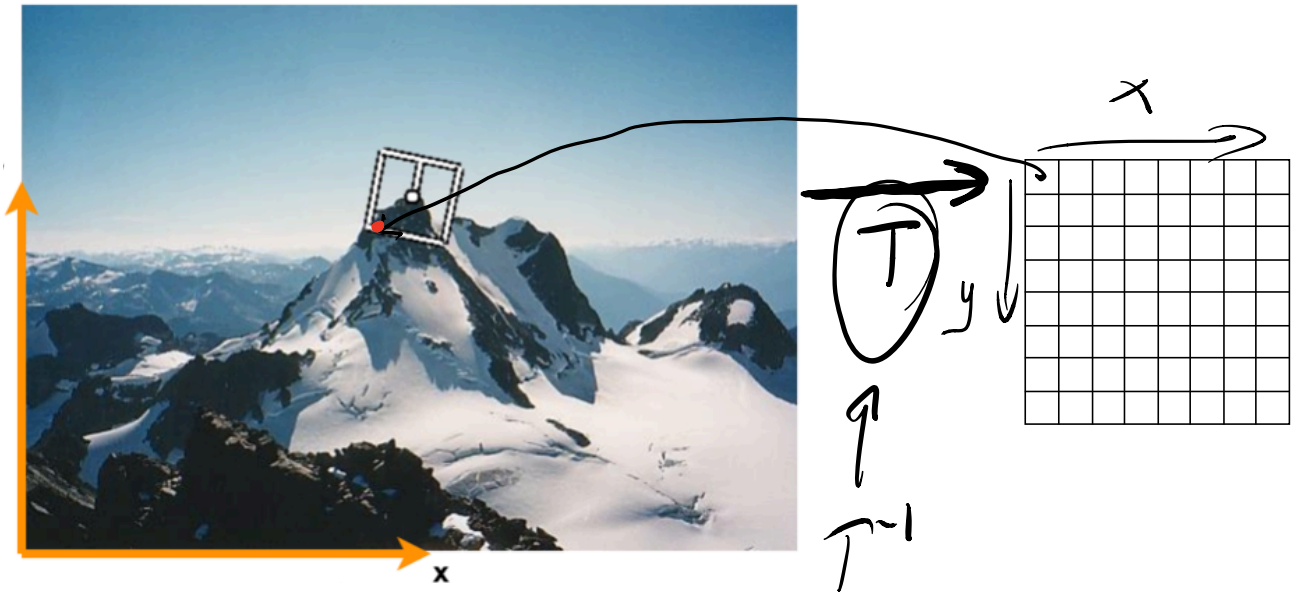
Inverse Warping, Revisited

- HW2, Problem 3.6



Input image

Output "image"



$\cancel{T(y', x')}$

```
for y in range(8):
  for x in range(8):
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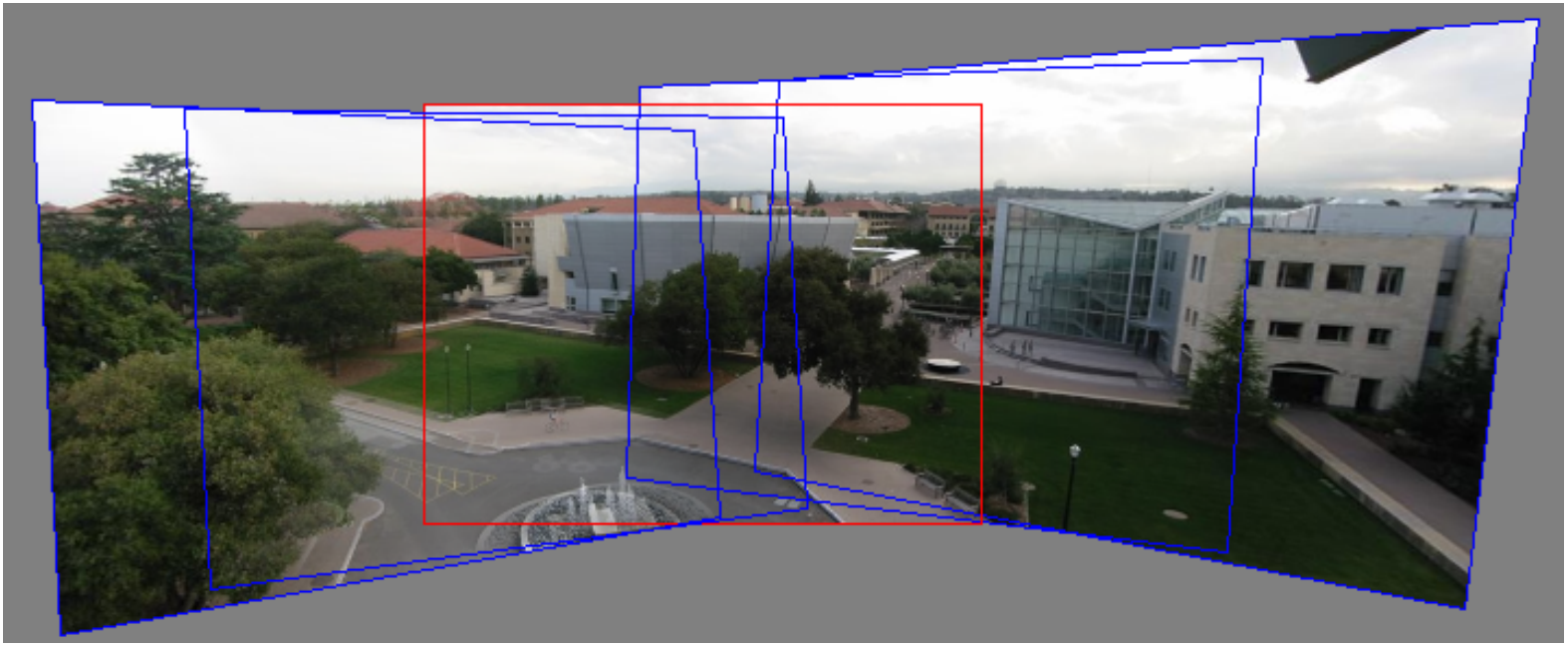
$[x', y', w]^T = np.dot(np.linalg.inv(T), [x, y, 1]^T)$

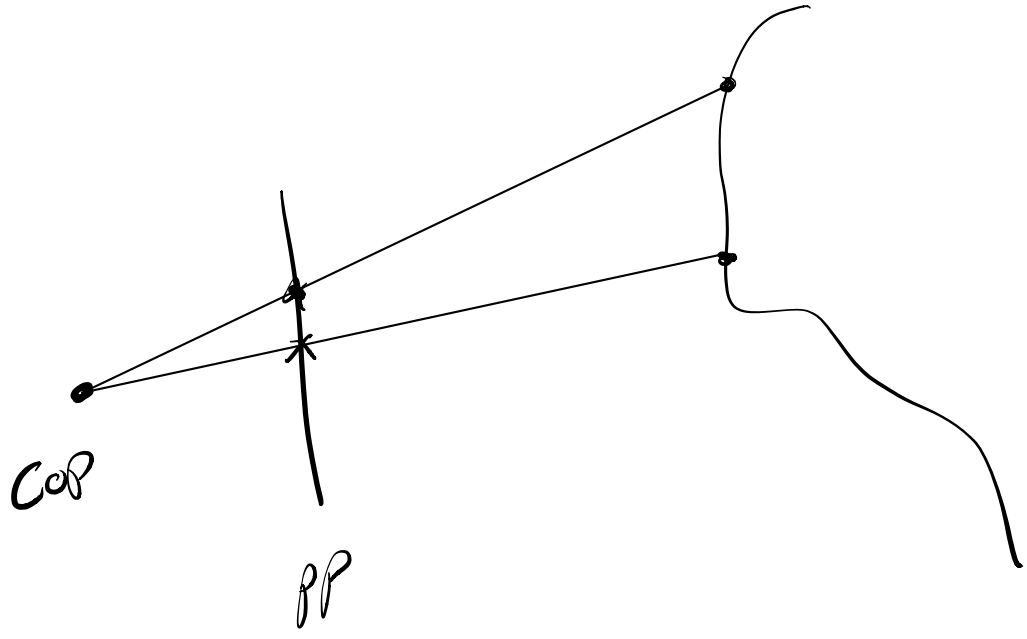
$desc[y, x] = bilerp(image, [y', x'])$

Can we make 360 panoramas?



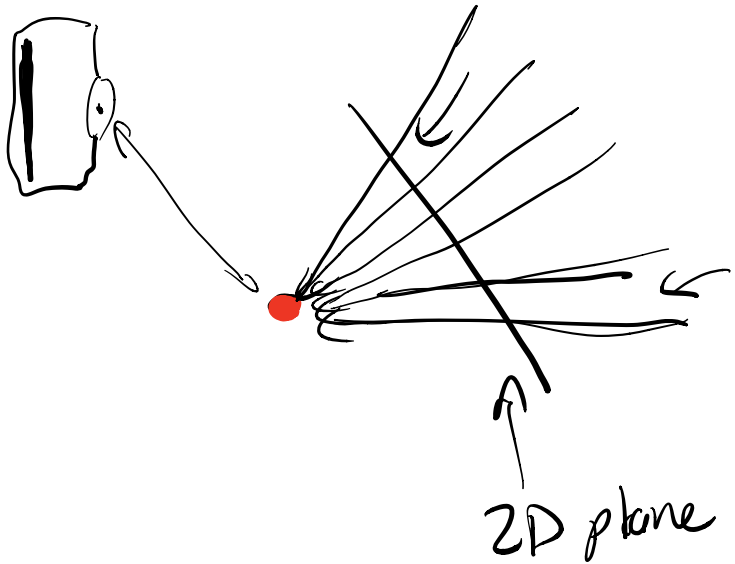
To answer this, we need to know how these images came to be.
Why can we even make **any** panoramas with homographies?

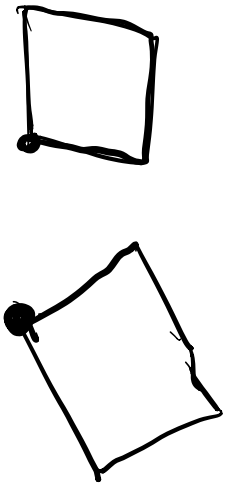
Projection



Reinterpreting Homographies

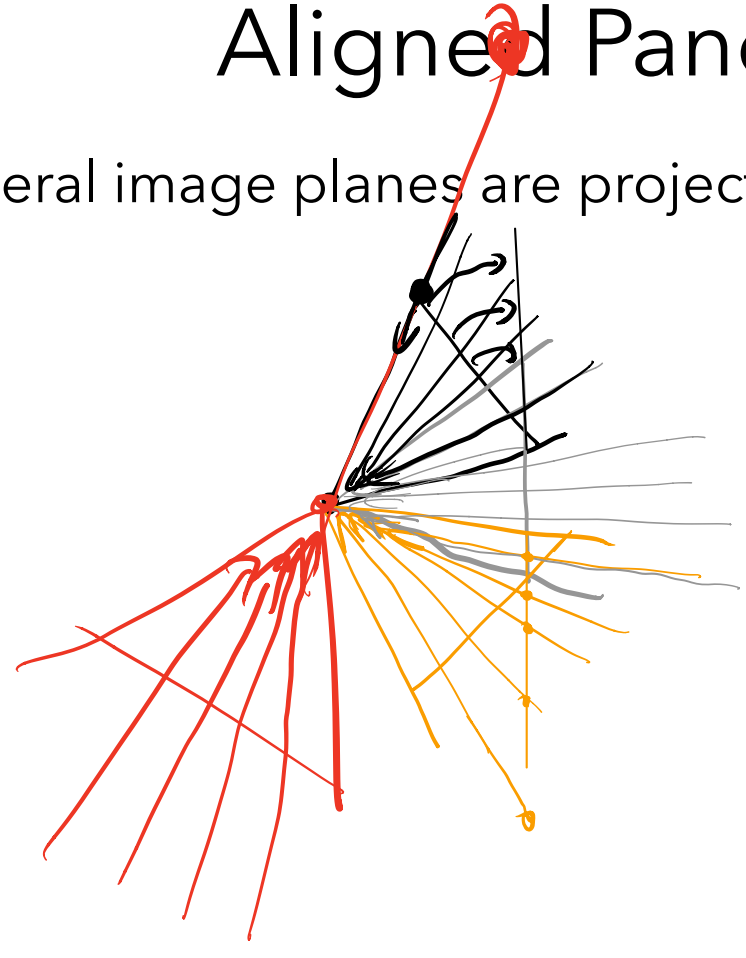
A **3x3 linear transformation**, applied to a projection **plane**.





Reinterpreting Homography-Aligned Panoramas

Several image planes are projected onto a single plane.

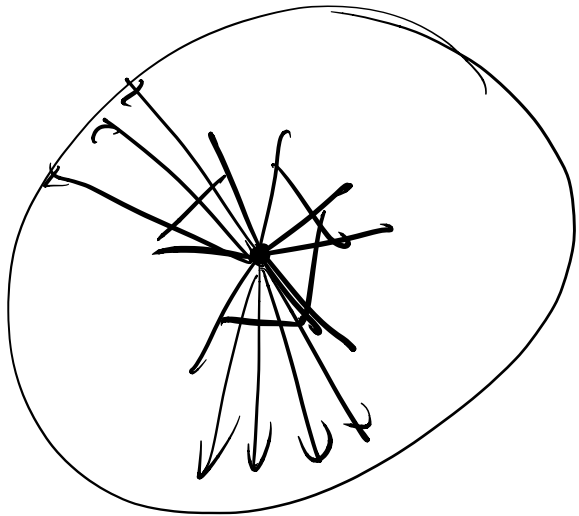


Planar Panoramas

We can't make 360 panoramas with homographies.

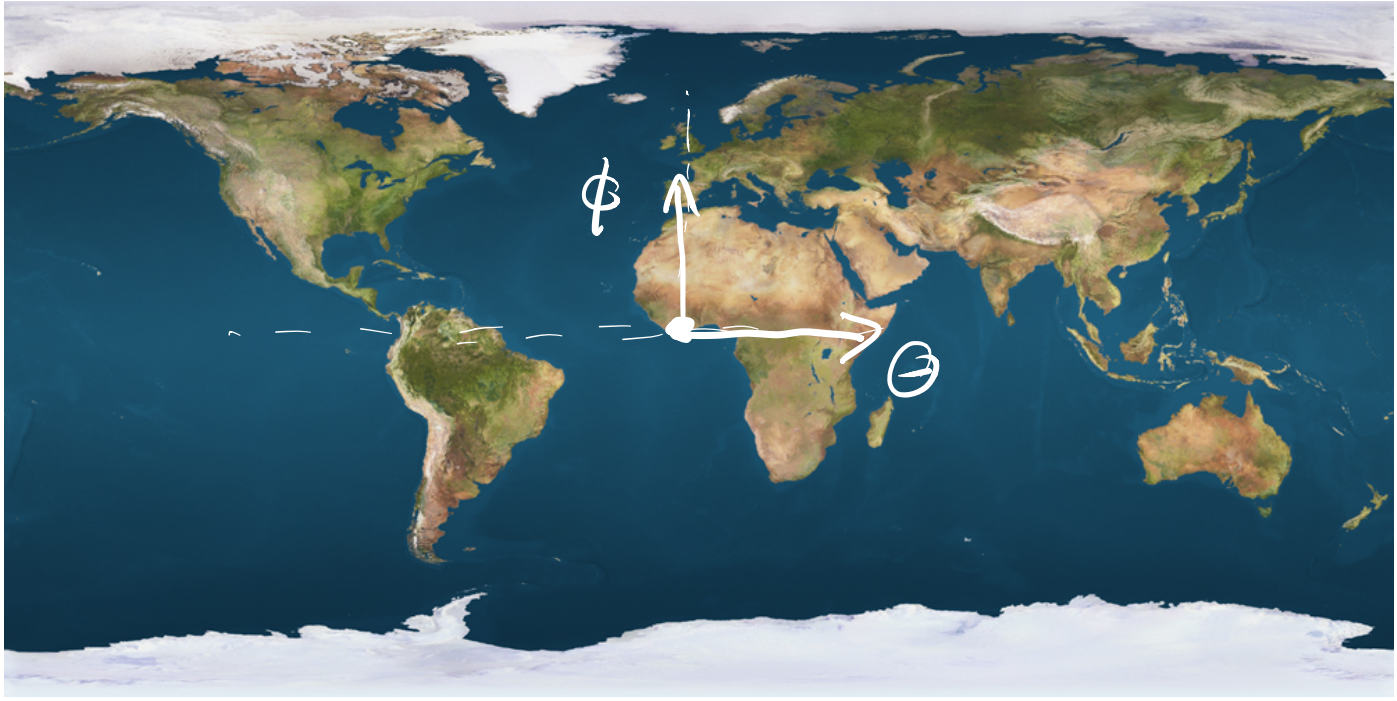
Spherical Panoramas

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



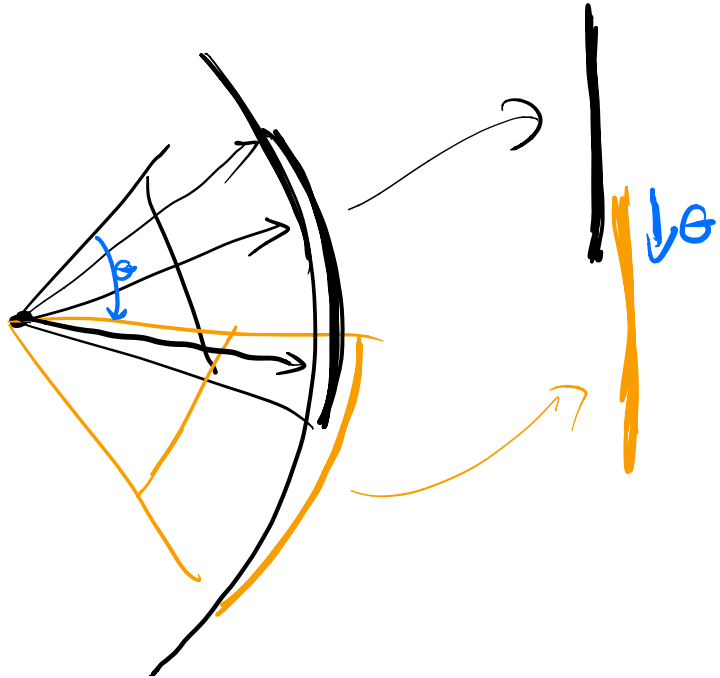
Example: Google Street View

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.

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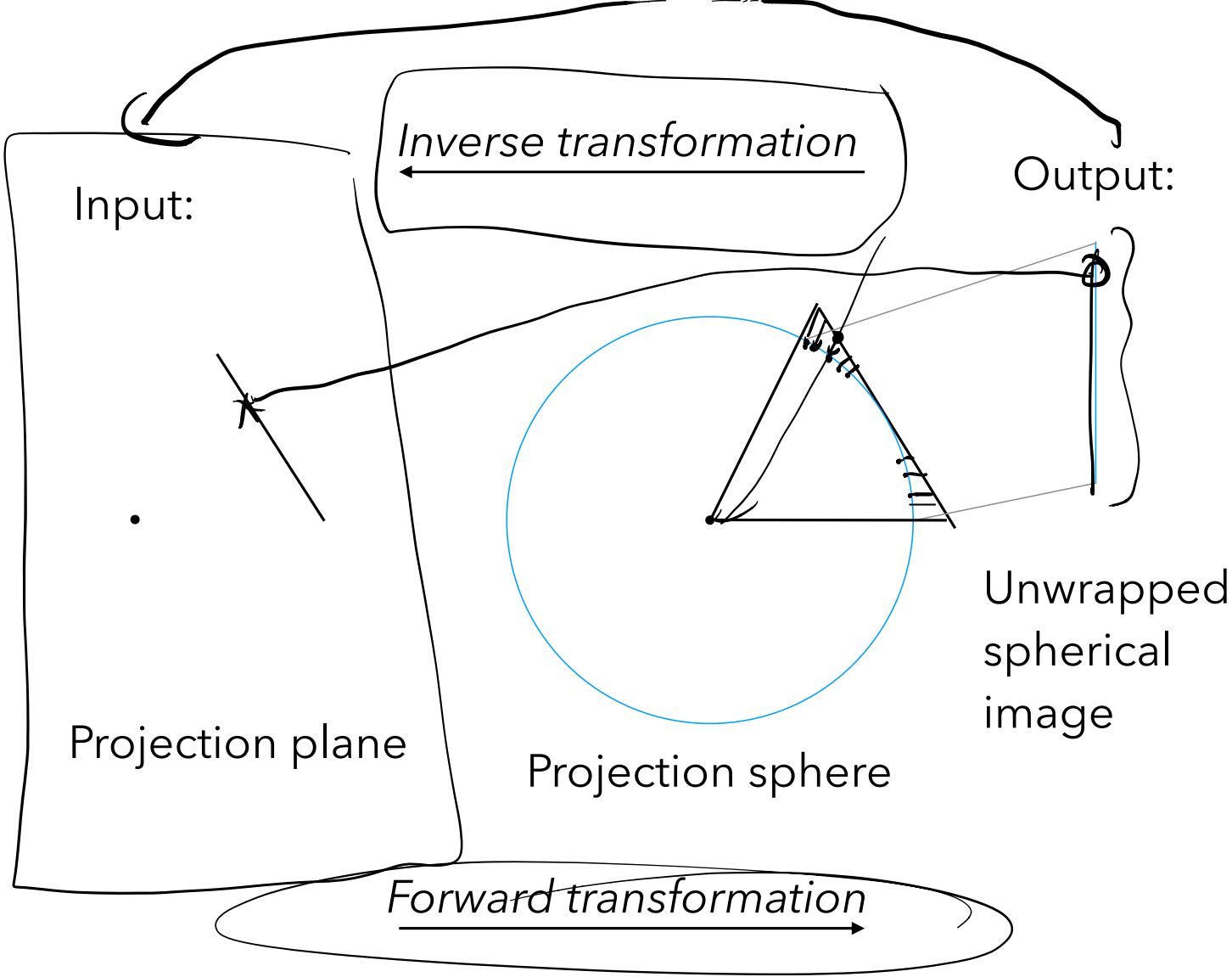
Inverse transformation
Input:
Output:
Projection plane
Projection sphere
Unwrapped spherical image
Forward transformation

GOTO notes