Epipolar Geometry

16-385 Computer Vision (Kris Kitani)

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Tie tiny threads on HERB and pin them to your eyeball

What would it look like?
You see points on HERB

What does the second observer see?
You see points on HERB

Second person sees lines
This is Epipolar Geometry
Epipolar geometry

Image plane
Epipolar geometry

Image plane

Baseline
Epipolar geometry

Image plane

Epipole (projection of o' on the image plane)

Baseline
Epipolar geometry

- Epipolar plane
- Image plane
- Baseline
- Epipole (projection of o' on the image plane)
Epipolar geometry
What is this?
Quiz

Epipolar plane
What is this?

Epipolar plane
Quiz

Epipolar line
(intersection of Epipolar plane and image plane)
What is this?
Quiz

Epipolar plane

Epipolar line (intersection of Epipolar plane and image plane)

Epipole (projection of o' on the image plane)
What is this?
Quiz

Epipolar line
(intersection of Epipolar plane and image plane)

Epipole
(projection of o' on the image plane)
Epipolar constraint

Potential matches for \( x \) lie on the epipolar line \( l' \)
Epipolar constraint

Potential matches for $x$ lie on the epipolar line $l'$.
Epipolar constraint

Potential matches for $x$ lie on the epipolar line $l'$. 
The point \( x \) (left image) maps to a ___________ in the right image

The baseline connects the ___________ and ____________

An epipolar line (left image) maps to a ___________ in the right image

An epipole \( e \) is a projection of the ____________ on the image plane

All epipolar lines in an image intersect at the _____________
Converging cameras

Where is the epipole in this image?
Converging cameras

Where is the epipole in this image?

It's not always in the image
Parallel cameras

Where is the epipole?
Parallel cameras

epipole at infinity
Forward moving camera
Forward moving camera
Where is the epipole?

What do the epipolar lines look like?
Epipole has same coordinates in both images. Points move along lines radiating from “Focus of expansion”
The epipolar constraint is an important concept for stereo vision.

**Task:** Match point in left image to point in right image

*How would you do it?*
The epipolar constraint is an important concept for stereo vision.

**Task:** Match point in left image to point in right image.

Want to avoid search over entire image

(if the images have been rectified)

Epipolar constrain reduces search to a single line.