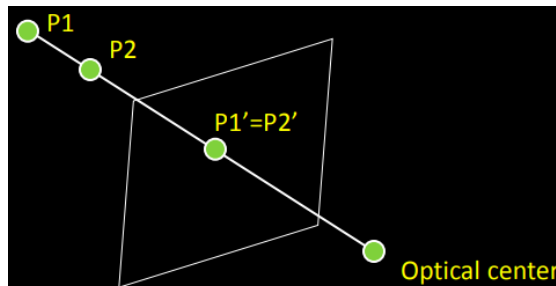


3B-L1 Stereo geometry

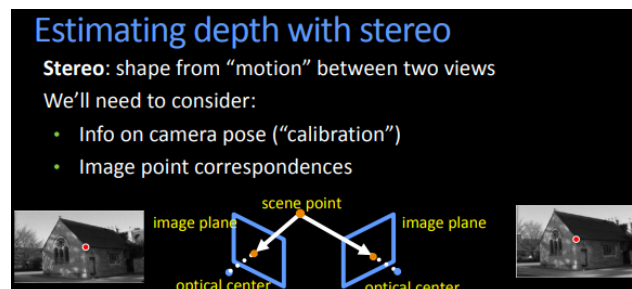
2017/11/25 03:05

1. Sum
 - a. get depth from stereo
 - i. camera calibration
 - ii. image point correspondence
 1. disparity (map)
 - b. depth $\hat{=} 1 / \text{disparity}$
2. Intro
 - a. focus
 - i. stereo
 1. two particular views
 - ii. the relationship between sort of camera geometry and scene geometry
 - iii. how do these images taken from different views relate
3. Why Multiple Views
 - a. Why multiple views?
 - i. Structure and depth are inherently ambiguous from single views.

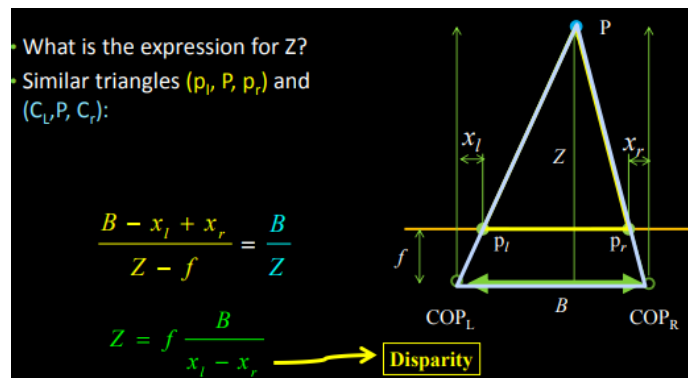


4. How do Humans see in 3D
 - a. Depth cues
 - i. perspective effects
 - ii. shading
 1. reflection
 - iii. texture
 1. recover the surface / orientation
 - iv. focus/defocus

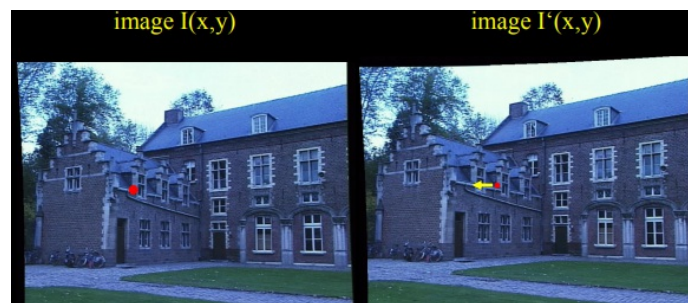
1. one eye from multiple pic
- v. motion
 1. related to stereo
 2. get depth from moving of the single image
5. Stereo
 - a. For a long time (70s), it was a big deal in computer vision: The general methods of estimating shape from some cue: shading, texture, focus, etc, called Shape from X.
 - i. we wanted to build machines that could compute depth from a single image
 - b. But we have two eyes! -- Stereo
 - i. The image from one eye is a little different than the image from the other eye.
 - ii. •Think of shape from “motion” between two views
 - iii. •Infer 3d shape of scene from two (multiple) images from different viewpoints
6. Basic Idea
 - a. from the two points of view, you get the depth
7. Random Dot Stereograms
 - a. for human, stereo is based on a low-level process that directly fuses the two images rather than matching large-scale structures.
8. Estimating Depth with Stereo



- a. how to figure out the depth
 - i. If I have two cameras
 - ii. if I can figure out which two points in the two cameras are the same point
 - iii. and if I know something about which way the cameras are pointed
- b. **two keys** -- Stereo: shape from “motion” between two views
 - i. Info on camera pose (“calibration”)
 1. how cameras oriented in space w.r.t each other
 - ii. Image point correspondences
 1. which point in image 1 corresponds to which in image 2
 2. it's fundamental for stereo matching
1. Geometry for a Simple Stereo System



- a. Distance is positive in left image, and negative in right
 - i. so disparity is the sum of two shifts from their own origin.
 - b. depth is inverse proportional to disparity
 - i. the bigger the depth, the smaller the disparity
1. Depth From Disparity
- a. definition of disparity
 - i. Disparity refers to the **distance between two corresponding points in the left and right image of a stereo pair.**



- b. disparity map
 - i. every pixel contains the distance/disparity value for that pixel in the left image.
 - ii. from the map we can see the inverse proportional relationship, the smaller the depth, the larger the disparity

