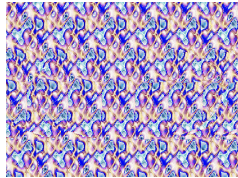


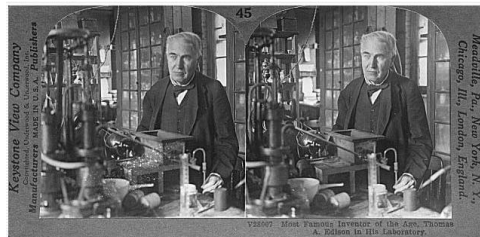
Binocular Stereo Vision

Stereo viewing geometry and the stereo correspondence problem



CS332 Visual Processing
Department of Computer Science
Wellesley College

Stereograms



Invented by Sir Charles Wheatstone, 1838

Stereo disparity



left



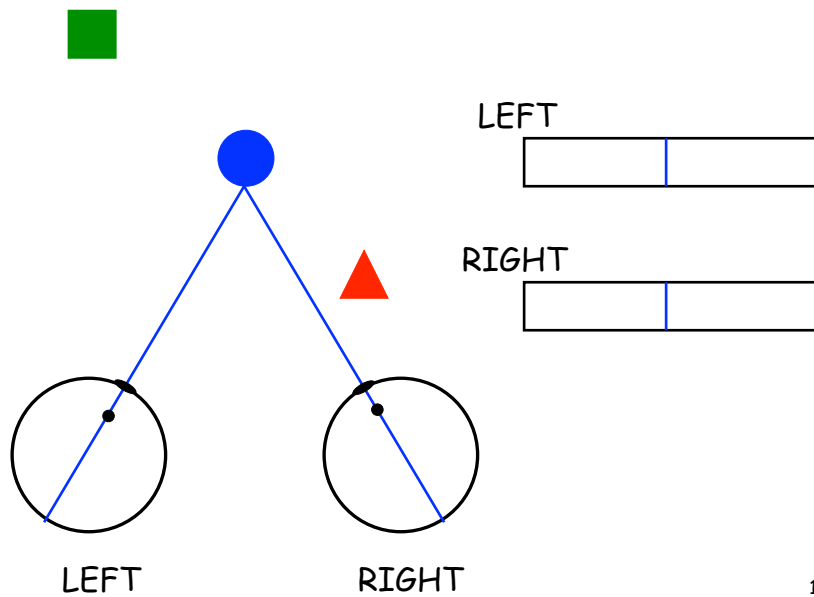
right



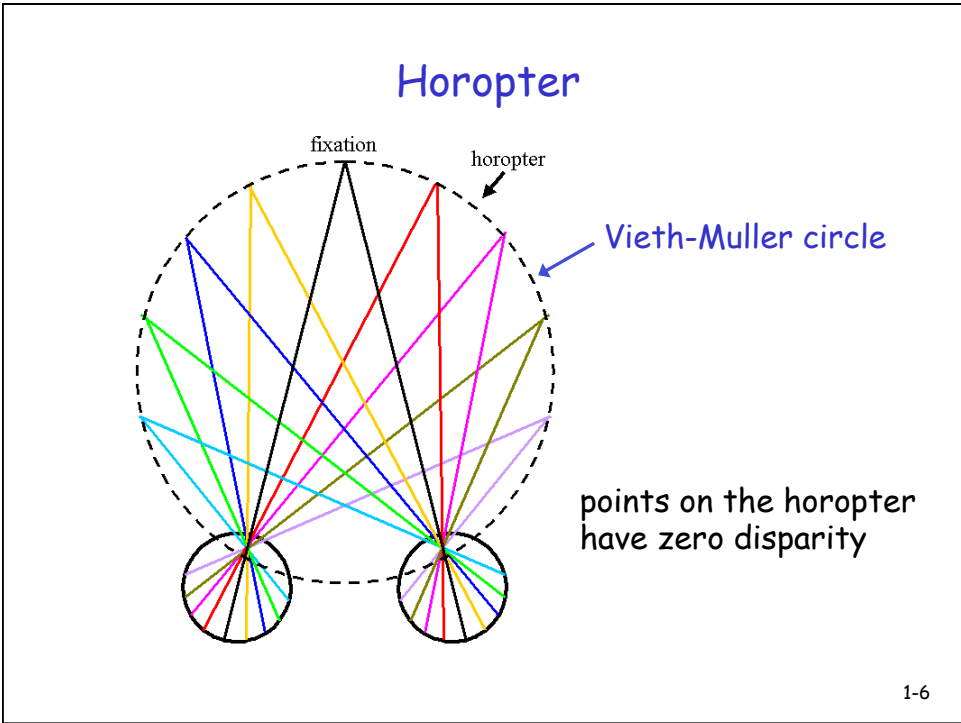
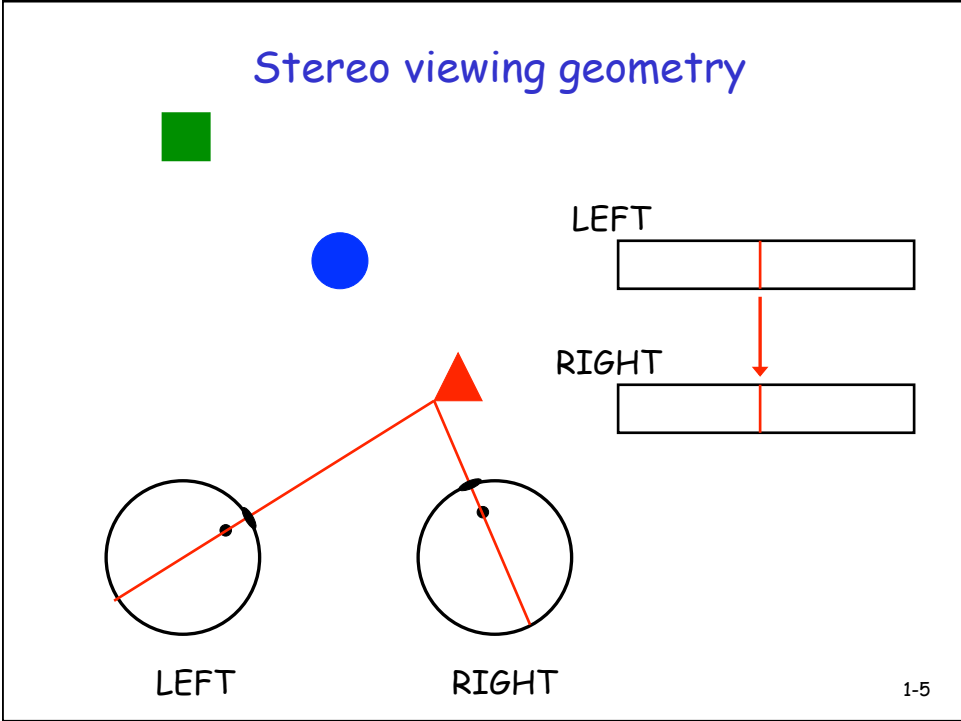
Magic-eye
"autostereograms"

1-3

Stereo viewing geometry



1-4



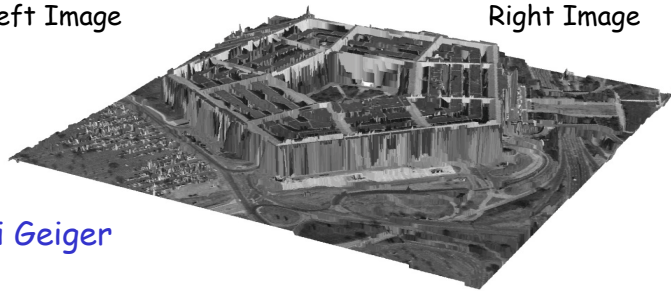
Results of stereo processing



Left Image



Right Image



Davi Geiger

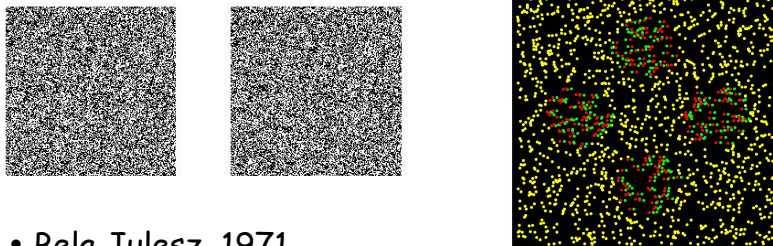
1-7

Steps of the stereo process

- extract features from the left and right images, whose disparity we want to measure
- match the left and right image features and measure their disparity in position
“stereo correspondence problem”
- use stereo disparity to compute depth

1-8

Random-dot stereograms



- Bela Julesz, 1971
- stereo system can function independently
- we can match “simple” features
- highlight the *ambiguity* of the matching process

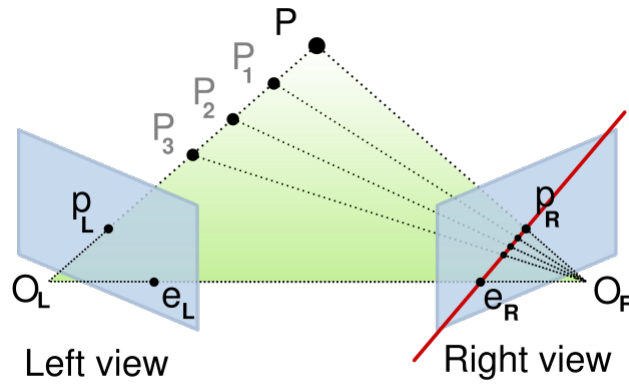
1-9

Constraints on stereo correspondence

- **Uniqueness**
each feature in the left image matches with only one feature in the right (and vice versa...)
- **Similarity**
matching features appear “similar” in the two images
- **Continuity**
nearby image features have similar disparities
- **Epipolar constraint**
simple version: matching features have similar vertical positions, but...

1-10

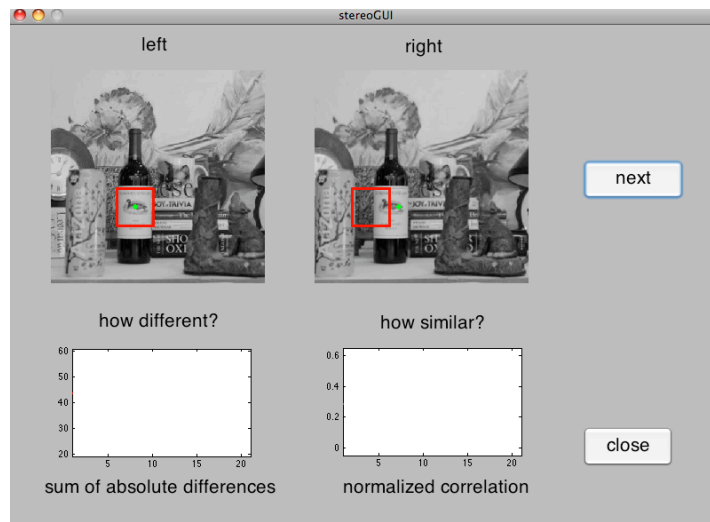
Epipolar constraint



Possible matching candidates for p_L lie along a line in the right image (the epipolar line...)

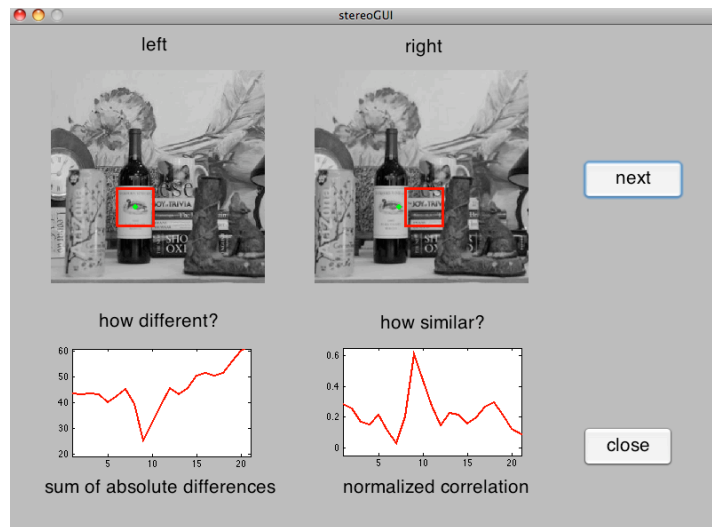
1-11

Solving the stereo correspondence problem



1-12

Solving the stereo correspondence problem



1-13