

SSP 100 - 10

How Computers See

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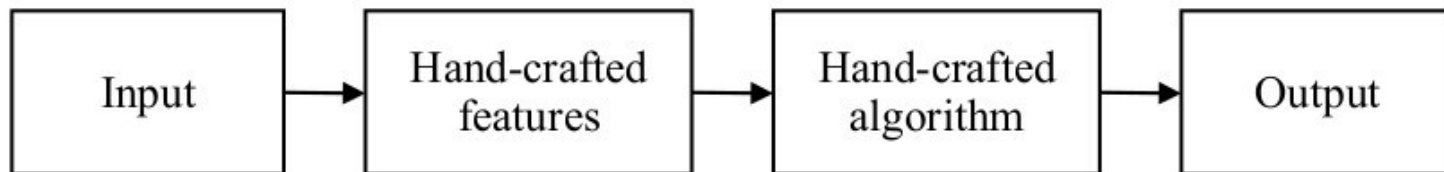
Today's Topics

- Questions? / Comments?
- Discussion of the readings
- An incomplete and concise history of computer vision from early days to present

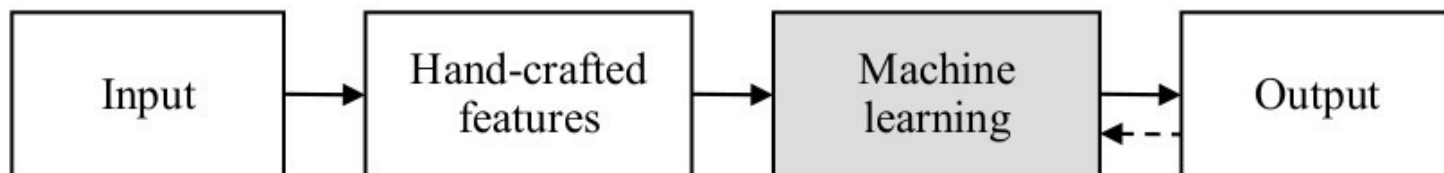
History of computer vision

- An incomplete and concise history of computer vision from early days to present
- Today I will discuss only some of the areas computer vision researchers focused in the past 60 years or so
- For much of the rest of the semester we will switch to discussing specific applications of computer vision and I will give historical contexts of those in turn

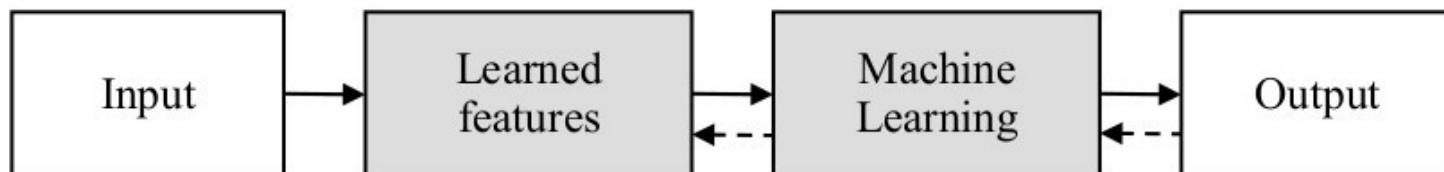
History of computer vision



(a) Traditional vision pipeline



(b) Classic machine learning pipeline



(c) Deep learning pipeline

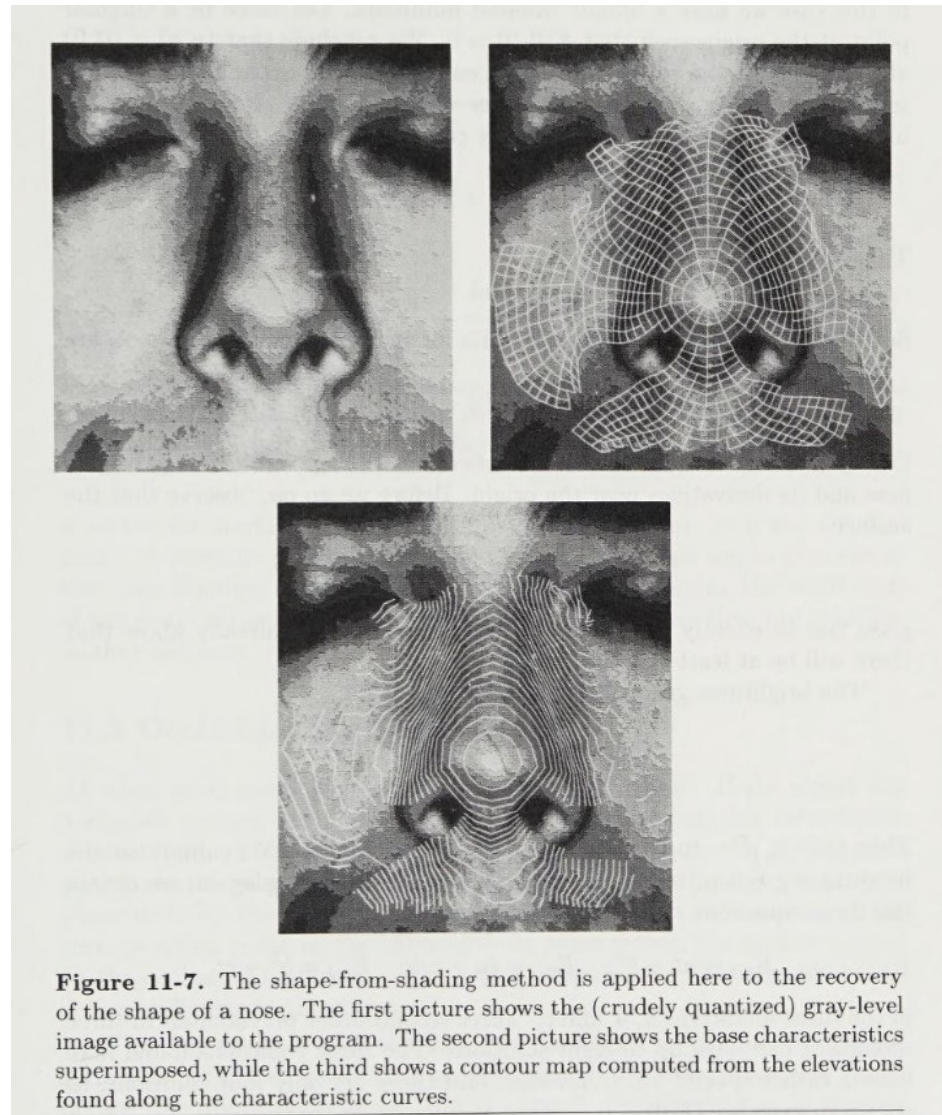
History of computer vision

- Lawrence Roberts – Ph.D. thesis at MIT 1960s
 - computed change in intensity in 2 dimensions via a 2x2 filter
 - detected edges of blocks and computed the 3d structure based on that
 - Show pages 35-37 of thesis

History of computer vision

- Berthold Horn -
 - 1970s
 - Shape from Shading
 - Computing shape of objects from single image

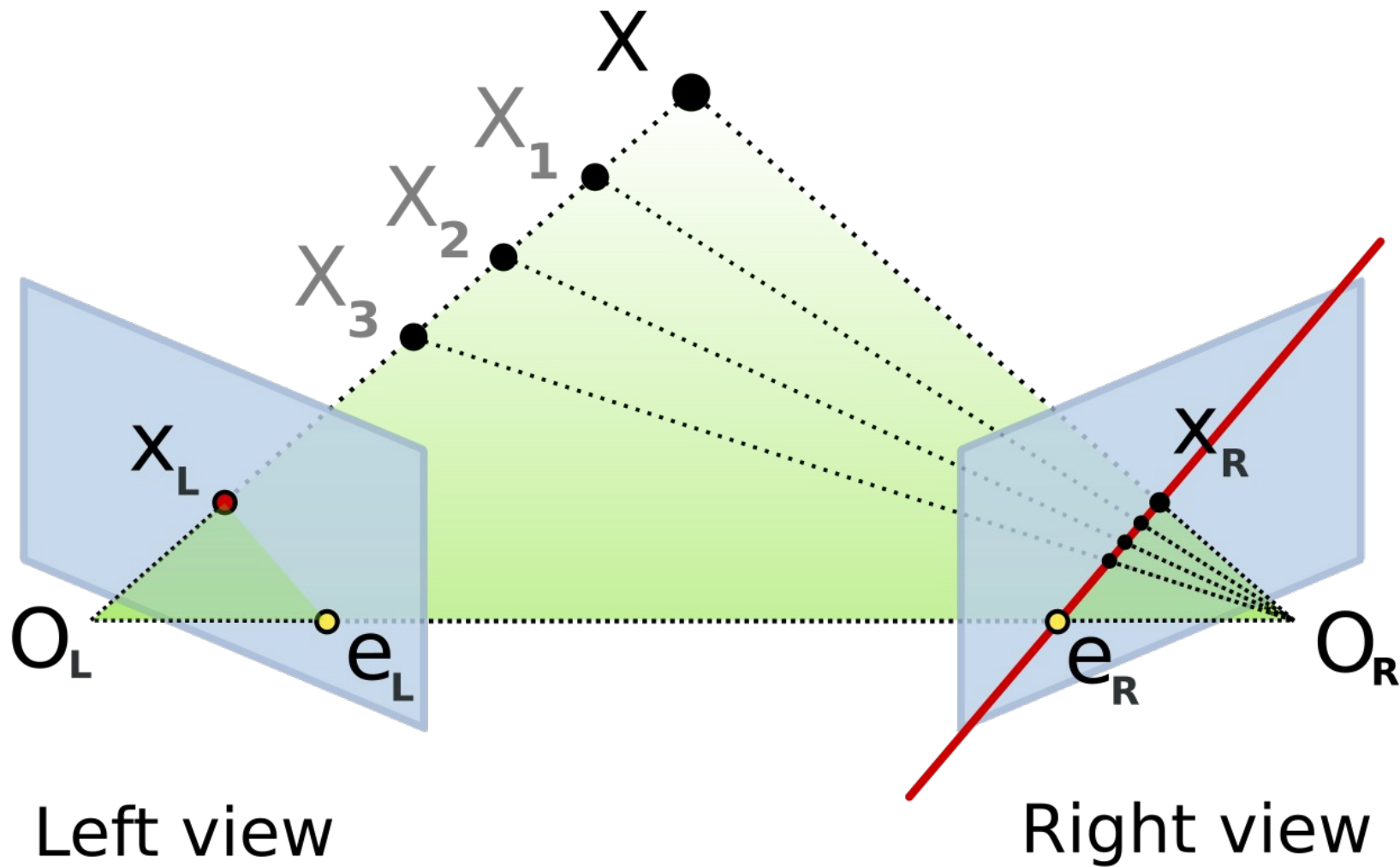
History of computer vision



History of computer vision

- Robert Woodham
 - Late 1970s, early 1980s
 - Photometric stereo
 - Uses multiple images of same object
 - Computes a surface normal at each pixel
 - https://en.wikipedia.org/wiki/Photometric_stereo

History of computer vision



History of computer vision

- Tomasi and Kanade
 - 1990s
 - Structure from Motion
 - Point correspondences
 - and linear algebra technique called Singular Value Decomposition (SVD)
 - Show images from the paper

History of computer vision

- Feature extraction to allow matching of points in different images for
 - Object recognition
 - Robot localization
 - Stitching for panoramas
 - Tracking objects in video

History of computer vision

- Feature extraction
 - Pixels that in relation to their neighborhood are distinctive
 - Why not use pixels that are edges?

History of computer vision

- Feature extraction
 - Pixels that in relation to their neighborhood are distinctive
 - Corners (Harris, SUSAN, and many others)
 - SIFT 1999 and early 2000s
 - SURF 2006

History of computer vision

- Let me read a paragraph about SIFT
- I want to note that it uses a histogram of 36 bins of orientations to relate it to the idea of histograms that we just learned
- Then show you a demo of a program that matches points using SIFT which stands for Scale Invariant Feature Transform

History of computer vision

