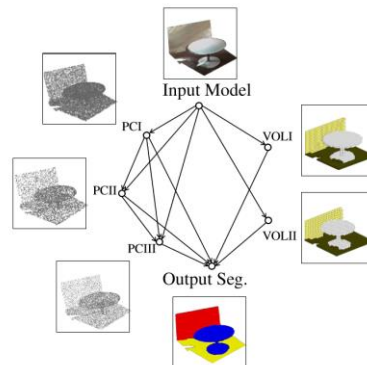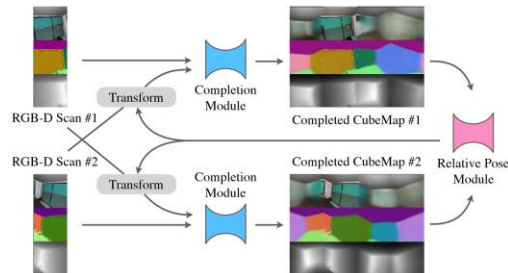# CS376 Computer Vision
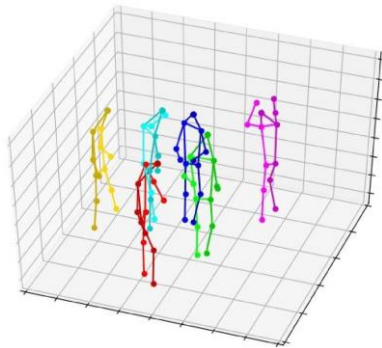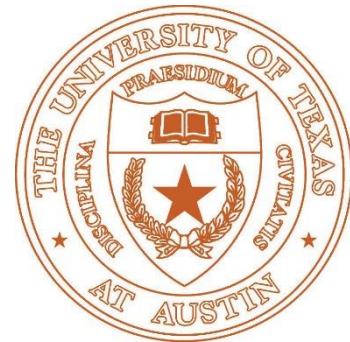# Lecture 7: Hough Transform

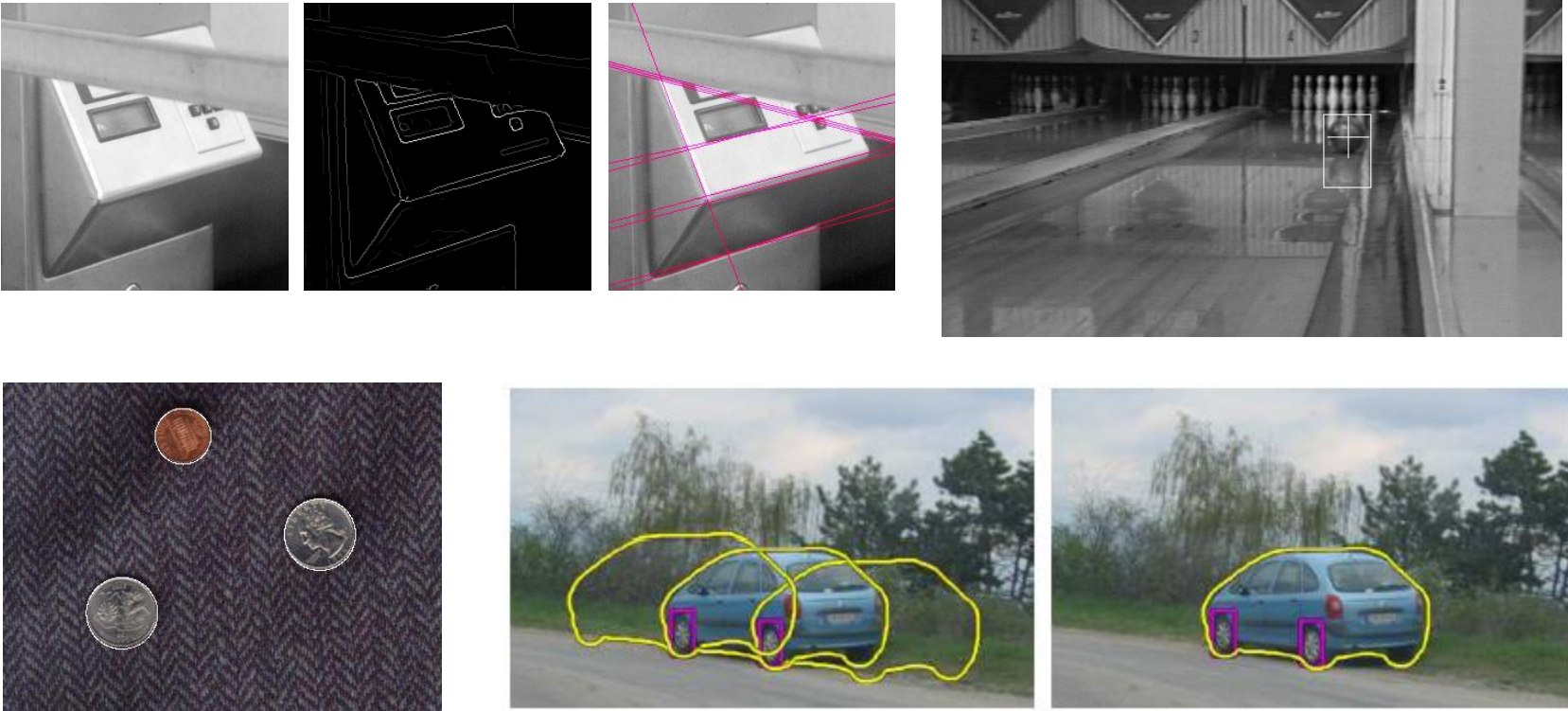Qixing Huang

Sep. 12th 2023

Review

- Image filters

- Edge detection

- Binary image analysis   Local analysis

- Texture

- Optical Flow

Now: Fitting

- Want to associate a model with observed features

[Fig from Marszalek & Schmid, 2007]

For example, the model could be a line, a circle, or an arbitrary shape.

Slide Credit: Kristen Grauman

Many Applications

- Vanishing point detection

- Segmentation/Detection

- 3D Vision
  - Calibration
  - Structure-from-motion

Fitting: Main Idea

- Choose a parametric model to represent a set of features

- Correlated problems
  - What are the models
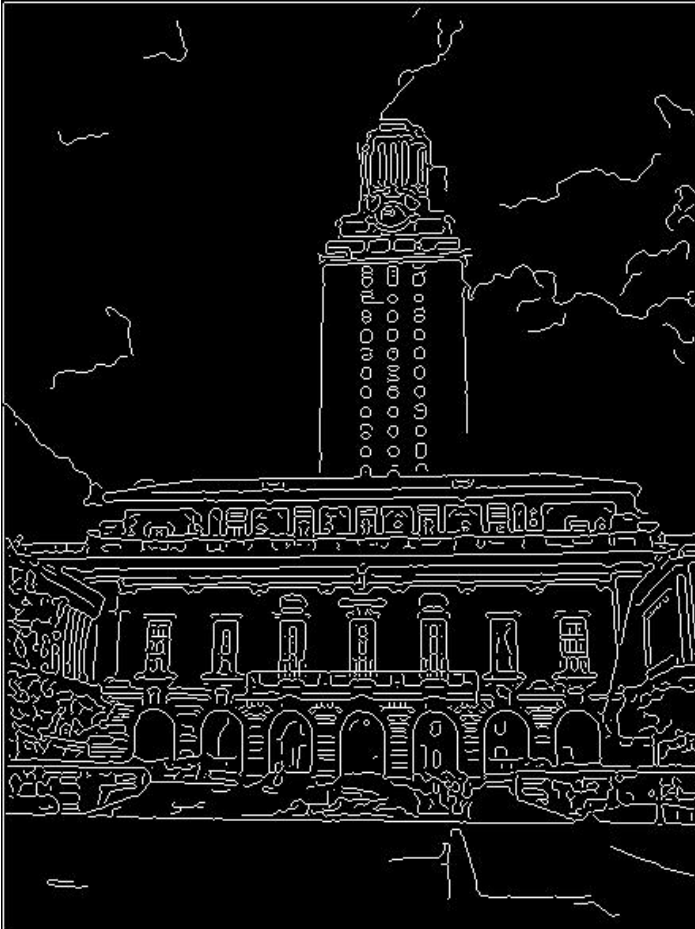 - Association between models and features
  - How to optimize the models

Case study: Line fitting

- Why fit lines?

  Line features are quite popular in natural images

# Difficulty of line fitting

- Incomplete edge detections

- How many lines

- Not all edges are lines

- Noise in detected edges

Voting

- Impossible to test all combinations of features to extract the models

- Let features vote for the models
  - Cycle through features, cast votes for model parameters
  - Usually each model should be low-dimensional

- Noise contribute less to the models

Fitting lines: Hough transform

- Given points that belong to a line, what is the line?

- How many lines are there?

- Which points belong to which lines?

- **Hough Transform** is a voting technique that can be used to answer all of these questions:
  - Record vote for each possible line on which each edge point lies
  - Look for lines that get many votes
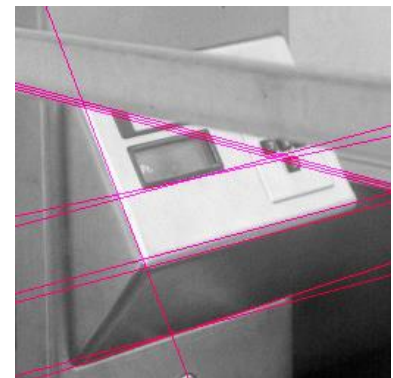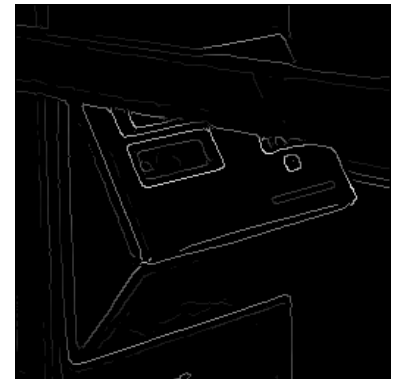
Basic Facts

- Not all the votes are correct, but the correct ones form 'clusters'

- Depend on the representations of the models

- Depend on how we fit the models