EEE-6512: Image Processing and Computer Vision

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Lecture #11: Model-Fitting

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Outline

- Overview
- Fitting Lines
- Fitting Curves
- Addressing Noise
- Fitting Multiple Models

Fitting

- We've learned how to detect edges, corners, blobs. Now what?
- We would like to form a higher-level, more compact representation of the features in the image by grouping multiple features according to a simple model

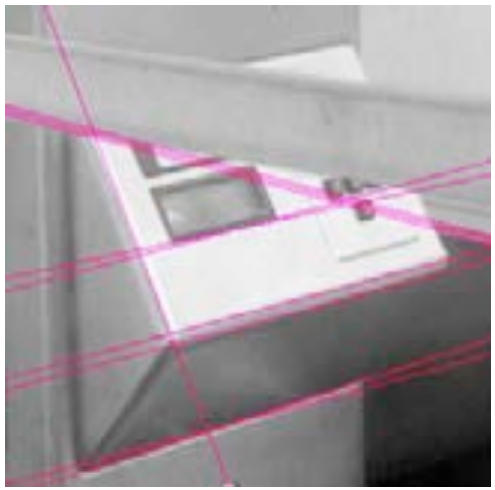
Fitting: Main idea

- **Choose a parametric model to represent a set of features**
- **Membership criterion is not local**
  - Can't tell whether a point belongs to a given model just by looking at that point
- **Three main questions:**
  - What model represents this set of features best?
  - Which of several model instances gets which feature?
  - How many model instances are there?
- **Computational complexity is important**
  - It is infeasible to examine every possible set of parameters and every possible combination of features

Slide credit: L. Lazebnik

Fitting

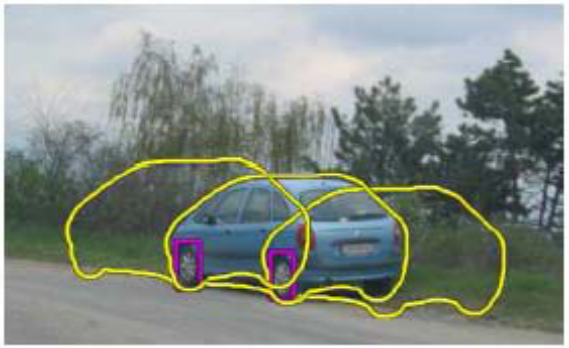
Choose a *parametric model* to represent a set of features

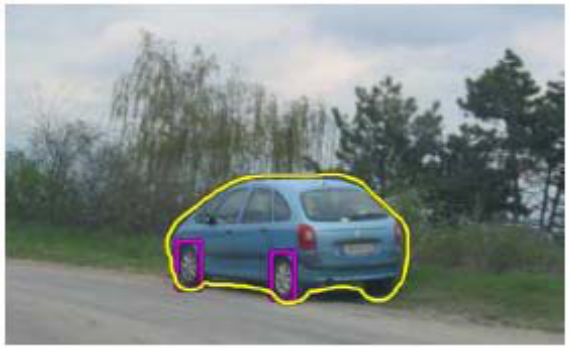


simple model: lines

simple model: circles

complicated model: face shape





complicated model: car

Source: K. Grauman

Fitting –Design challenges

- Design a suitable **goodness of fit** measure
  - Similarity should reflect application goals
  - Encode robustness to outliers and noise

- Design an **optimization** method
  - Avoid local optima
  - Find best parameters quickly

Fitting: Issues

Case study: Line detection

- **Noise** in the measured feature locations
- **Extraneous data:** clutter (outliers), multiple lines
- **Missing data:** occlusions

Fitting: Overview (cont.)

- **If we know which points belong to the line, how do we find the "optimal" line parameters?**

  Least squares

- **What if there are outliers?**

  Robust fitting, RANSAC

- **What if there are many lines?**

  Voting methods: RANSAC, Hough transform

Questions?

Slide Credits

Some slides from Dr. Stanley Birchfield, Dr. Kristen Grauman, Dr. Svetlana Lazebnik, Dr. Jia-Bin Huang