Object Identification and Recognition (I)

Introduction to Computational and Biological Vision

CS 202-1-5261

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Object identification and recognition

What does it mean to “recognize and object”?

- Retrieving information associated with an object that is not provided in the raw data (the image) itself
  - Name
  - Type
  - Class
  - Function
  - What would it do to me if it caught me
  - :

- Matching against a knowledge base (memory)
Object identification and recognition

Recognition as classification

- Hierarchical
  - My car
  - Jeep
  - Car
  - Vehicle
  - Man-made object
  - 
  
- Classification level depends on application or circumstances.
Object identification and recognition

How are objects recognized?

- Characteristic shape or structure
- Relative location
- Characteristic motion
- Color
- Texture
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Issues in shape perception

• What is the “shape” of an object?
  That spatial property of objects that don’t change when certain spatial transformations are applied.

• Shape constancy
  When does the same object have the same shape despite differences in viewing conditions

• Shape equivalence
  When do different objects (having different shapes) are seen as having the same shape

• How is shape equivalence determined?
  What information and (algorithmic) operations are involved in determining shape equivalence?

• Shape and object representation
Object identification and recognition

Shape representation – viewer-centered templates
Object identification and recognition

Shape representation – viewer-centered templates
Object identification and recognition

Shape representation – viewer-centered feature vectors

\((v_1, v_2, \ldots, v_n)\)
Object identification and recognition

Shape representation – viewer-centered feature vectors

$\left( v_1, v_2, \ldots, v_n \right)$
Object identification and recognition

Shape representation – object-centered components
Object identification and recognition

Shape representation – object-centered components

Generalized Cylinders
Object identification and recognition

Shape representation – object-centered components
Object identification and recognition

Recognition vs. Localization

Recognition • What object from the database exists in the image?
• Does this database object exist in the image?

Localization • What transformation would map the database object to the measured one.
Object identification and recognition

Main approaches to recognition

- Appearance-based
- Feature alignment
- Parts and structural matching
- Shape invariances