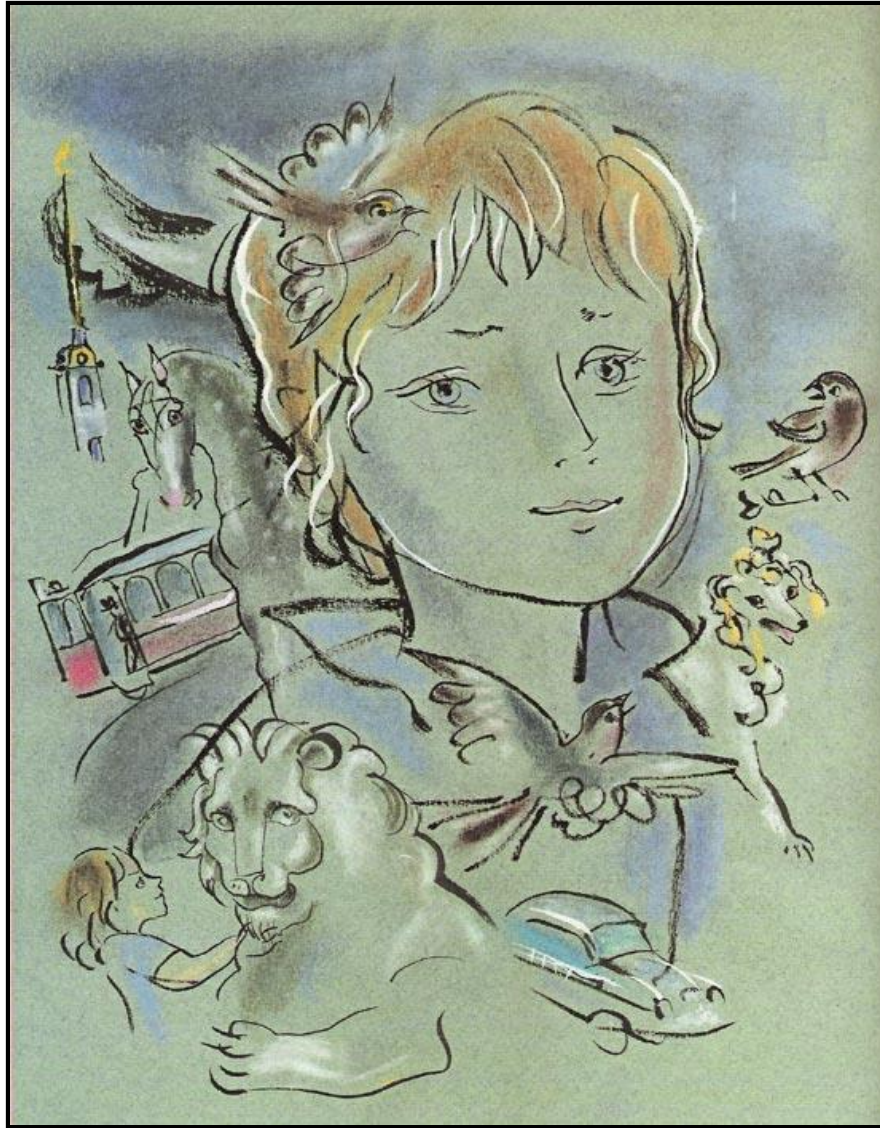


# Object Recognition: History and Overview

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Slides adapted from Fei-Fei Li, Rob Fergus, Antonio Torralba, and Jean Ponce

# Outline

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What is object category recognition?

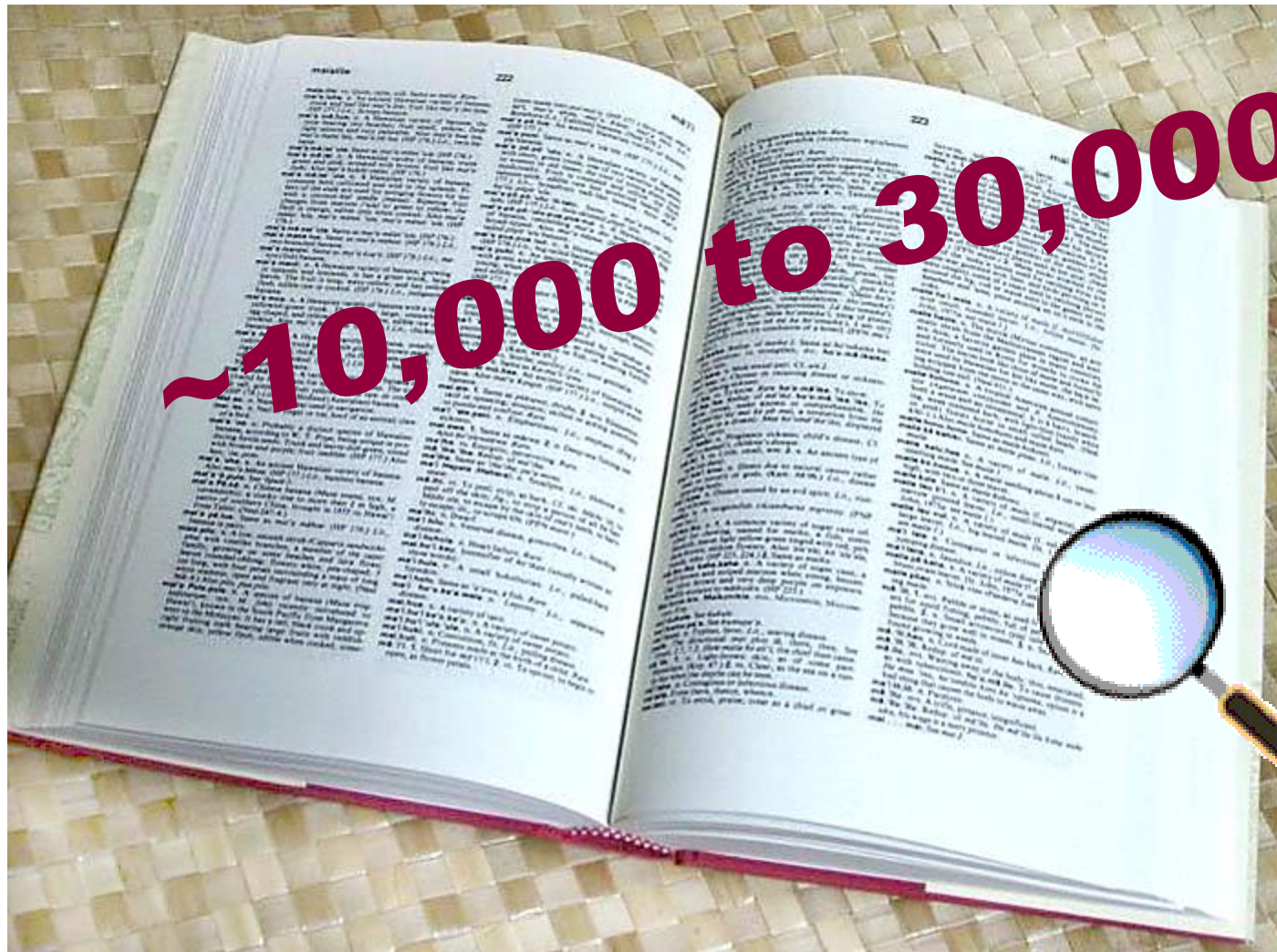
History of object representation

- Geometric
- Global appearance-based
- Sliding window
- Indexing with local features
- Constellation models
- Bags of features

Issues in statistical recognition

- Generative vs. discriminative models
- Supervised vs. unsupervised
- Different kinds of recognition tasks
- Datasets

# How many object categories are there?







~10,000 to 30,000

# OBJECTS

ANIMALS

PLANTS

INANIMATE

.....

VERTEBRATE

NATURAL

MAN-MADE

MAMMALS

BIRDS

TAPIR

BOAR

GROUSE

CAMERA





# So what does object recognition involve?



# Verification: is that a lamp?





# Detection: are there people?





Identification: is that Potala Palace?



# Object categorization



mountain

tree

building

banner

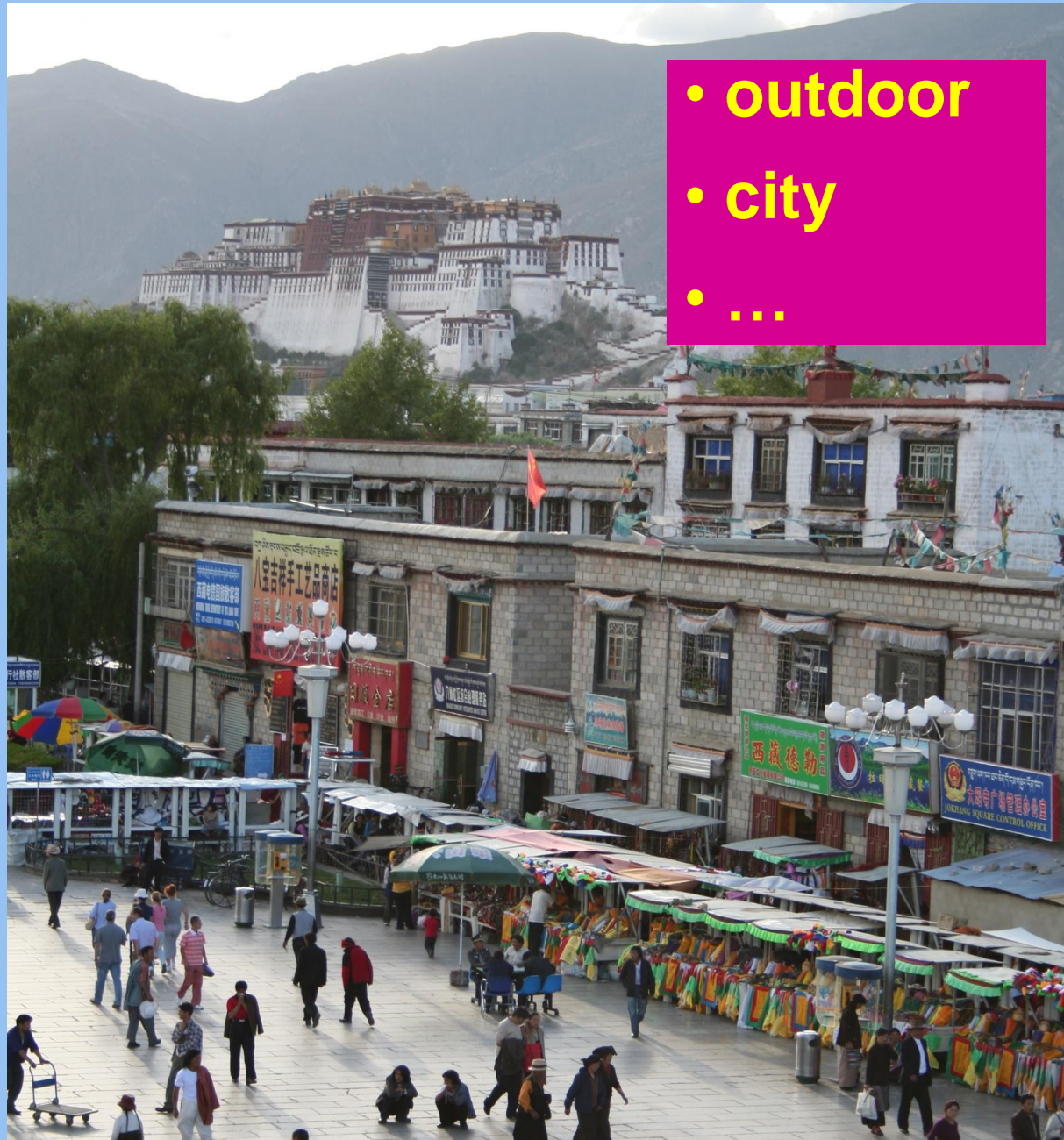
street lamp

vendor

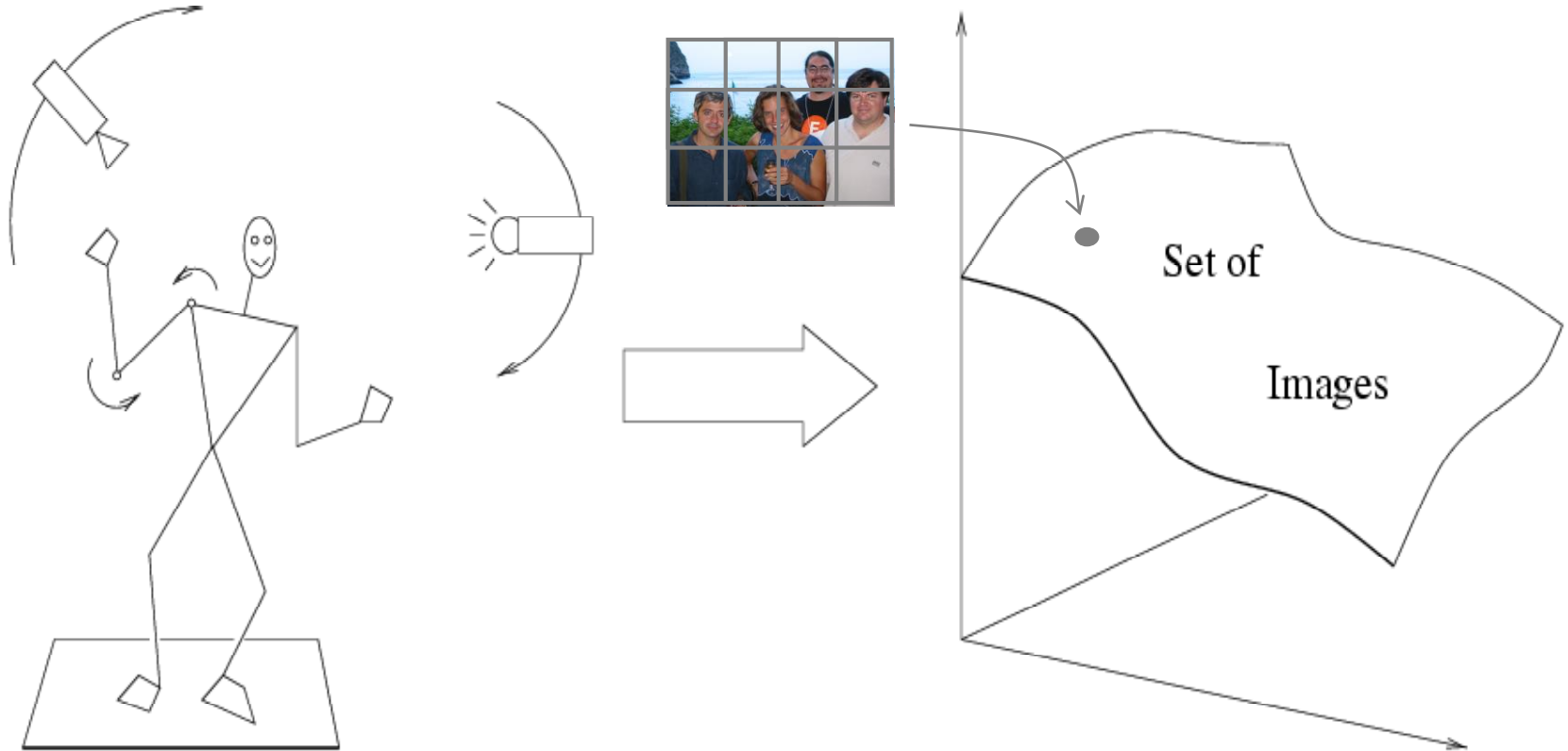
people



# Scene and context categorization



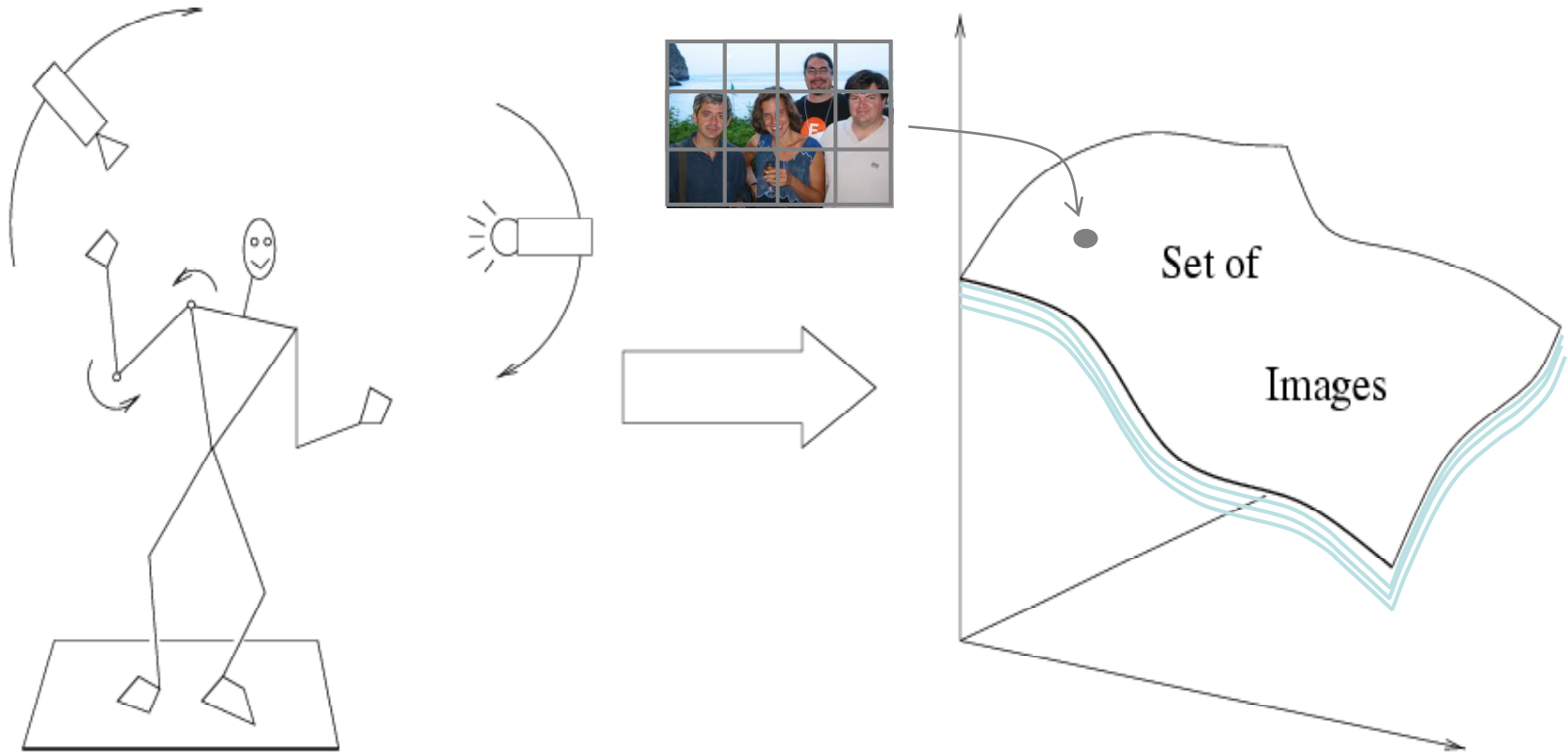
# Modeling variability



Variability: Camera position  
Illumination  
Internal parameters



# Modeling variability

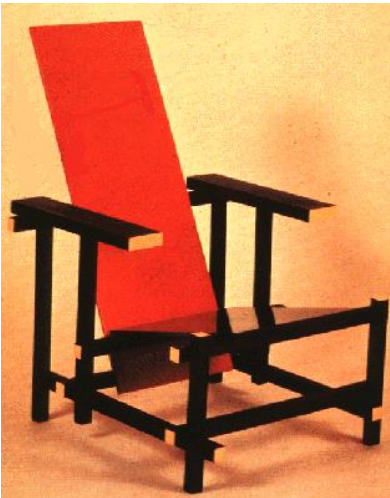


Variability: Camera position  
Illumination  
Internal parameters

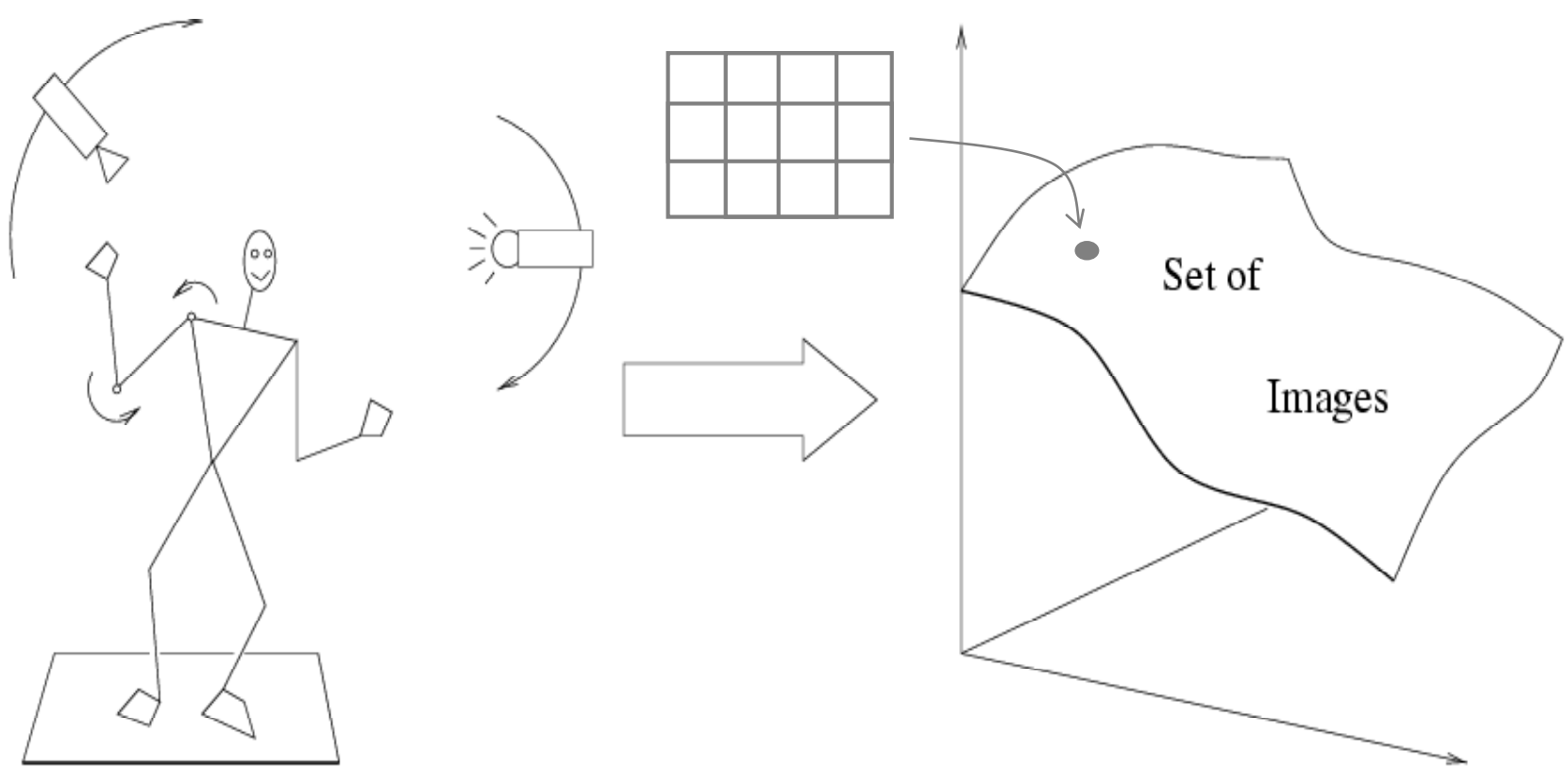


Within-class variations

# Within-class variations

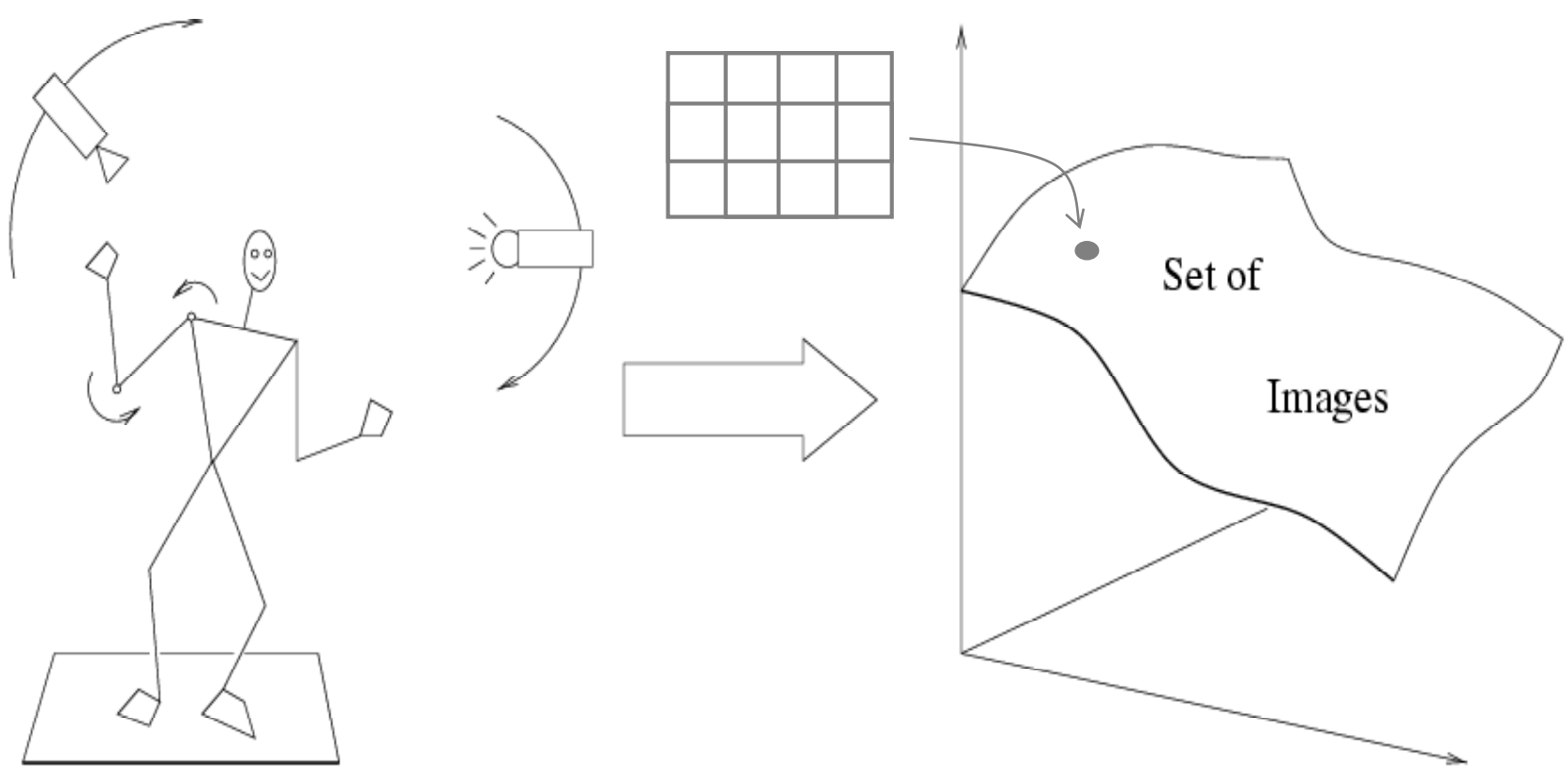






Variability:

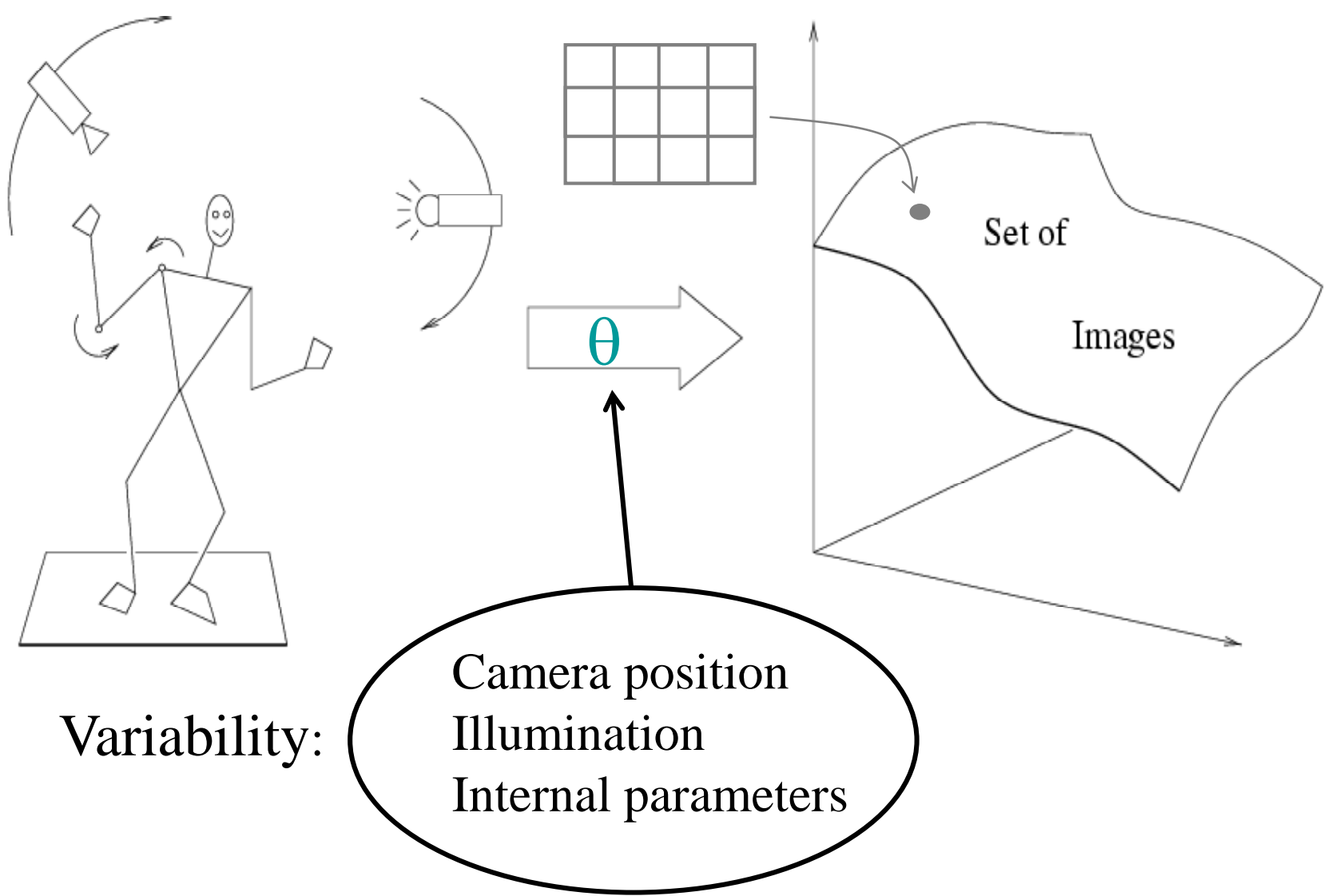
Camera position  
Illumination  
Internal parameters



Variability:

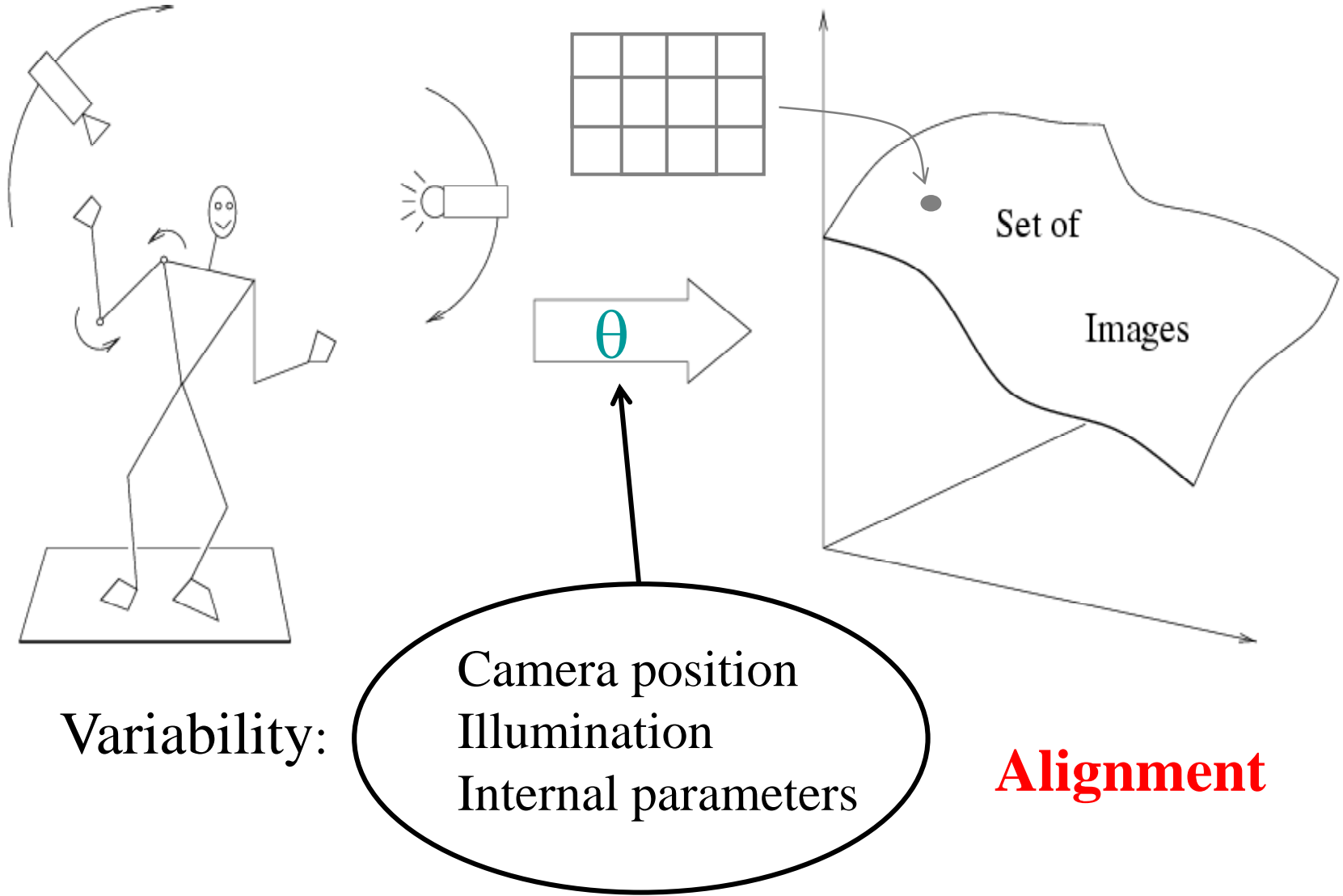
Camera position  
Illumination  
Internal parameters

Shape: assumed known



Shape: assumed known



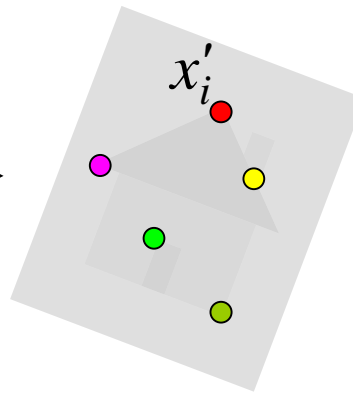
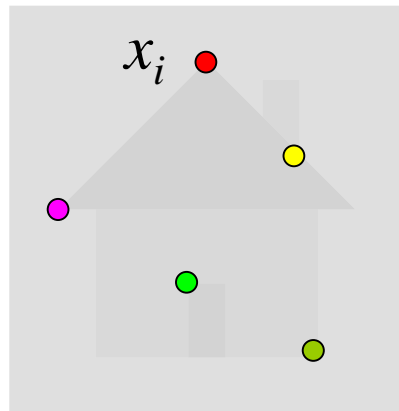


Shape: assumed known

Roberts (1965); Lowe (1987); Faugeras & Hebert (1986); Grimson & Lozano-Perez (1986); Huttenlocher & Ullman (1987)

# Recall: Alignment

- Alignment: fitting a model to a transformation between pairs of features (*matches*) in two images



Find transformation  $T$   
that minimizes

$$\sum_i \text{residual}(T(x_i), x'_i)$$