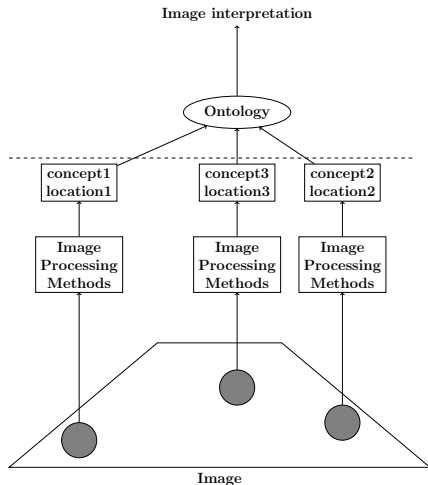# Biological Vision and Applications
Module 07-03: Knowledge representation for visual cognition
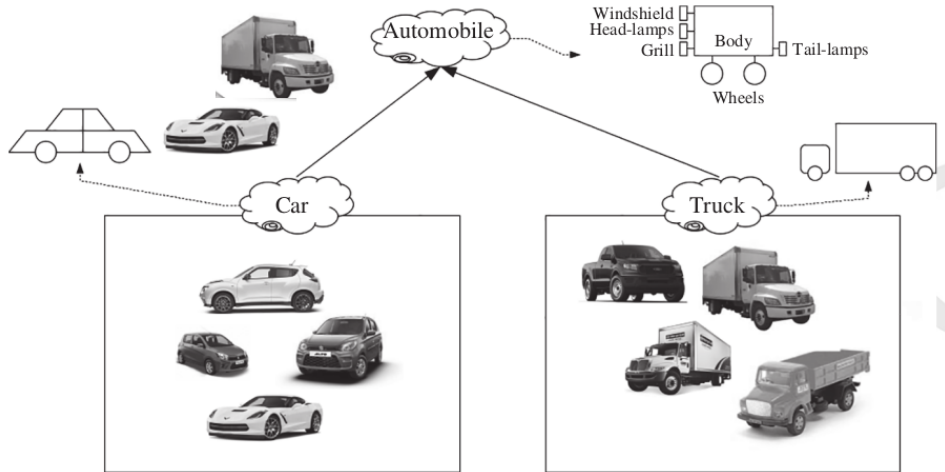
Hiranmay Ghosh

Traditional practice in ontology-based computer vision

- Media data and concepts are processed separately and differently
- Context is missing for image processing Semantic Gap
- ▶ Many-to-many mapping between objects and their visual features
  ▶ Often resolved with context

How concepts are formed

... Taxonomy learning

How to build perceptual ontology

- Include perceptual description (declarative) of an object in the ontology
  - ball – color – red (symbolic)
  - Limited capability for feature representation

- Matching problem starts when we put numeric feature descriptors
  - e.g. color value expressed as r-g-b
  - how do we compare the colors in the logical framework?
  - crisp yes/no answer does not work

- Need probabilistic matching
  - Merger of Bayesian Network and Knowledge graph
    - Banana has yellow color with probability 0.7
    - $\langle\langle Banana, color, yellow\rangle, prob, 0.7\rangle$

Baye's OWL

Spatial / Temporal Structure

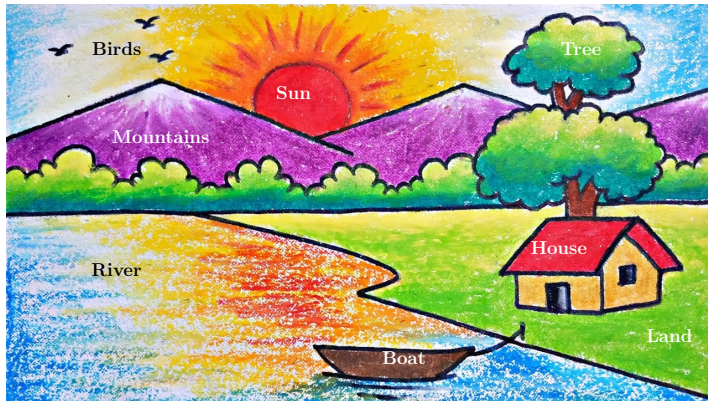# Structural composition of a scene

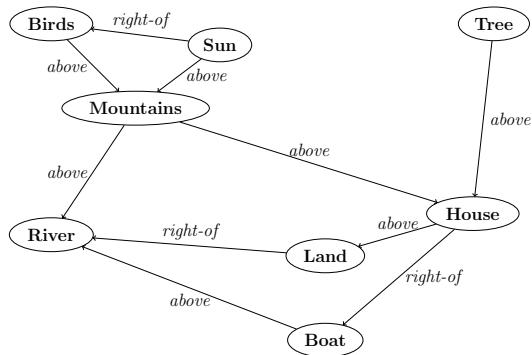Example

Scene hierarchy

Describes hierarchical composition of a scene
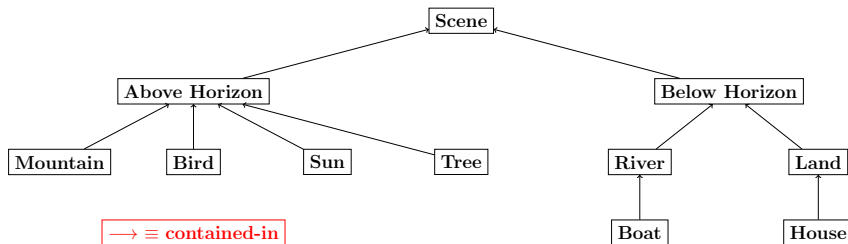
- Reasoning: *A* contained-in *B*, *B* contained-in *C* → *A* contained-in *C*

Scene graph

Describes network structure of a scene

- Reasoning:
  - ▶ *A* above *B*, *B* above *C* → *A* above *C*
  - ▶ Inverse relations: inverse(right-of) = left-of, etc.

Encoding knowledge about a scene
Coping up with intrinsic variations

- Avoid unnecessary details
  - ▶ Do not overspecify
- Express as qualitative relations
  - ▶ Approximate relations
- Express the relations as probably distribution

Graph matching (short paper)

Quiz

No quiz for module 07-03

End of Module 07-03