Image Understanding

Joint course AI Paris Saclay - DataAI IP Paris

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Imperfect information and of multiple nature

Objets
- TAGS
- Zoo
- Animal
- Cat
- ...

Relations
A droite

Connaissance
CN Close To LV

Voiture

Visuelle

Conceptuelle

Contextuelle

I. Bloch (LTCI - Telecom Paris)
Models to guide image understanding

- Develop mathematical models to represent
  - knowledge (context, expertise, spatial organization...),
  - information contained in images (geometry, statistics, shape, appearance...),
  - and to combine them,

leading to operational and efficient algorithms for image understanding.

- Semantic gap?
- Pathological / unexpected cases?
- Adaptation to application needs.
(Inexact) graph matching, alignment and instanciation of models (ontologies, conceptual graphs...), constraint satisfaction problems, spatial reasoning...
Ontology-based segmented image database

Generic knowledge
- Brain anatomy ontology + brain structural description

Knowledge of specific cases
- Brain tumor ontology

Healthy cases
Pathologic cases

Infiltrating tumors
Circumscribe tumors

Graph based representation of the generic model

Learning procedure

Step 1:
- learning spatial relations (adjacency, distance, orientation) of the generic model using healthy cases

Step 2:
- learning spatial relation for specific cases
- deducing stable relations for each class of pathologies

Dealing with a specific case

Inside(PtR, GPR) is preserved

Fuzzy modeling of spatial relations

Fuzzy representations and adaptation
(a) Example image.

(b) Labeled image: The blue regions represent the sea, the red and orange represent ships or boats and the yellow regions represent the docks.

(c) Concept hierarchy $T_C$ in the context of harbors.

(d) Conceptual graph representing the spatial organization of some elements of Figure 5.8(b).
Physical entities models

human  object  robot

Learning through observation  Learning through interaction
Organization

Professors:

- Isabelle Bloch (Télécom Paris)
- David Filliat (ENSTA Paris)
- Céline Hudelot (Centrale Supelec)
- Antoine Manzanera (ENSTA Paris)
- Florence Tupin (Télécom Paris)

Pedagogy:

- Courses: methods, applicative examples in various domains.
- Analysis and synthesis of scientific papers.