E-Training for Interpreting Images of Man-Made Scenes

eTRIMS

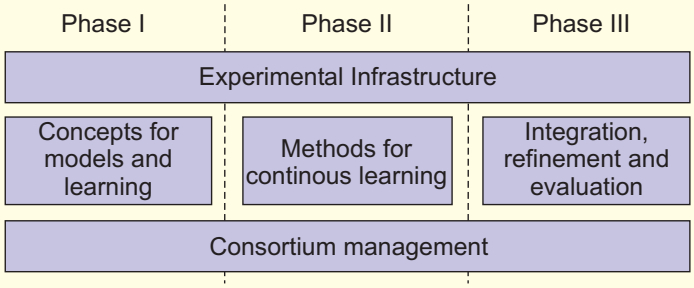
Goal:

Methodology for autonomous and continous learning
* Concept learning
* Pattern discovery
* Self learning

Motivation:

* Communication with human: need for supervision
* Transfer to other domains: need for autonomy
* Spatial arrangements of visual structures relevant in complex domains

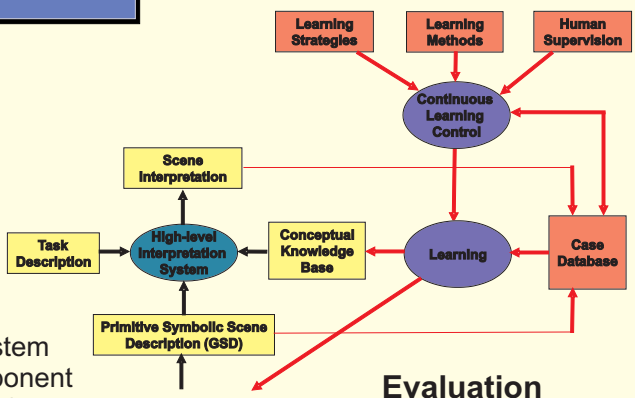
Workpackages:



Means:

Interpretation models

* Bayesian Networks
* Markov Random Fields
* Logical Structures
* 2D-Grammars

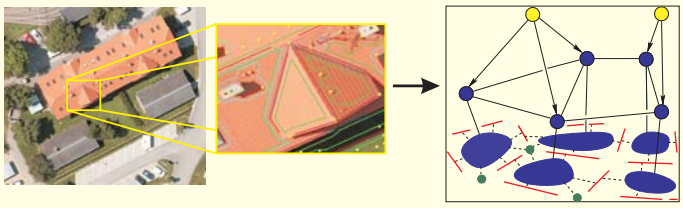


Continuous learning

* Highly structured training with immediate response
* Exercises at various levels of difficulty with task specification and response of variable precision
* Autonomous exploration with weak response

System SCENIC

* High level interpretation system
* Extension by learning component
* Extension by user interface for supervision
* Use of existing low level vision modules



Evaluation

* Database of images of urban environment
* Measures
* Parsimonity of models
* Complexity of tasks
* Learning rate
* Success and failure rates
* Ability to detect new structures
* Degree of autonomy
* Selfassessment --> self-awarenes

Project Summary:

The aim of this project is to advance the state of the art of cognitive systems by developing a methodology for *autonomous and continuous learning*.

The project will concentrate on *structural learning*, where relations between components and compositional hierarchies play a central role in object categorization. Such learning is particularly relevant for the interpretation of man-made objects, hence the project will use the *recognition of buildings and parts of buildings in outdoor scenes* as its exemplary application domain. Due to the diversity of shapes and spatial arrangements of the different parts of a building, the recognition system must be capable of continually updating its conceptual knowledge. This requires the development of innovative methods for continuous learning.

The project will advance the state of the art by concentrating on techniques of *pattern discovery, concept learning, and ultimately self-learning*. Just like a human child which has to be taught not only a certain subject but also the skills of autonomous learning, the proposed system will incorporate several levels of learning with decreasing responsibility of the teacher and increasing autonomy of the trained system, developing some self-awareness.

The project will use symbolic primitives extracted by low-level modules. The relationships between the extracted components will be represented by 1) *Bayesian networks*, which will be used to model hierarchical structures, 2) *Markov Random Fields*, which will be used to model peer-to-peer relations, 3) *logical structures* which represent taxonomical and compositional hierarchies, and 4) *2D grammars* which will attempt to capture the structural relations syntactically.

For the development and evaluation of the system the project will *use a rich dataset of* several thousands of *images of urban environments* in the different countries of the participants. The learning components will be developed around the *knowledge-based interpretation system* SCENIC.

Partners:

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UH (Hamburg, Cognitive Systems Laboratory, B. Neumann)

Imperial College London
CTU (Prag, Centre for Machine Perception, R. Sara)
IMPERIAL (London, Dept. of Electric and Electronic Engineering, M.Petrou)

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