

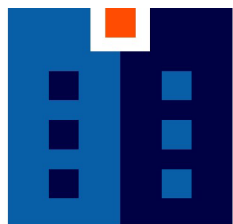
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Ontology Based Shape Annotation and Retrieval

Olga Symonova

Outline

- Shape Retrieval Problem and Research Proposal
- Suggested Approach:
 - ✦ Shape Descriptor Extraction
 - ✦ Mapping to Semantic Labels
 - ✦ Ontology Based Shape Annotation
 - ✦ Retrieval through Annotations
- Related Work
- Results



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Shape Annotation and Retrieval



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Shape Retrieval Problem

- Textual search of graphical objects
- Shape descriptor: compact vs. descriptive
- SD: invariant and robust
- Ambiguity of words and shapes



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Multilayered Shape Descriptor

- Represent information of different levels of detail of a model:
 - topological structure
 - geometrical features
 - semantic characteristics
- Descriptor matching should consider needs of a user, exploiting correspondingly topological, geometrical or semantic information about 3D model



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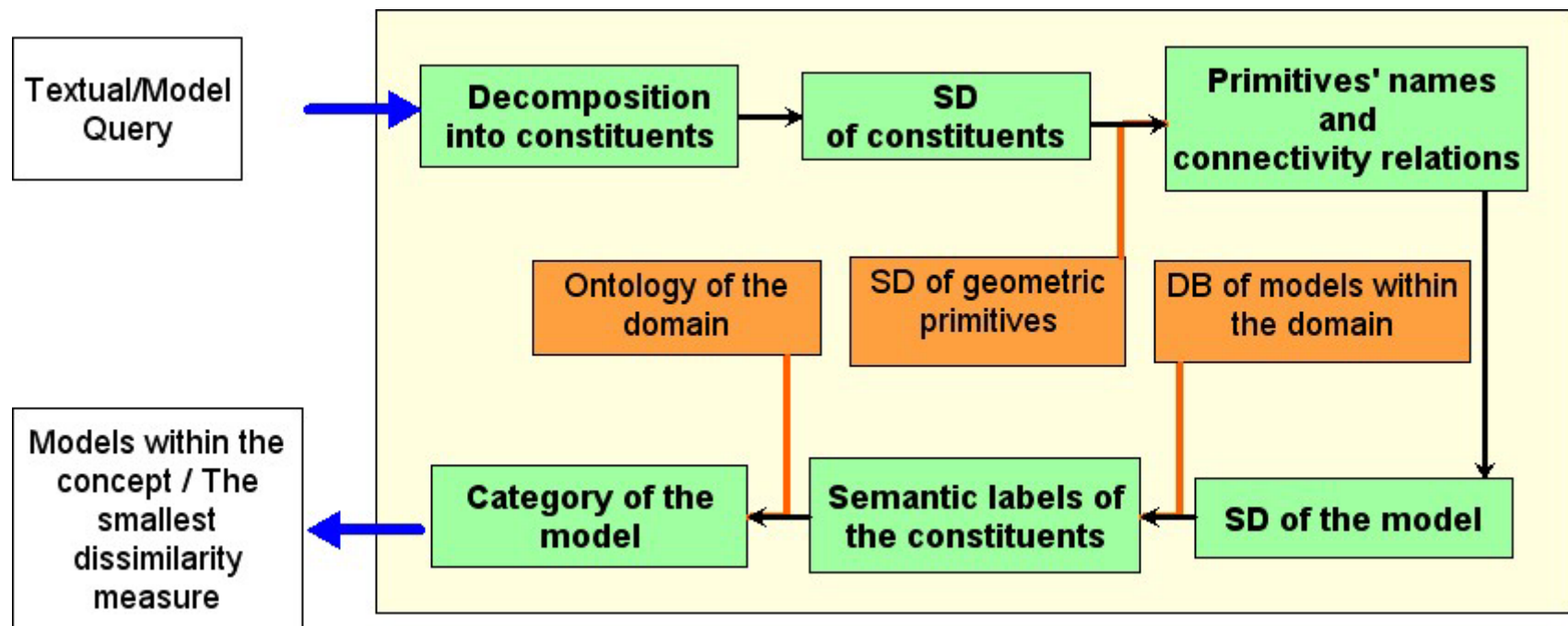
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Approach Overview: from Geometry to Semantics

- Interpretation of a 3D model within a particular domain.



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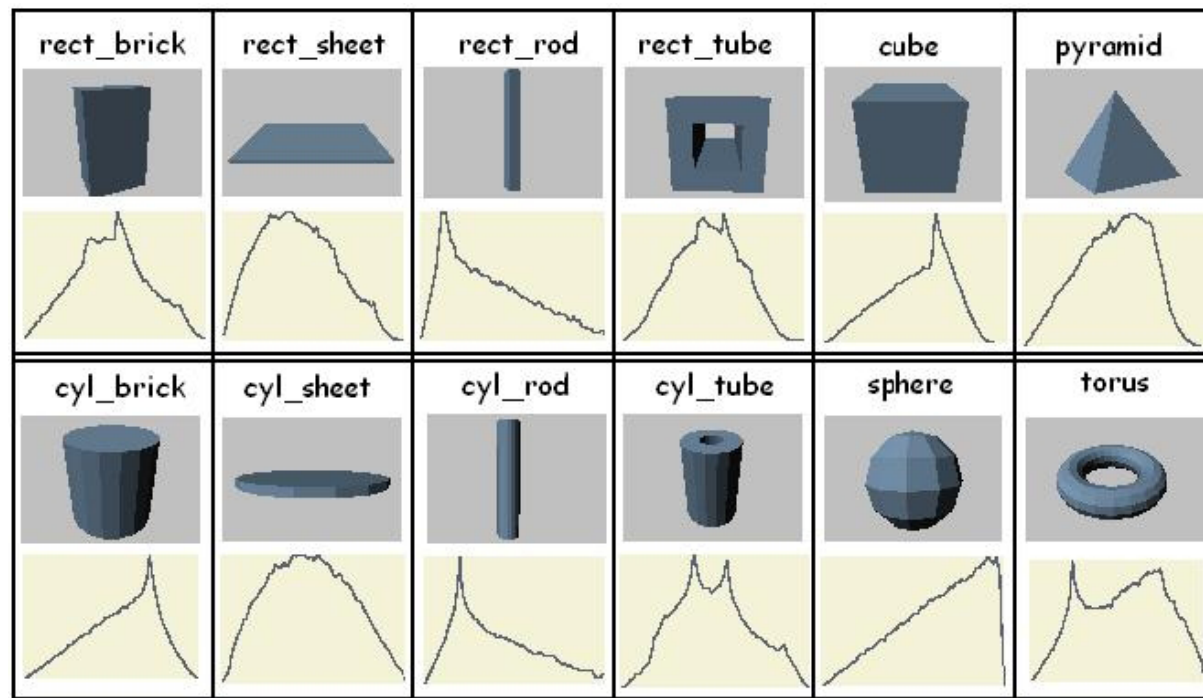
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Shape Descriptor Extraction

SD for geometric primitives



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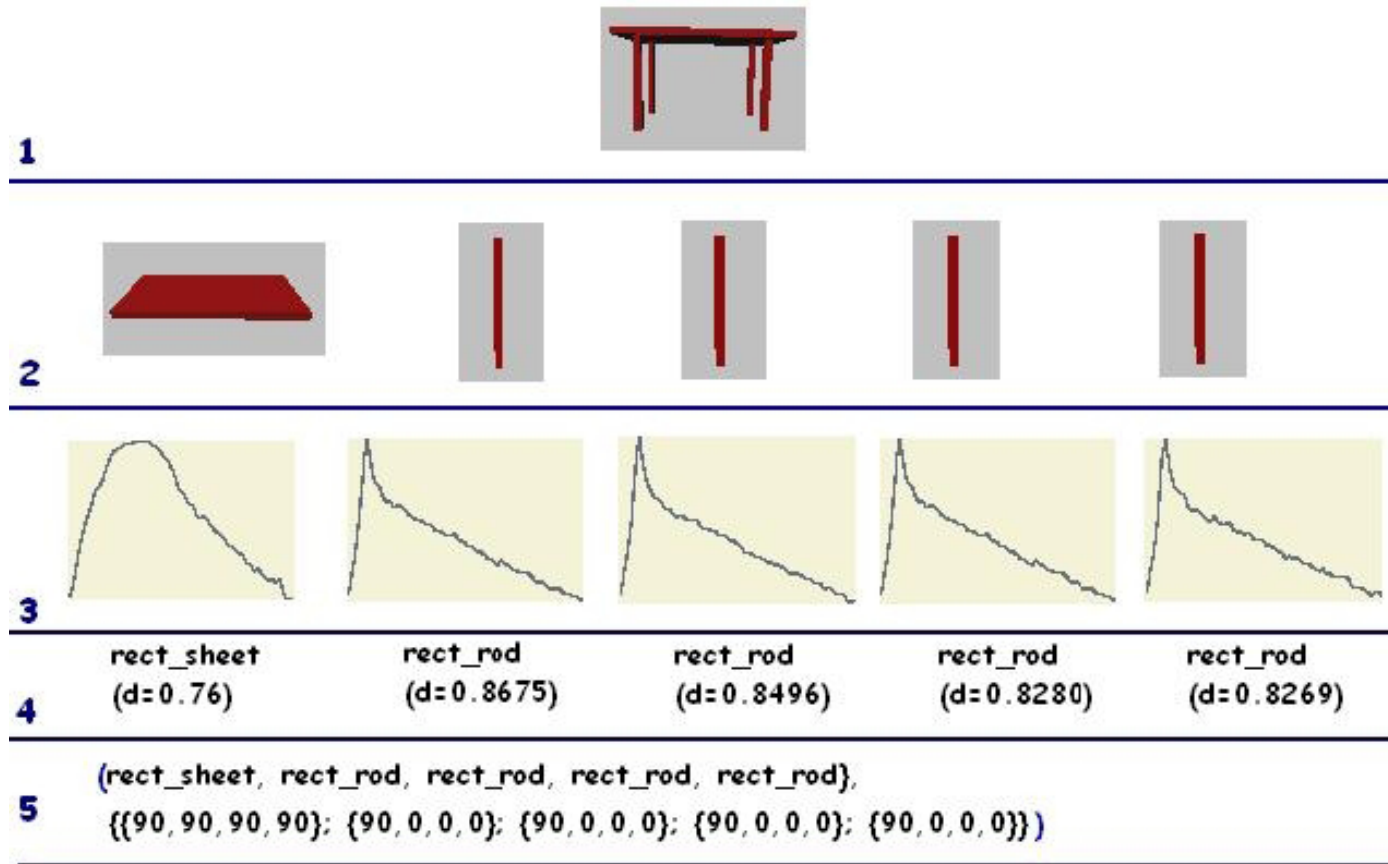
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Shape Descriptor Extraction- Contd.



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Mapping to Semantic Labels

- The models of the domain should be described by the shape of constituents and the connectivity relations between them.

Component	Geometric primitive	Connectivity (pairwise angle between components)	Semantic label
1	Rect_sheet	{90,90,90,90}	Top
2	Rect_rod	{90,0,0,0}	Leg
3	Rect_rod	{90,0,0,0}	Leg
4	Rect_rod	{90,0,0,0}	Leg
5	Rect_rod	{90,0,0,0}	Leg



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Ontology for Shape Annotation

- The intended use:
 - ✦ Annotation of models with ontology concepts
 - ✦ Retrieving the models by textual queries
- An interpretation function assigns to each 3D model a concept from ontology
- System precision: color does not matter



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Retrieval through Annotations

- Textual query or ontology browsing →
 - all the models annotated with the input concept or with a subconcept of the input concept
- By example model →
 - all models within the category of the example model;
 - the smallest dissimilarity measure between feature vectors of the constituents of the sample model and corresponding parts of models from the same category



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Related Work

- Osada et al 'Matching 3d models with shape distributions'
- Kazhdan et al 'Rotation invariant spherical harmonic representation of 3d shape descriptors'
- Attene et al 'Shape understanding by contour driven retiling'

- Uschold et al 'Towards a methodology for building ontologies'
- Tijerino et al 'A shape knowledge representation scheme and its application on a multi-modal interface for a virtual space teleconferencing system'



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Results

- New synthesis of shape description and ontology-based annotation and retrieval
- Shape-to-text (shape annotation) and text-to-shape (query shape by text) schemes
- Enrich the database in terms of number of 3D models and also by number of other specific domains.
- Construct the ontology in more details to improve the accuracy of the query process



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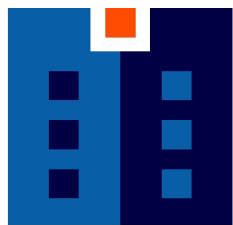
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Thanks for
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