Acquisition of 3D Indoor Environments with Variability and Repetition

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Motivation

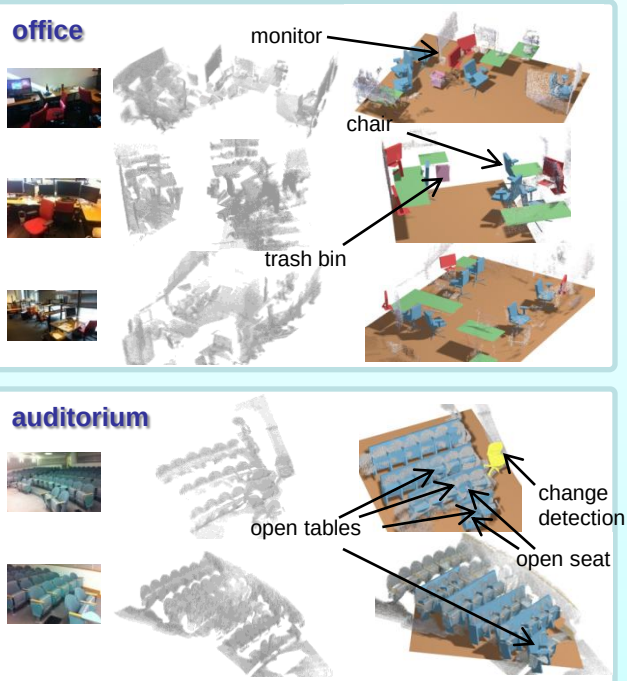
We explore the possibility of quickly acquiring indoor environments in large scale based on three observations:

- Most of indoor environments exhibit **repeating** elements (tables, chairs, monitors, etc)
- Man-made objects are generally formed of simple rigid **parts** and low-dimensional **variability**
- **Mutual relationships** among basic elements (floor, desk) provide a strong prior

Contributions

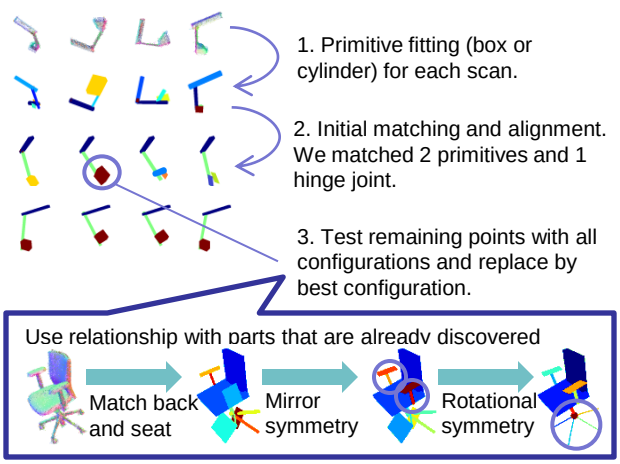
- Acquire proxy models of common indoor objects consisting of rigid parts, and their variability modes
- Detect occurrence of such models from single-view, low-quality scans
- Speed up large-scale indoor acquisition towards high-level scene understanding

Results

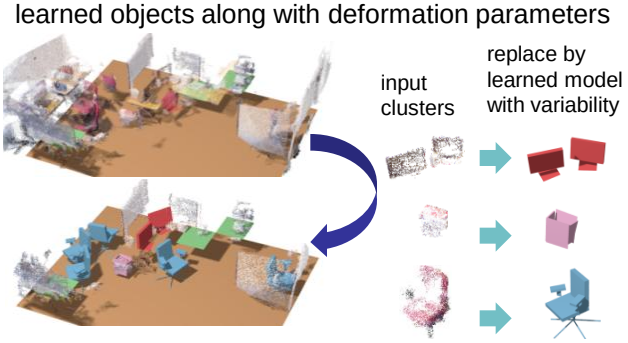


Approach

Learning phase starts from registered scans, builds low-complexity models with their variability modes.



Recognition phase starts from a single view scan, clusters points and quickly populates learned objects along with deformation parameters



MRF formulation compares segments in clusters (s_i) against parts in learned model (m_i) by unary term D and pair-wise term V

$$E = \underbrace{\sum_i D(s_i = m_i)}_{\text{geometry, distance from ground}} + \eta \underbrace{\sum_{i,j} V(s_i = m_i, s_j = m_j)}_{\text{consider joint parameters}}$$

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