Approximate 3D Partial Symmetry Detection Using Co-Occurrence Analysis
Symmetry detection – perfect geometry

Very well understood.

Pauly et al. 2008
Against noise & incompleteness

Bokeloh et al. 2009

*Inefficient* brute-force *rigid* mapping, without *instance* output.
Against strong deformation

Needs to be fine tuned on *hi-precision manifold* geometry.

Huang et al. 2013
A symmetry detection algorithm …

- General applicable
  - Noisy, incomplete scan
  - Geometric deformation
- Robust against structural variations
  - Approximate mappings
  - Partial symmetry
  - Irregular patterns
- Output classes & instance
- Unsupervised
Unfortunately, initially we know neither.
Transformation voting

Only works for precise geometry.
Low quality data may *appears* to be irregular

Instance can not be represented by a single feature.
Overview
Dense feature detection & description

Initial feature pool needs not to be precise.
Feature clustering

We employ an iterative approach to discover co-occurring pattern.
Hypothesis generation

\[ T \circ \text{red} \Rightarrow \text{blue} \]
Co-occurrence estimation

\[ p(\circ, \bullet) = p(\circ|\bullet) \times p(\bullet) \]

Voting confidence
Pattern maximization

\[ p(\bullet) = \sum_{\bullet, \circ} p(\bullet, \circ) \]
Eliminate false detection

\[ p(\bullet) = \sum \ p(\bullet, \bullet) \]

Low voting score
Repeat …

- Constellation completion
- Co-occurrence linking
- Remove outliers
Example
Iterative optimization …

- Pattern recognition
- Instance mining
Iterative optimization …

• Pattern recognition
• Instance mining
Iterative optimization …

- Instance mining
- Pattern recognition
Iterative optimization …

- Instance mining
- Pattern recognition
Results - 1
Results - II
Thank you!
Dense feature
Feature constellation