Approximate 3D Partial Symmetry Detection Using Co-Occurrence Analysis

Symmetry detection – perfect geometry

Pauly et al. 2008

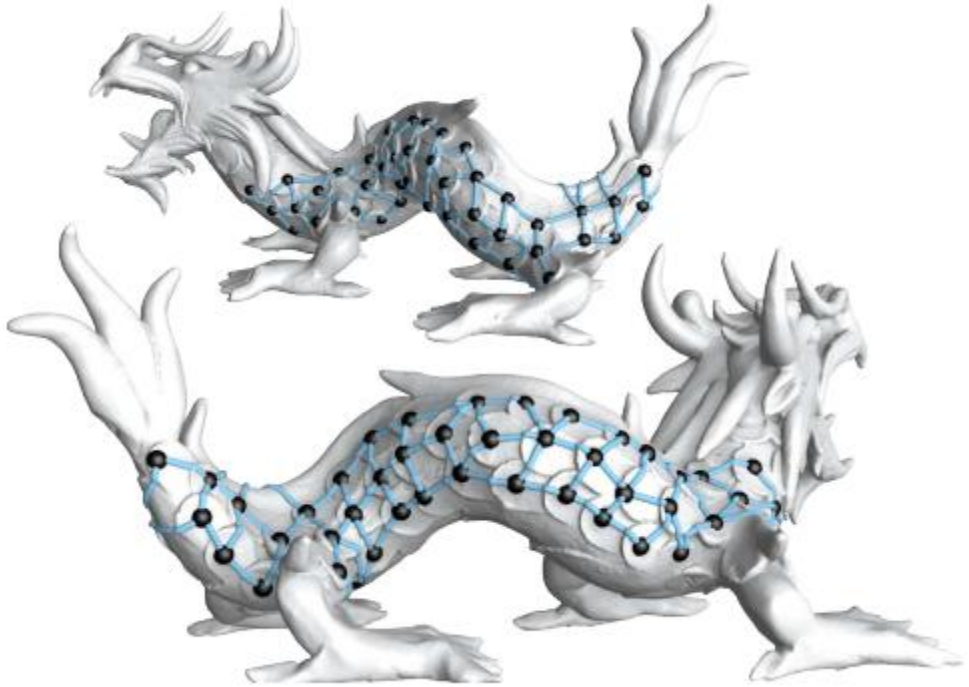
Very well understood.

Against noise & incompletion

Bokeloh et al. 2009

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

Against strong deformation

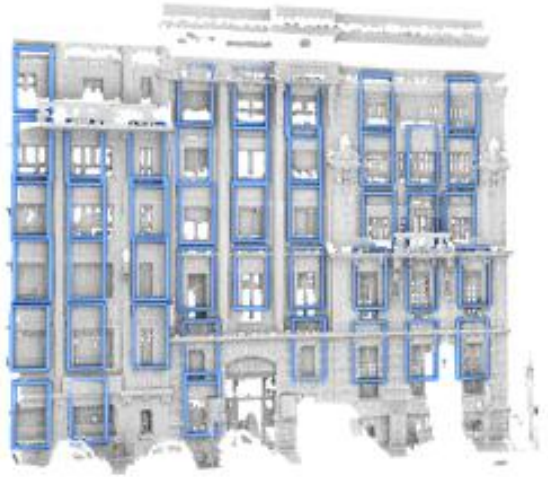


Huang et al. 2013

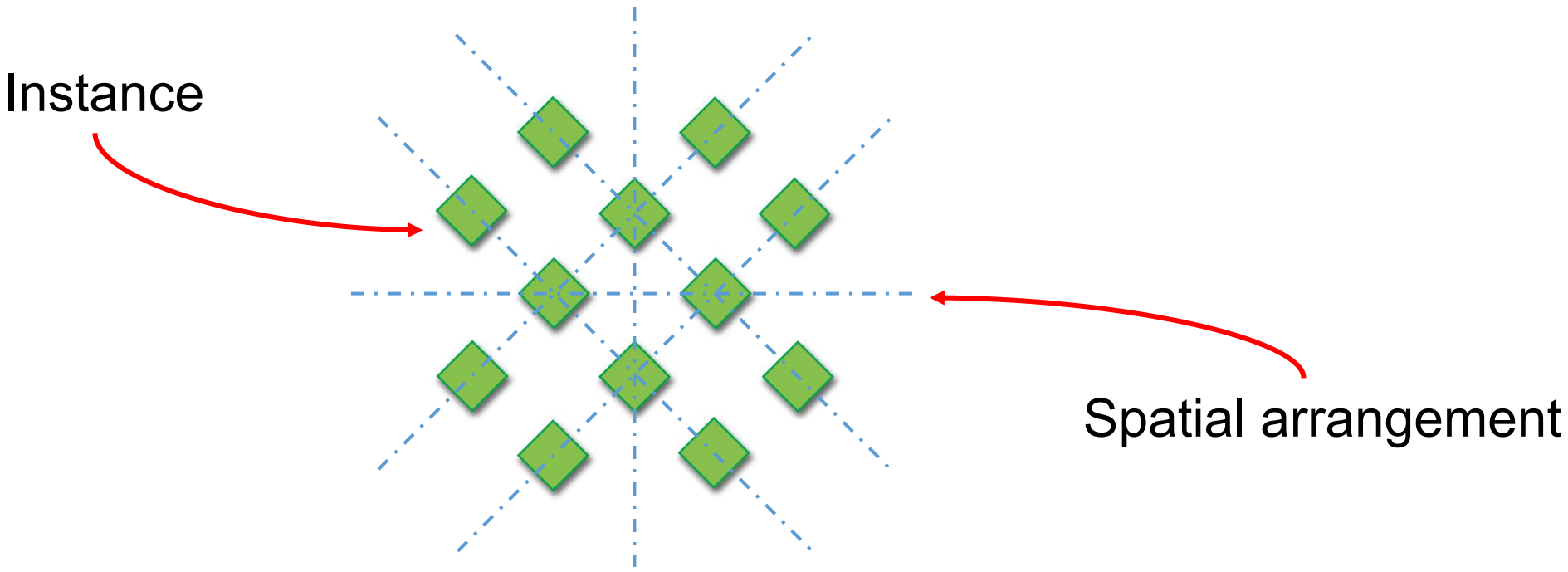
Needs to be fine tuned on *hi-precision manifold* geometry.

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

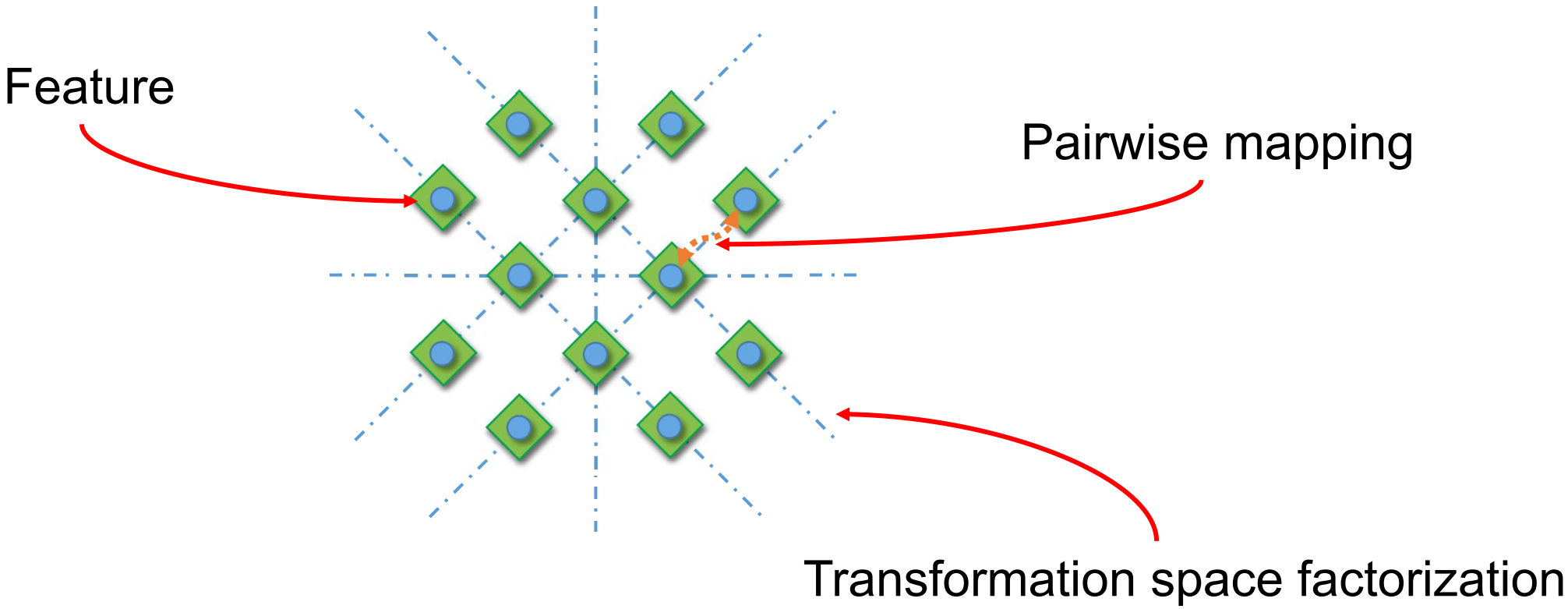


Pattern



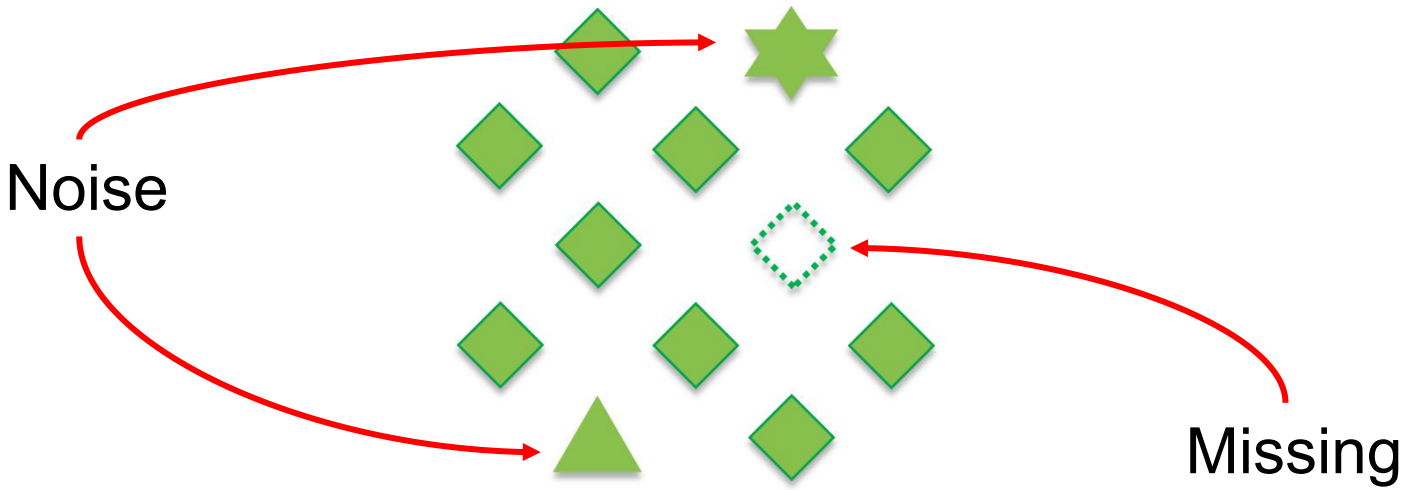
Unfortunately, initially we know neither.

Transformation voting



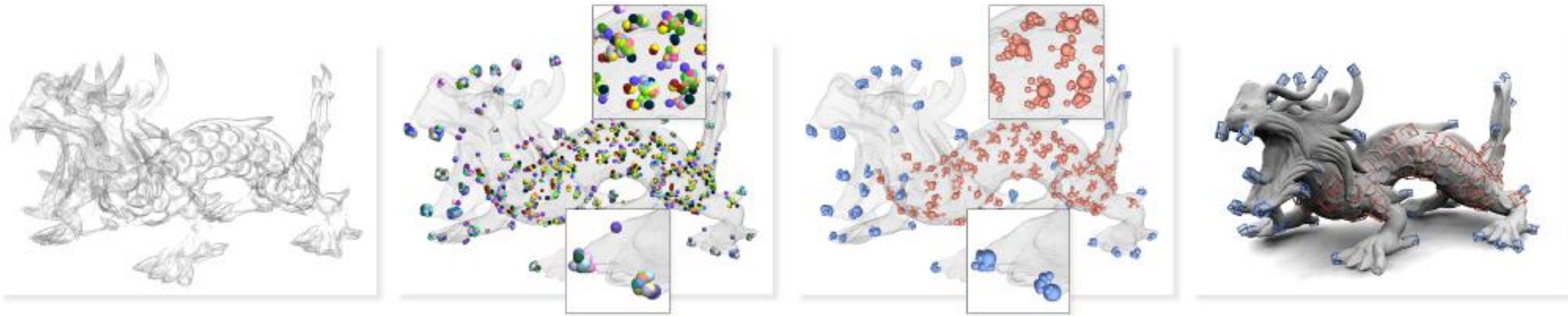
Only works for precise geometry.

Low quality data may *appears* to be irregular

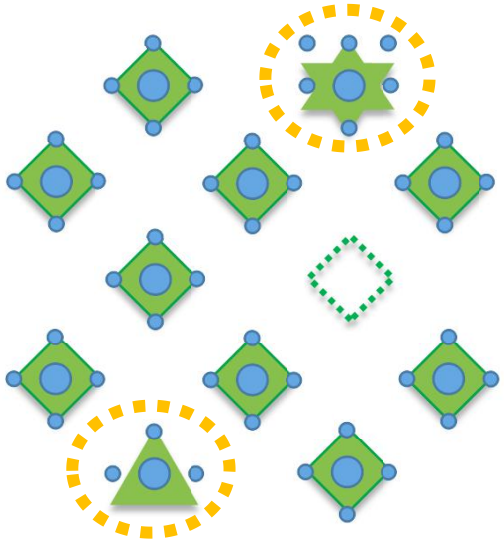


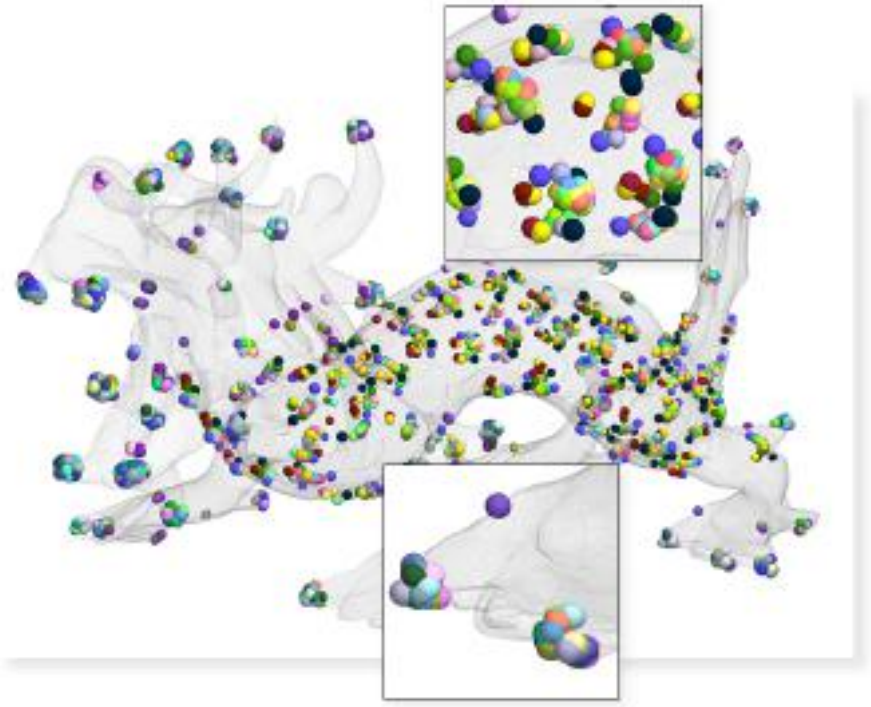
Instance can not be represented by a single feature.

Overview



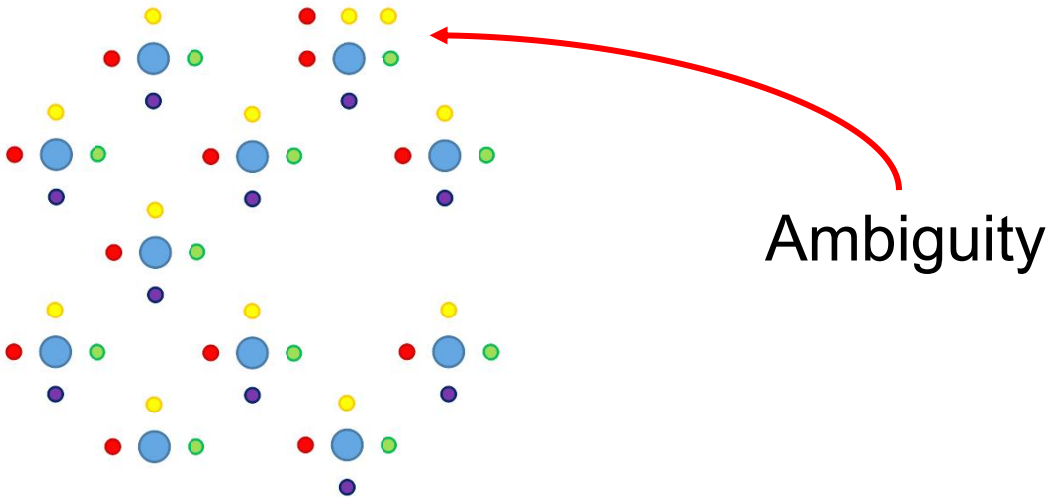
Dense feature detection & description





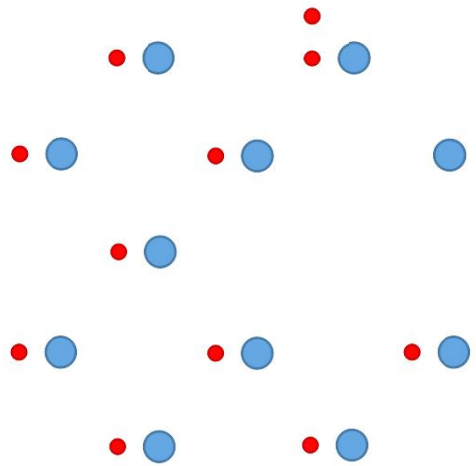
Initial feature pool needs not to be precise.

Feature clustering



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

Hypothesis generation



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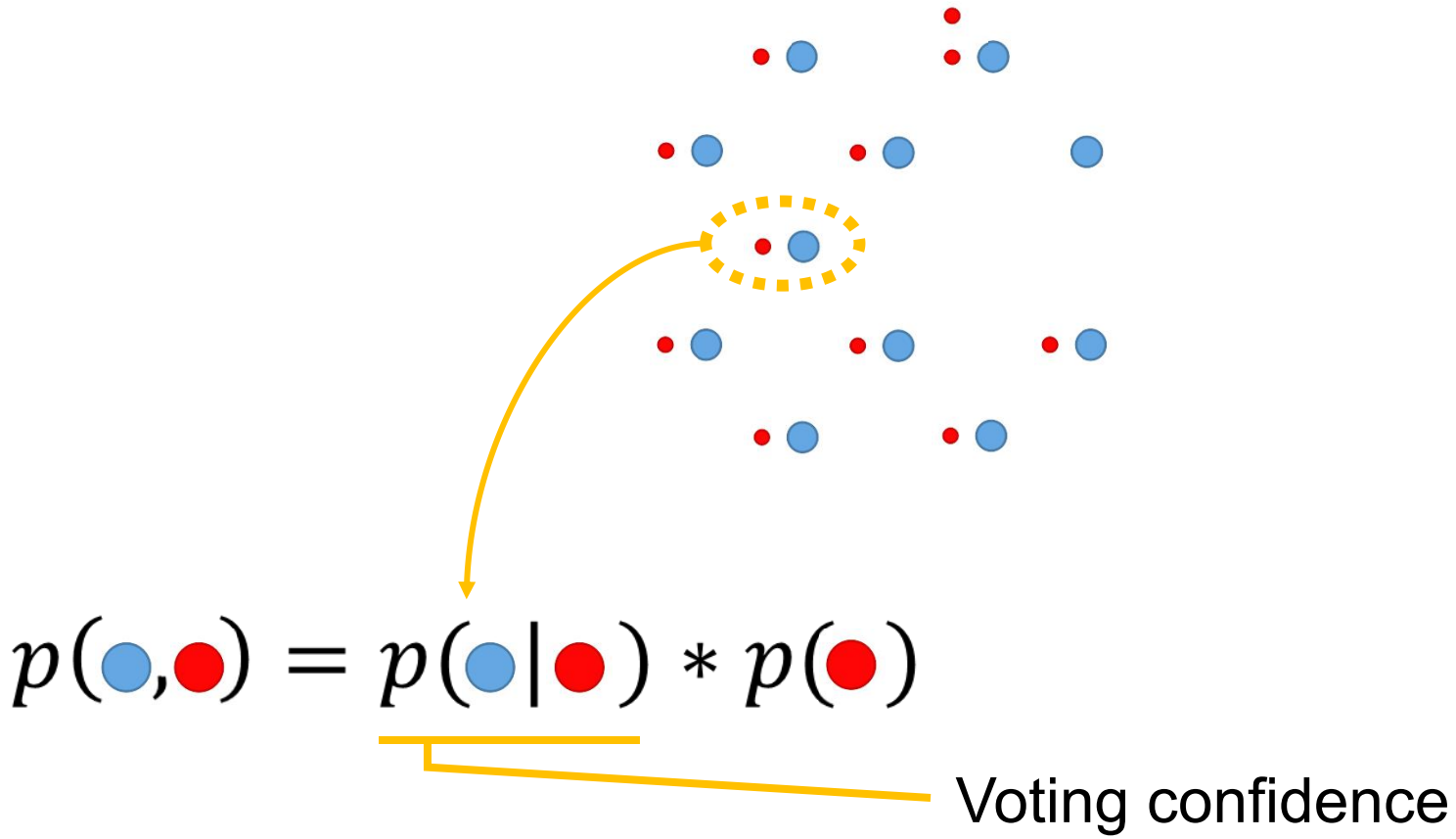
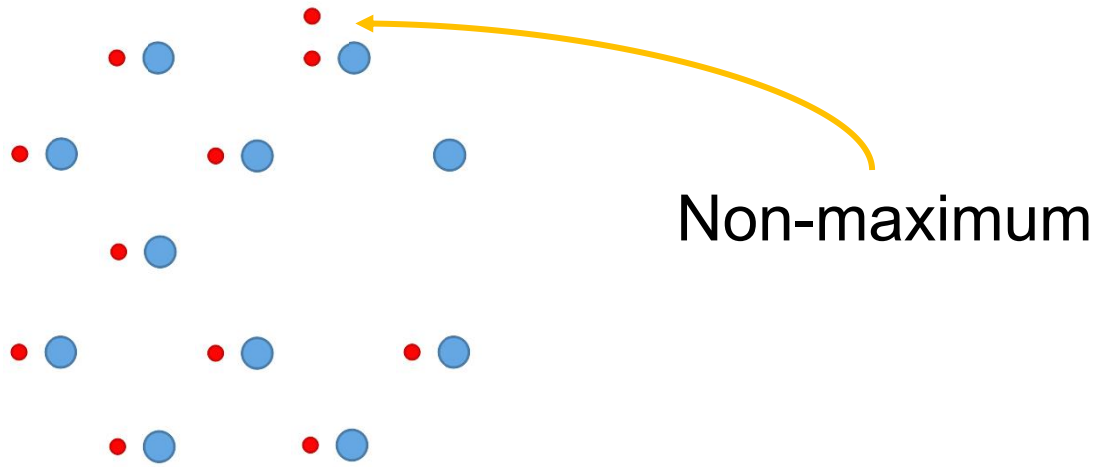
Co-occurrence estimation

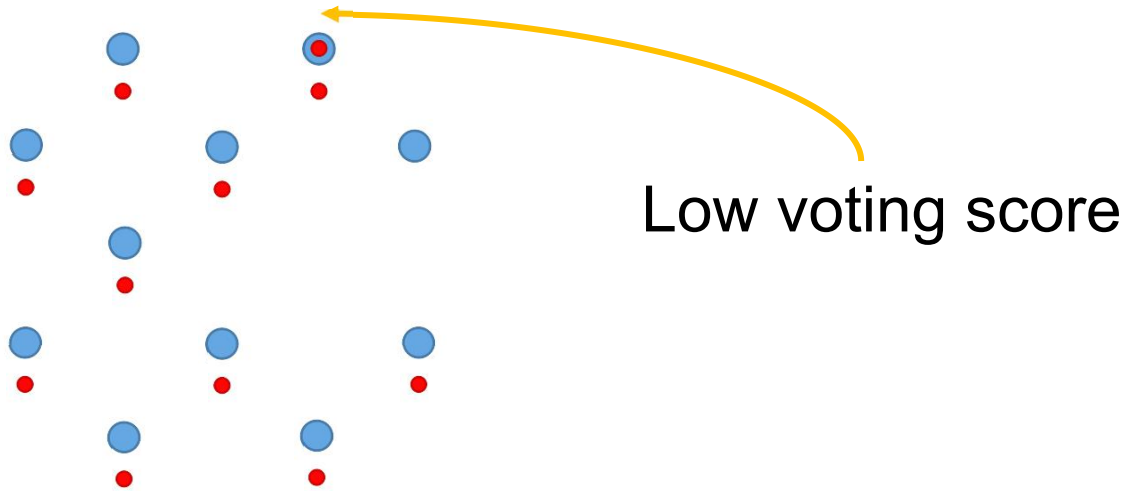


Pattern maximization



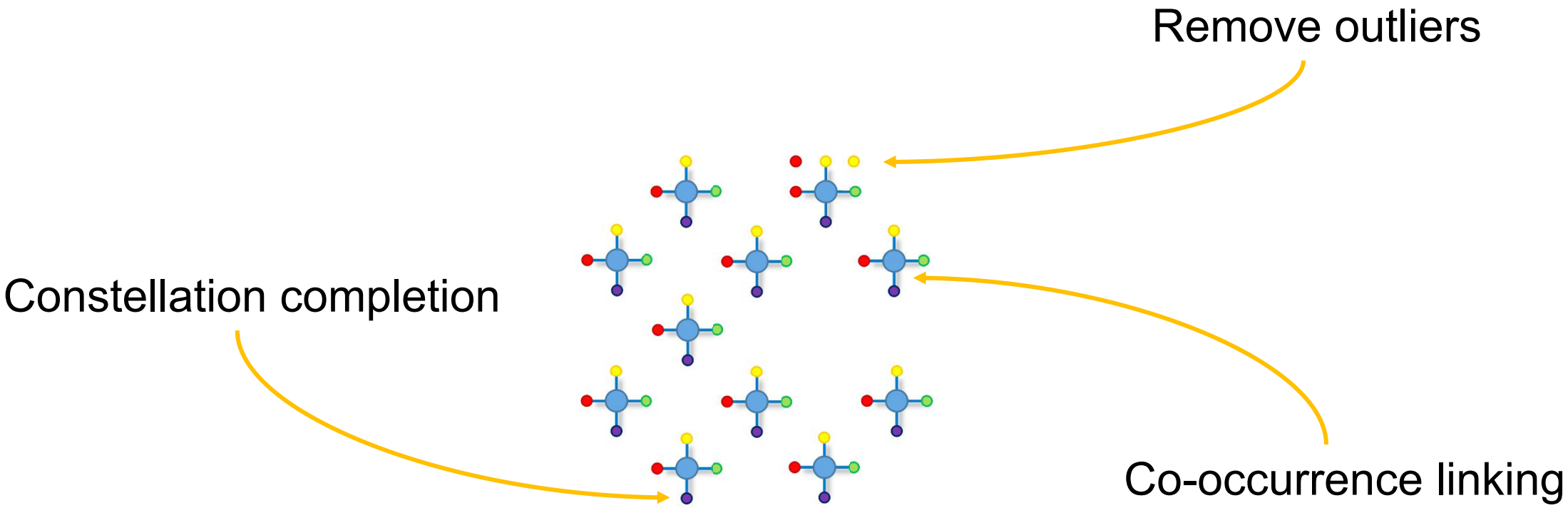
$$p(\bullet) = \sum_{\bullet} p(\bullet, \bullet)$$

Eliminate false detection

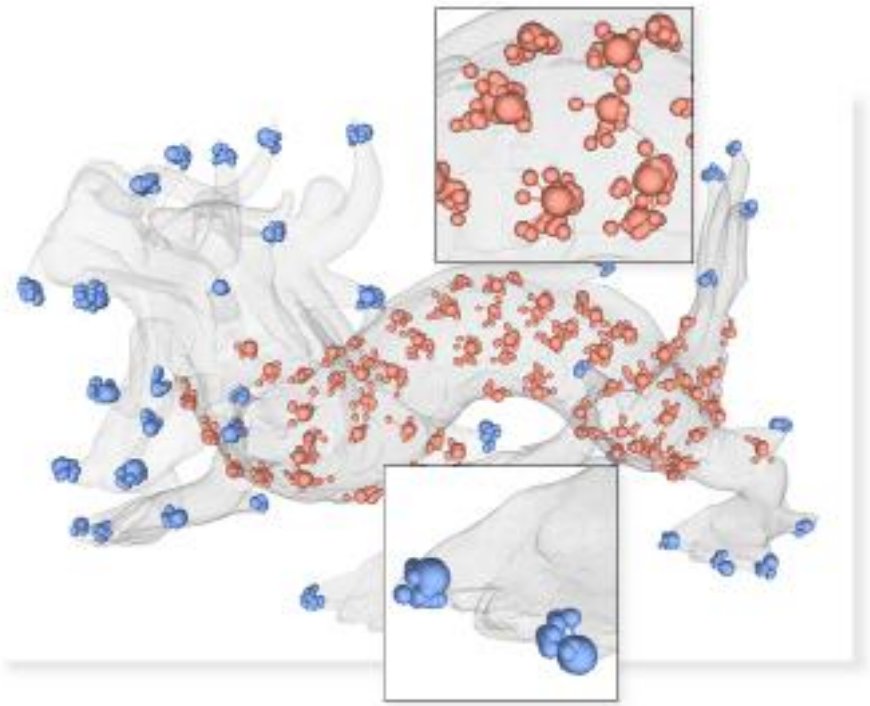


$$p(\bullet) = \sum_{\bullet} p(\bullet, \bullet)$$

Repeat …

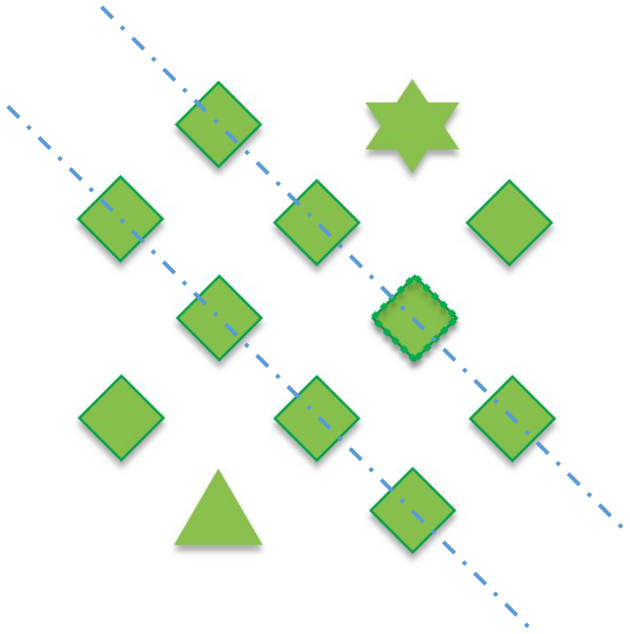

Remove outliers
Constellation completion
Co-occurrence linking

Example



Iterative optimization …

- Pattern recognition
- Instance mining



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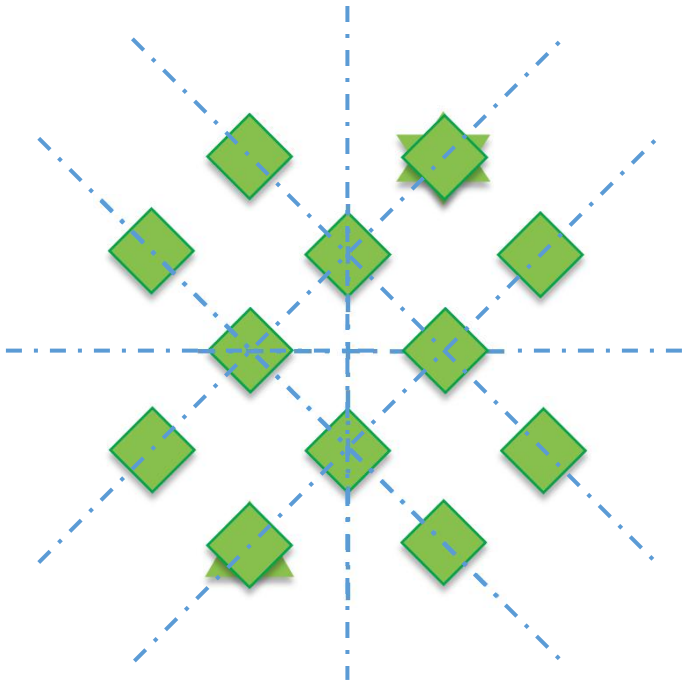

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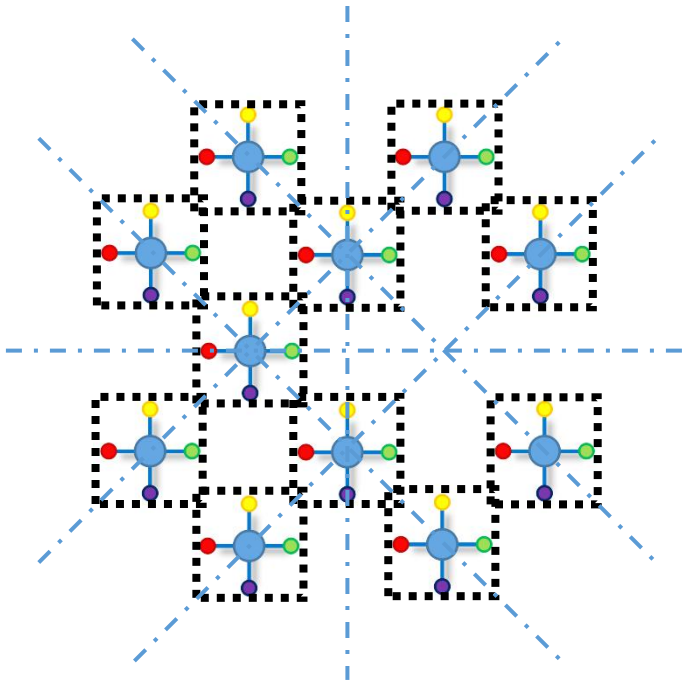

Iterative optimization …

- Instance mining
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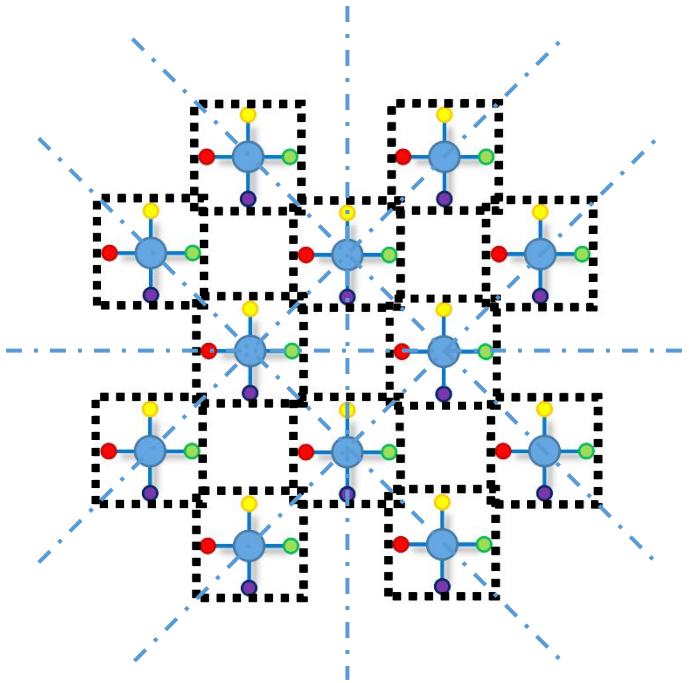
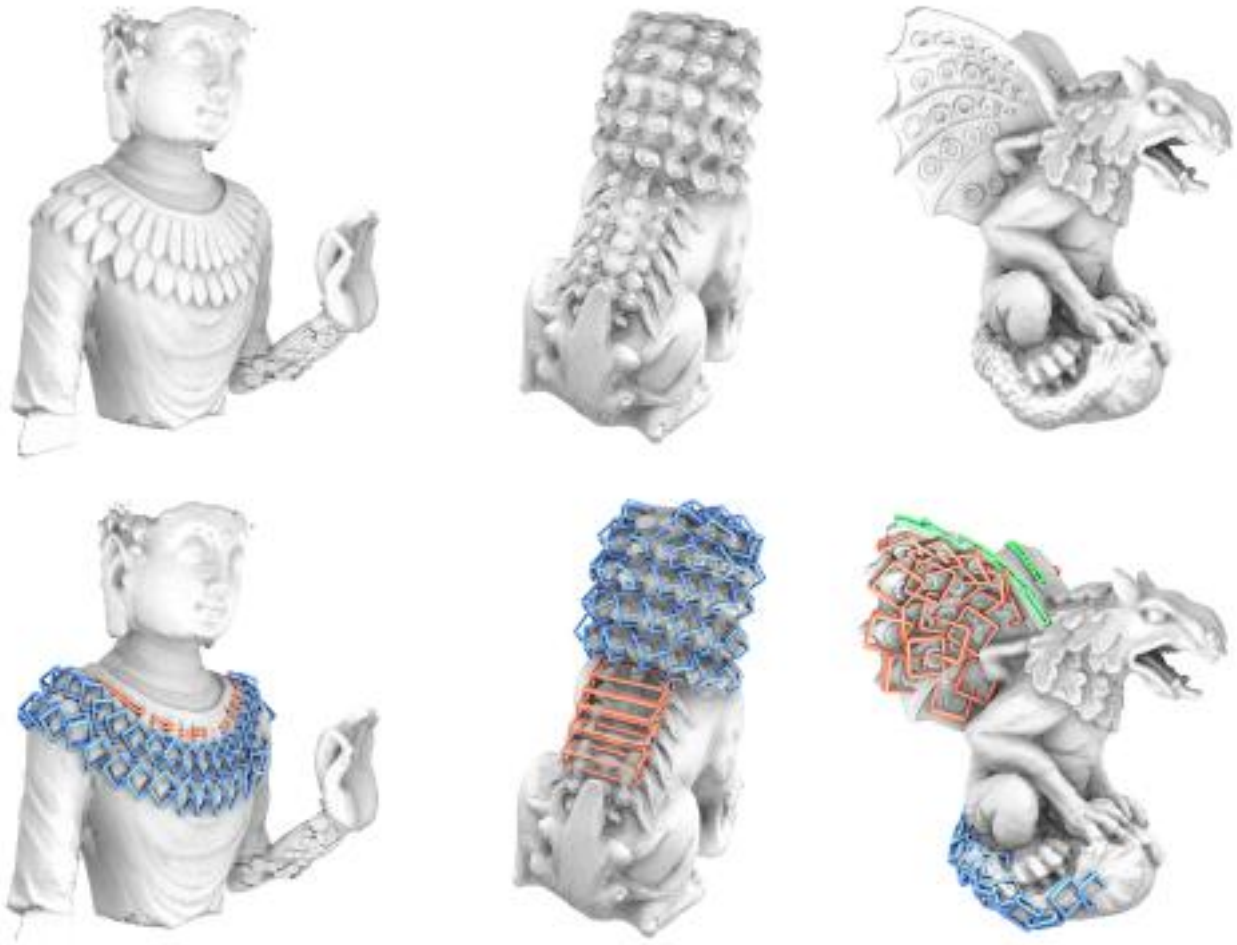


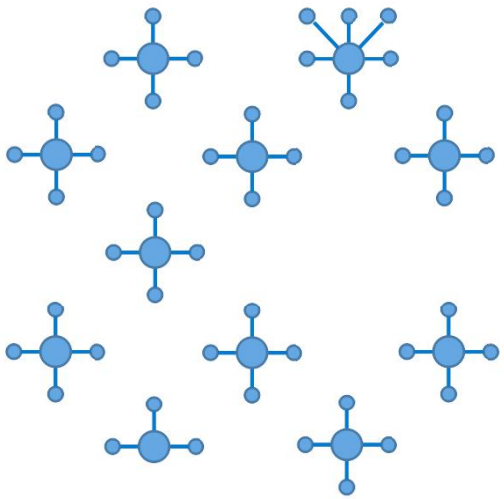
Results - I

Results - II



Thank you!

Dense feature



Feature constellation