



Partial Symmetry Detection in Volume Data

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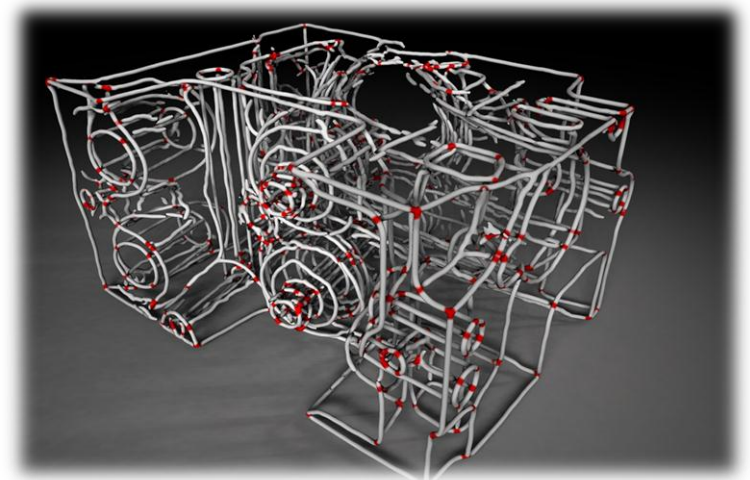
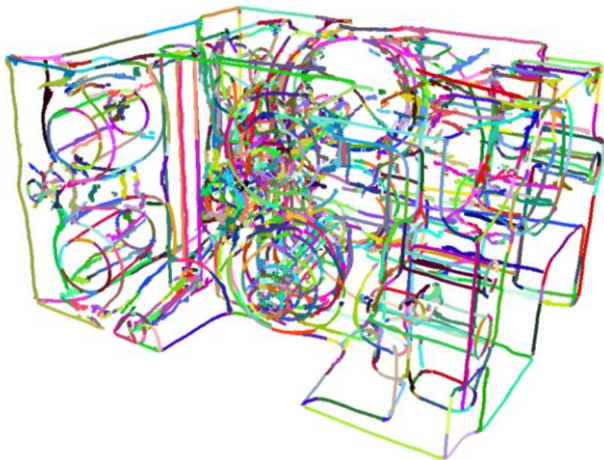
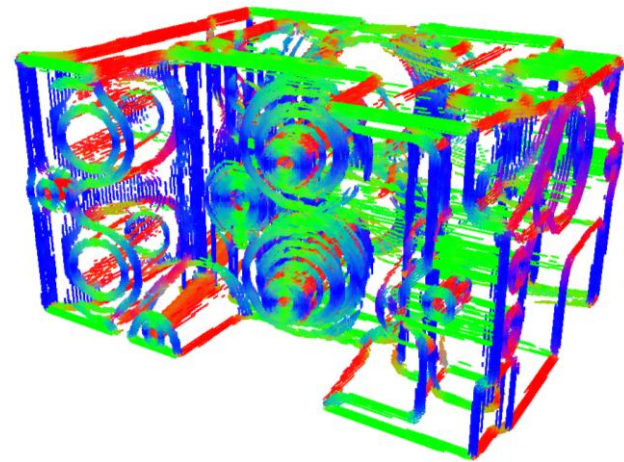
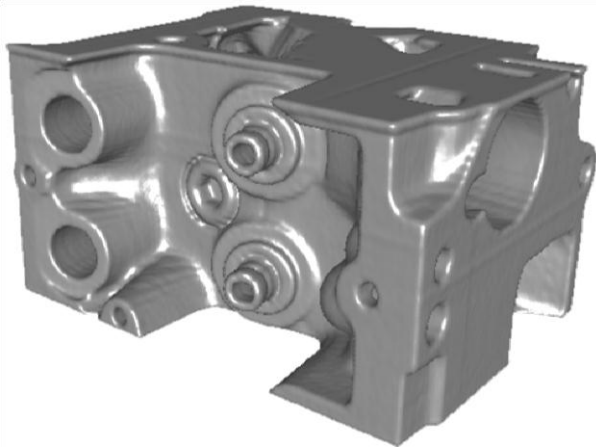
- Euclidean symmetries
 - Translation, rotation, reflection
 - No scaling or deformation
- Visualizing information
 - Decomposition
- Preprocessing
 - Classification
 - Labeling
 - Abnormity detection
- No prior knowledge



- Extract line features and junctions
 - Abstraction
- Analyze local constellations
 - Pairwise
- Validate Symmetry
 - Voxel based



- Volume Sketching
 - VMV [Kerber et al. 2010]





- Little number of feature points
 - Sparse
 - Informative

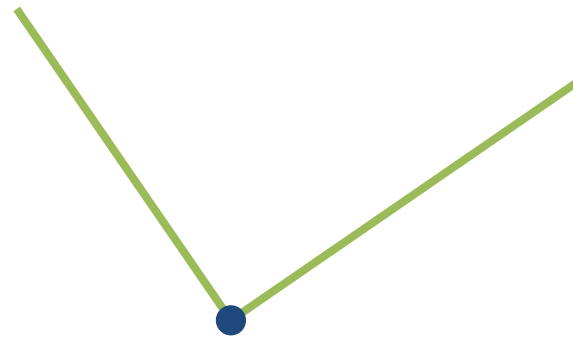
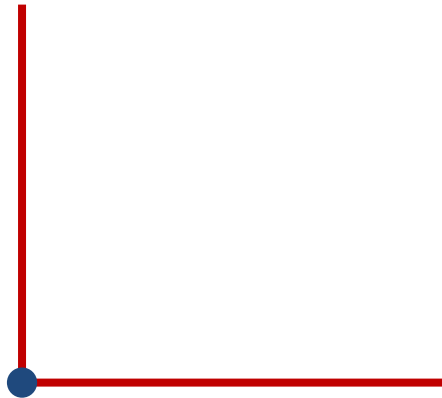
- Small search universe
 - Efficiency
 - Engine: 16.7 Mio voxels \Leftrightarrow 1602 junctions



- Derive pairwise transformations
 - Sparse matching
- Scoring function
 - Number of similar adjacent line segments
 - Deviation in local constellations
- Select candidate transformations
 - for later expensive dense matching

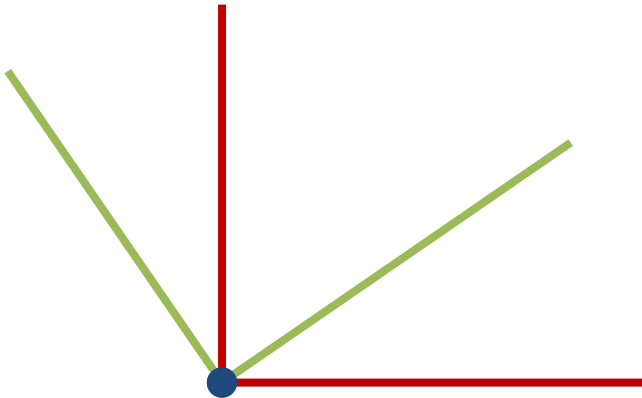


- ICL
 - Iterative Closest Lines



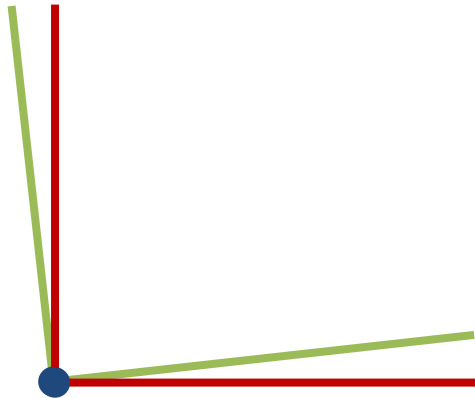


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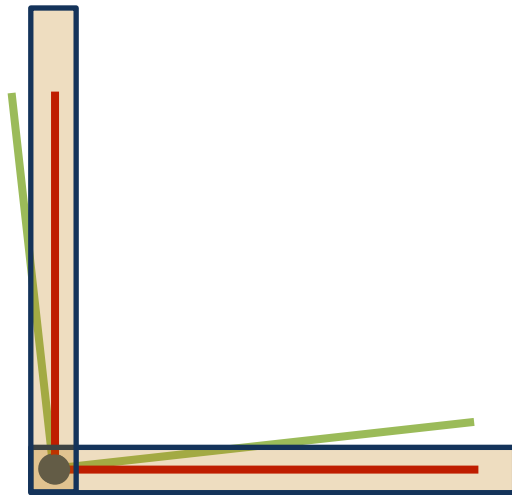


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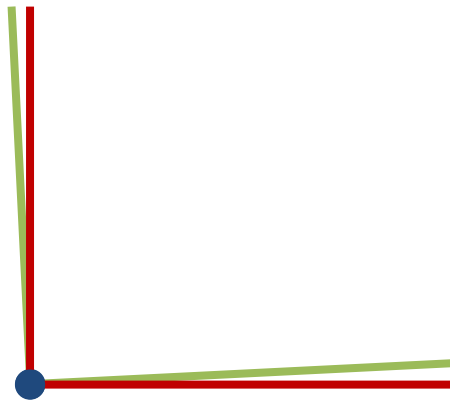


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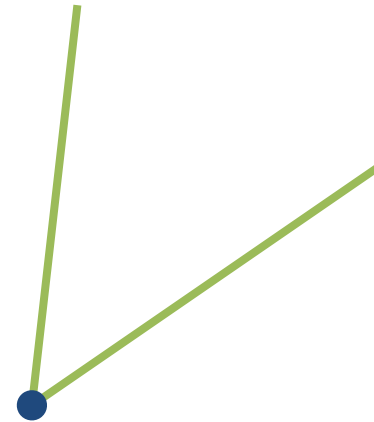
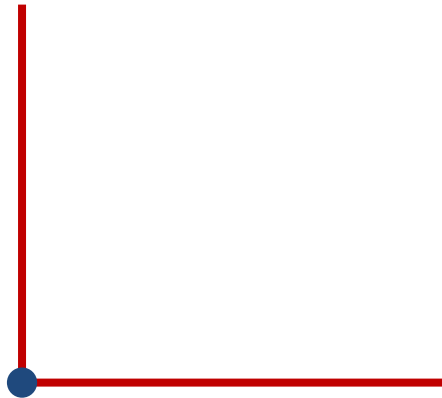


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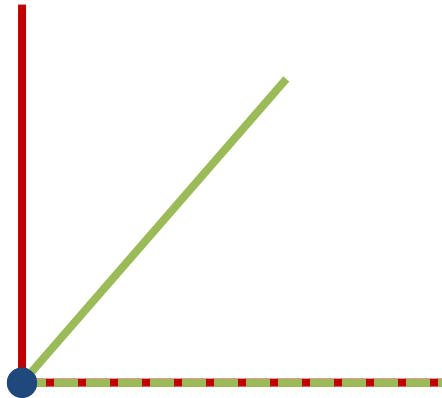


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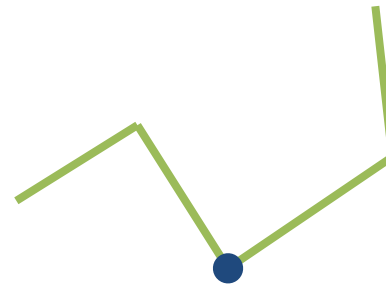
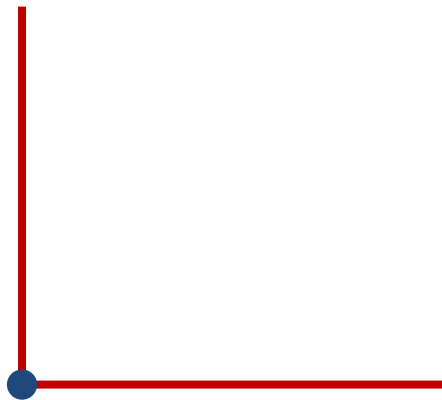


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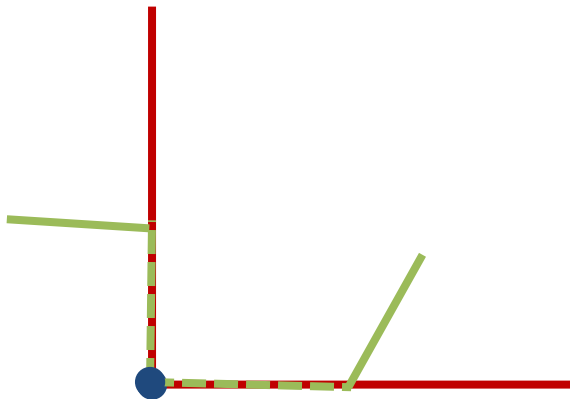


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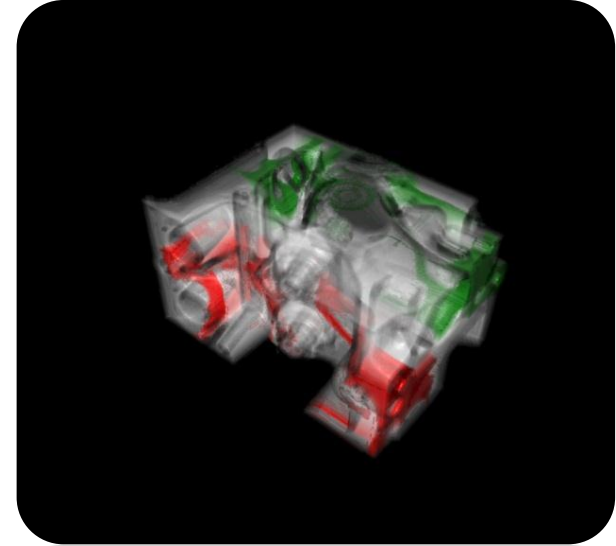
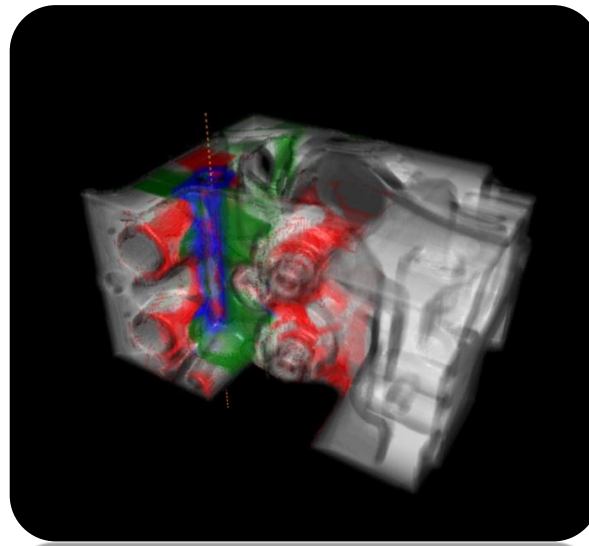
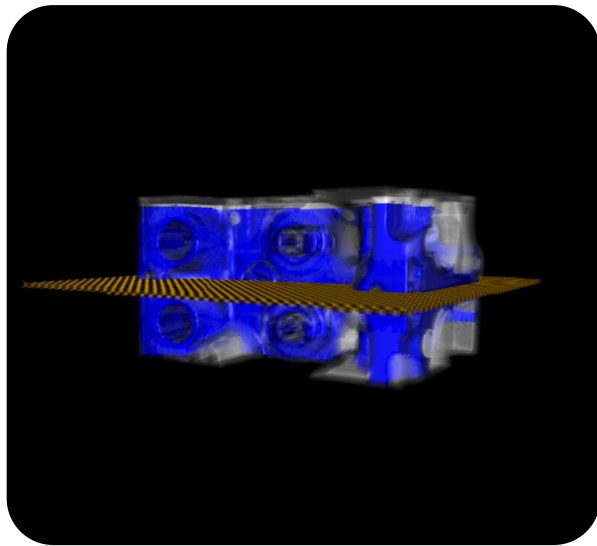
- Parallel processing
 - Can afford exhaustive search
 - Randomized sampling could boost further
- Remove
 - Bad matches
 - Doublets
 - Inverse transformations
- Few candidates left
 - Expensive dense comparisons



- Voxel based comparison
 - Apply each transformation
 - Map model to itself
 - Intensity deviation threshold

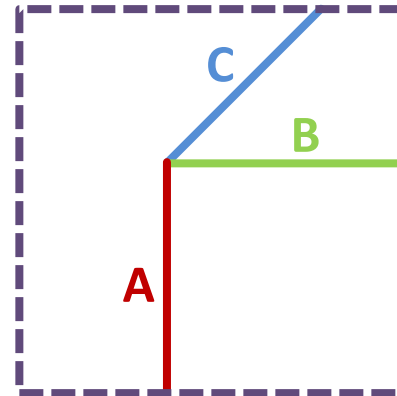
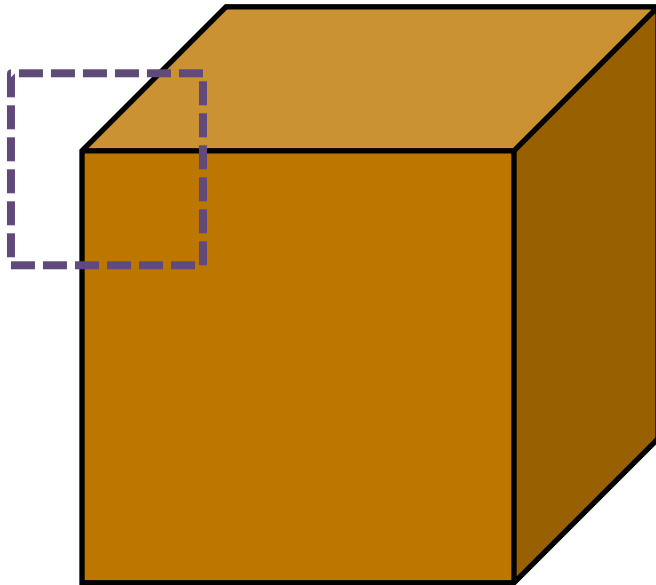


- Visualization
 - Source, target, overlap
 - Remaining foreground
 - Rotation axes and reflectance planes





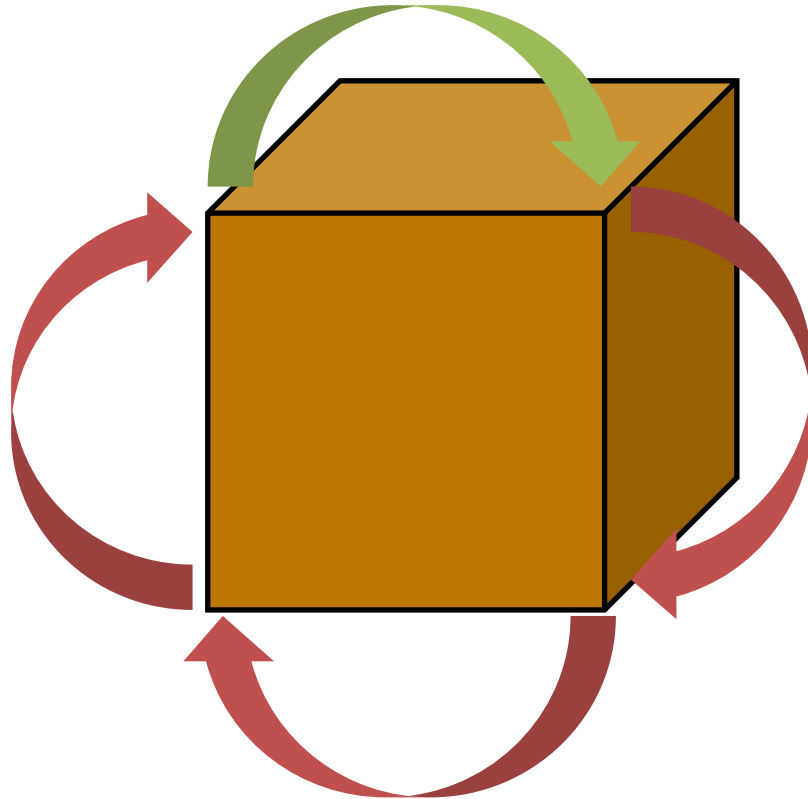
- Euclidean Symmetry Group of a Cube
 - Contains 48 Elements
 - 6 different Line pairs meet in each corner
 - All can be mapped to each other
 - High Redundancy



AB	BA
AC	CA
BC	CB

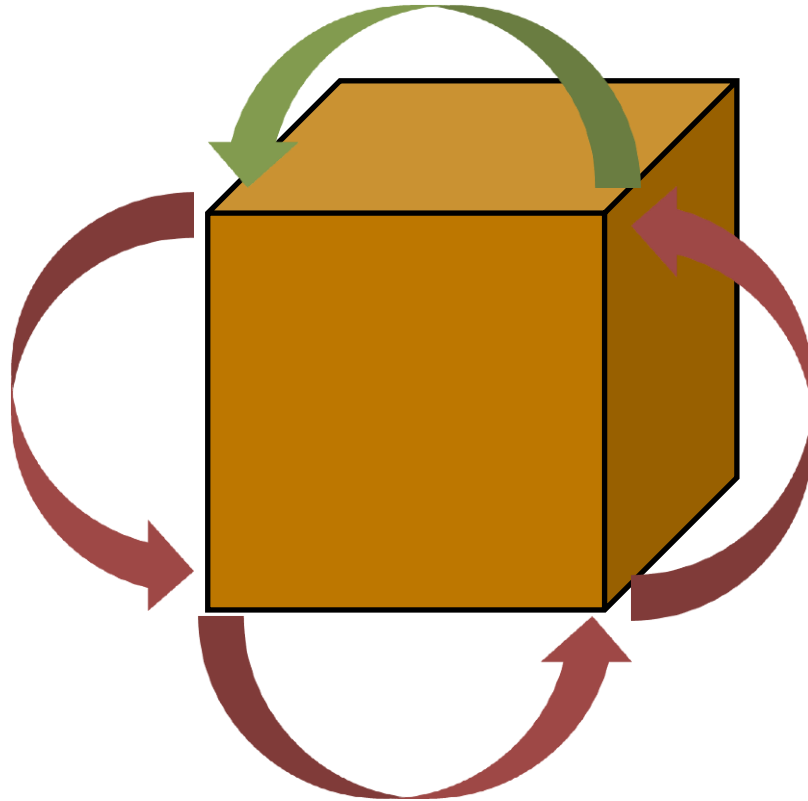


- Euclidean Symmetry Group of a Cube
 - Initially 48x48
 - 47 after removing doublets
 - 33 after removing inverse



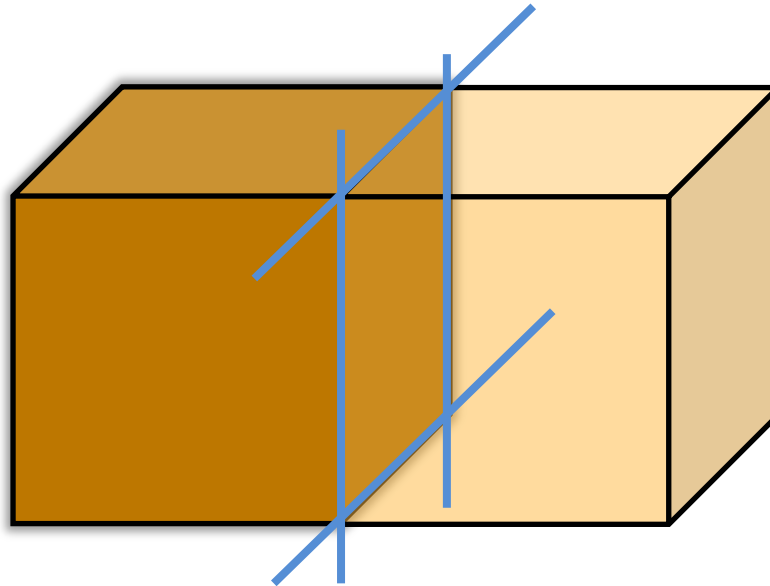


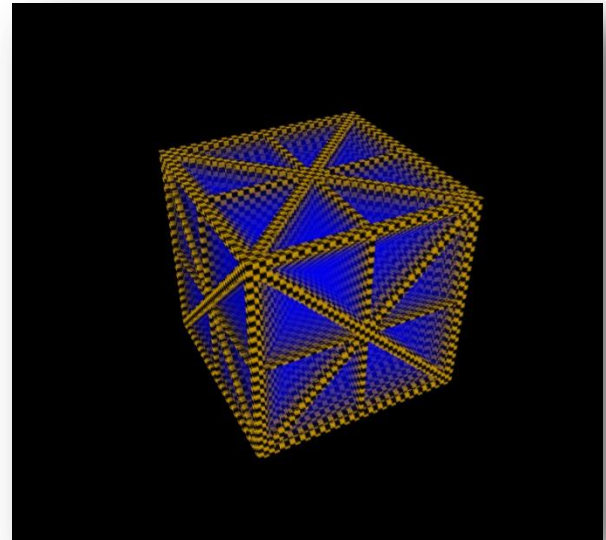
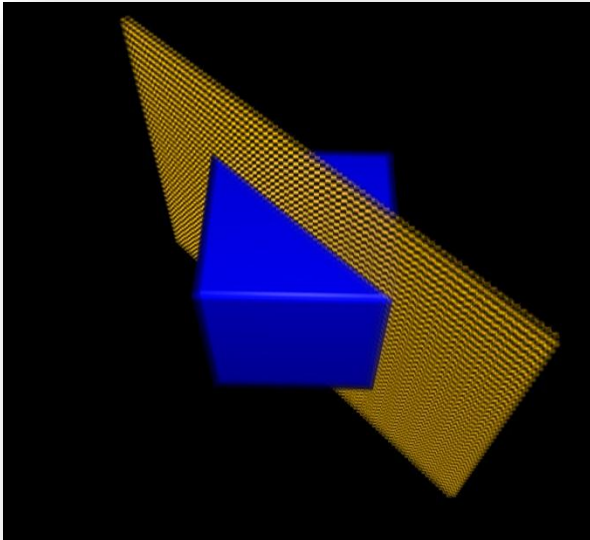
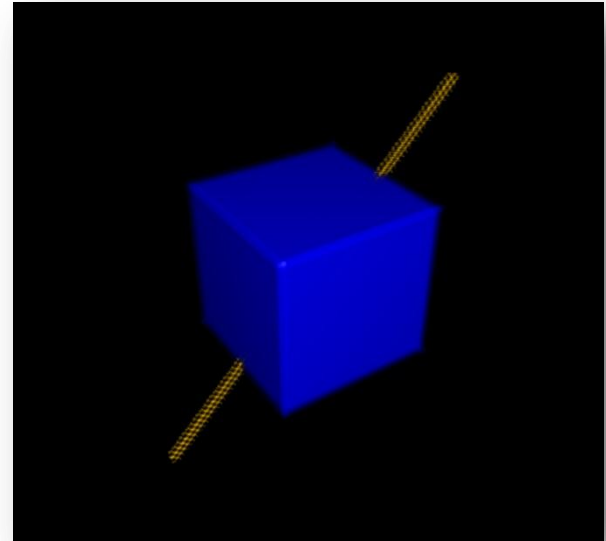
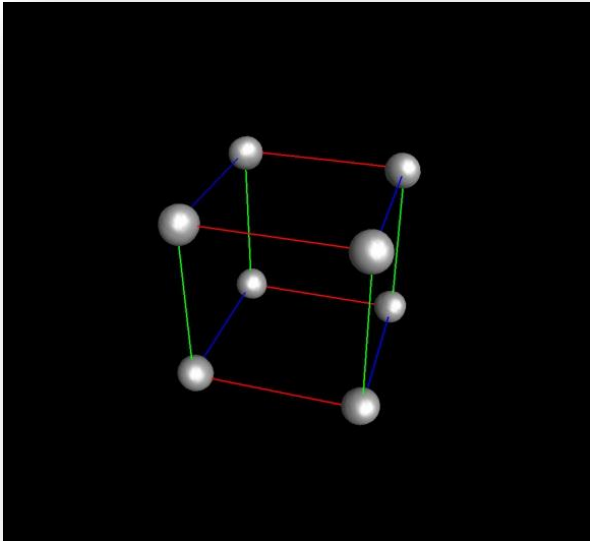
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- Partial Overlap
 - Very low score







Symmetry Transformations for a Cube



- Extension to hierarchies
- Matching against database
- Improve visualization
 - Multiple transformations at once



- Thank you for your attention!
 - Questions?

