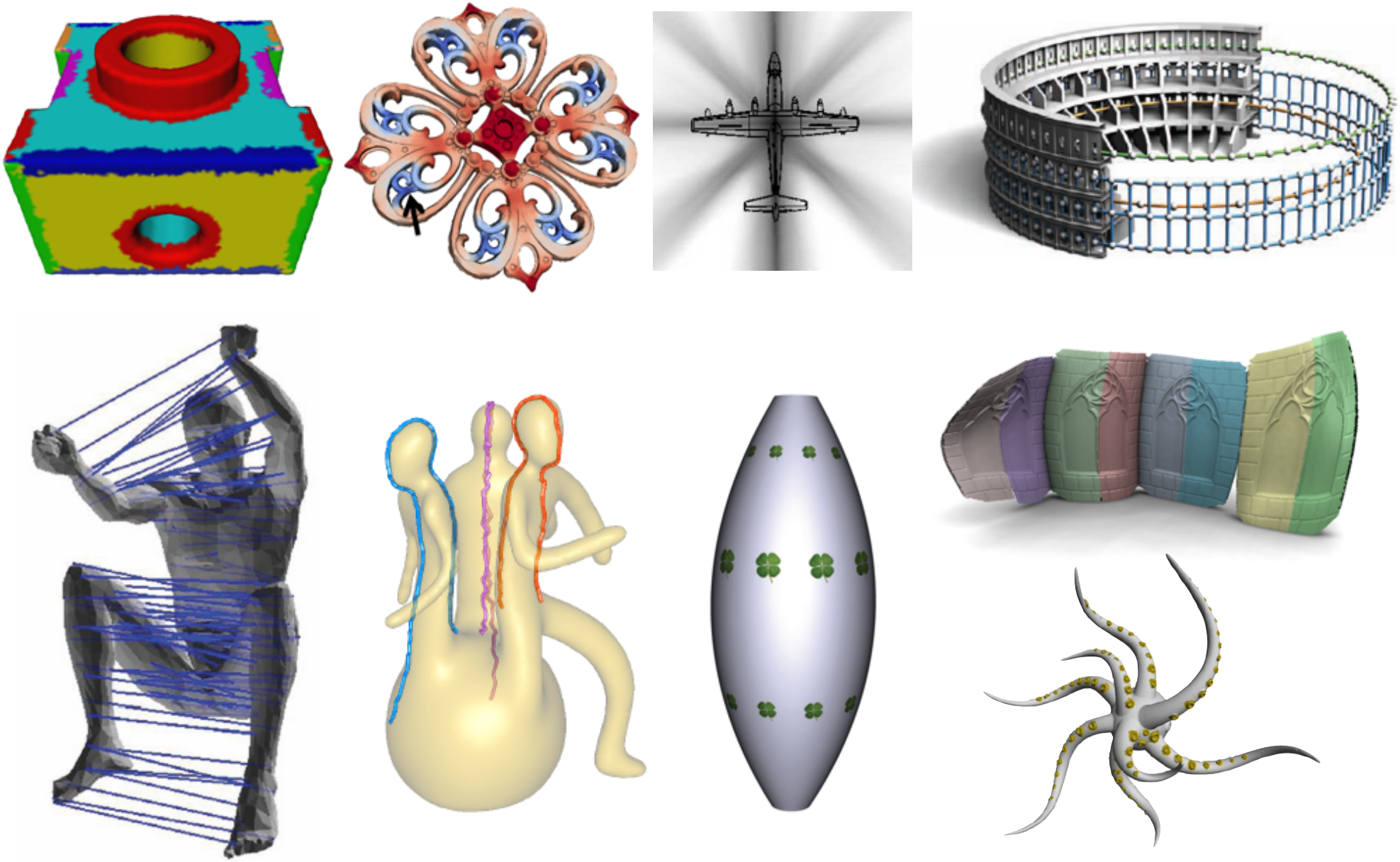
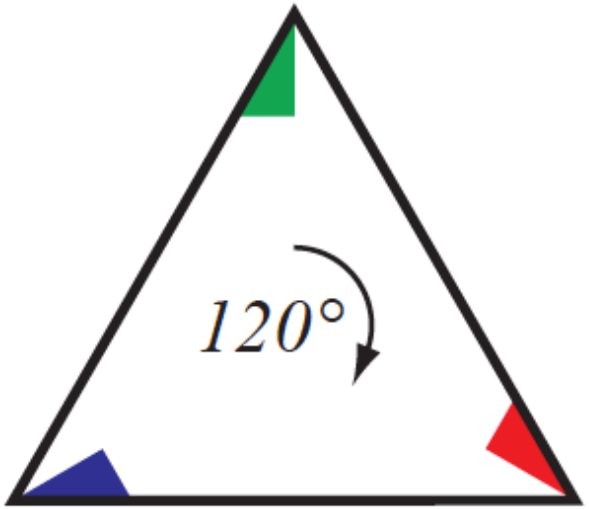
Classification



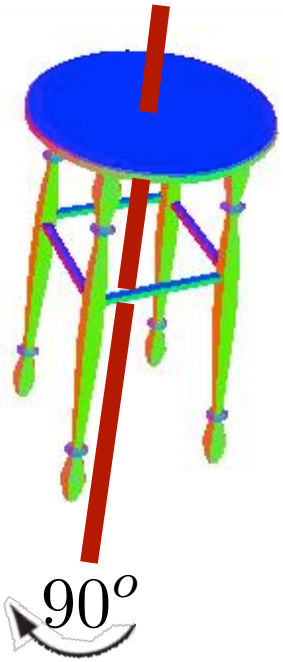
Exact vs. Approximate



Global vs. Partial

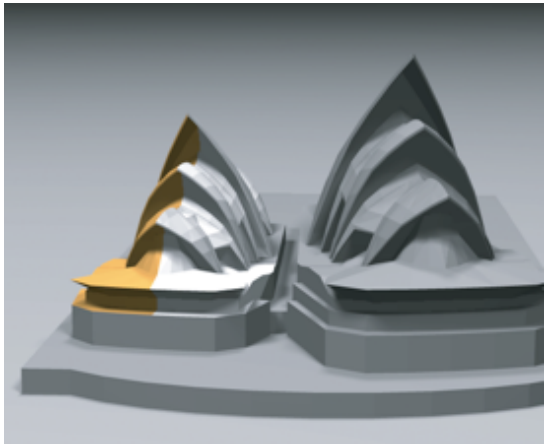
reflections

Kazhdan et al. 2003

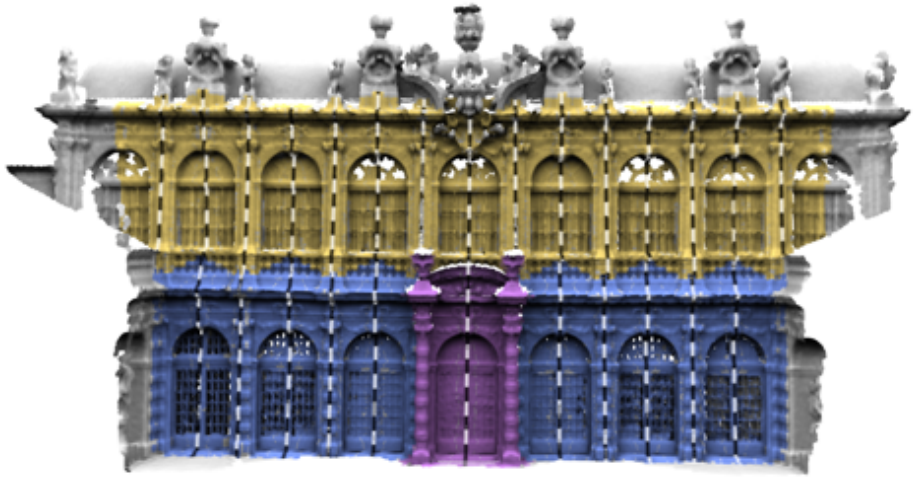


rotations

Kazhdan et al. 2004



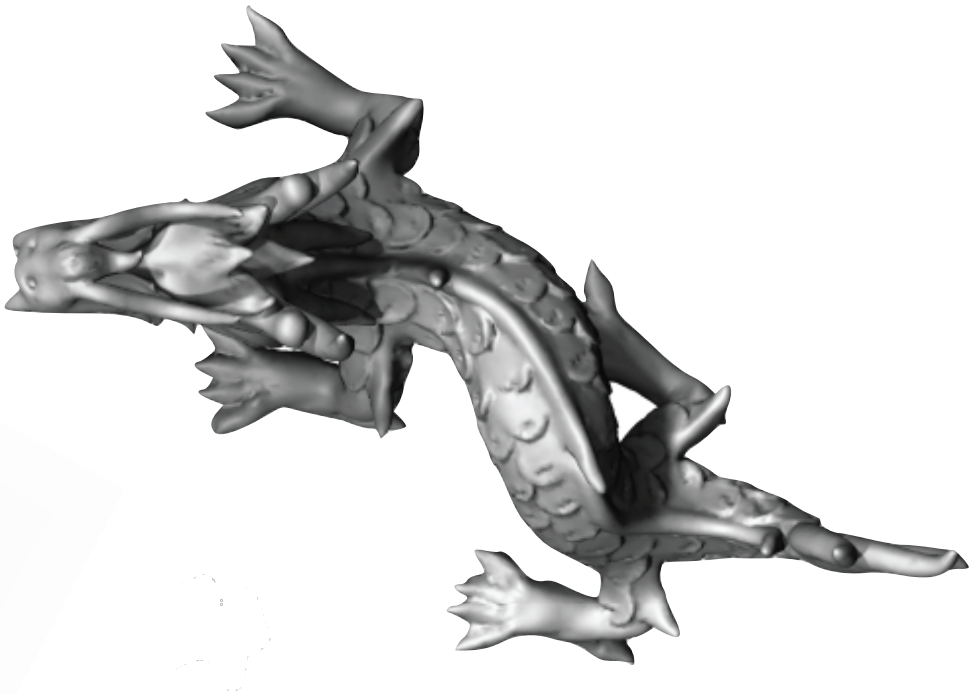
Mitra et al. 2006



Bokeloh et al. 2009

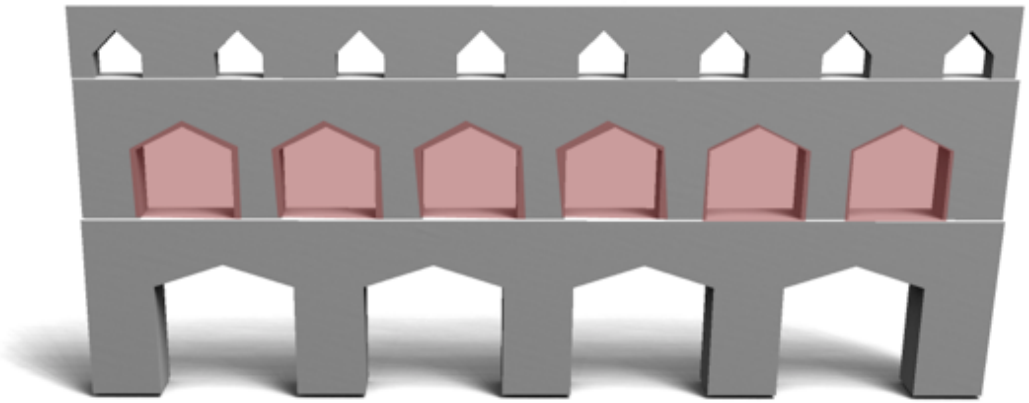
Extrinsic vs. Intrinsic

Extrinsic symmetries depend on the embedding of the object in space.



Intrinsic symmetries are defined with respect to an intrinsic metric of the surface.

Extrinsic Symmetries



translations

Bokeloh et al. 2011

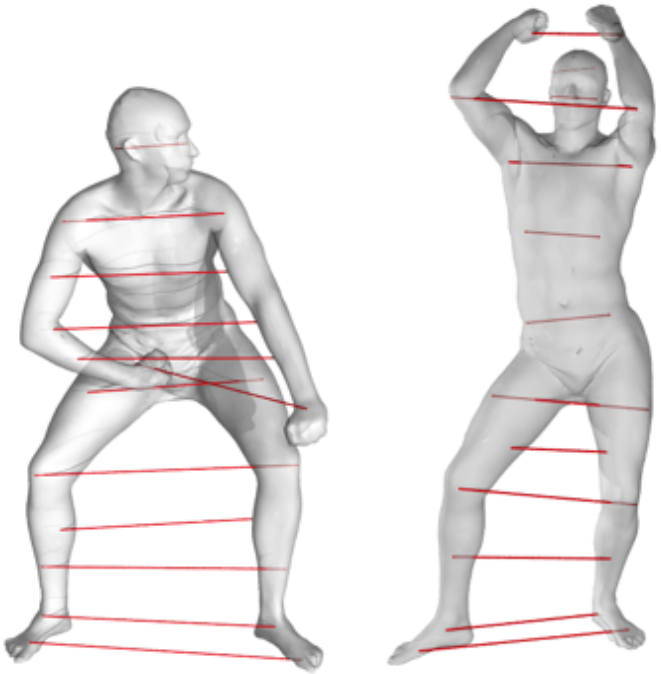
rotations reflections

Martinet et al. 2006

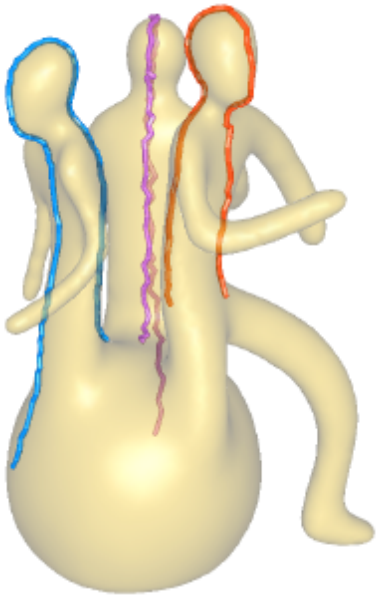
similarity transformations

Gal et al. 2006

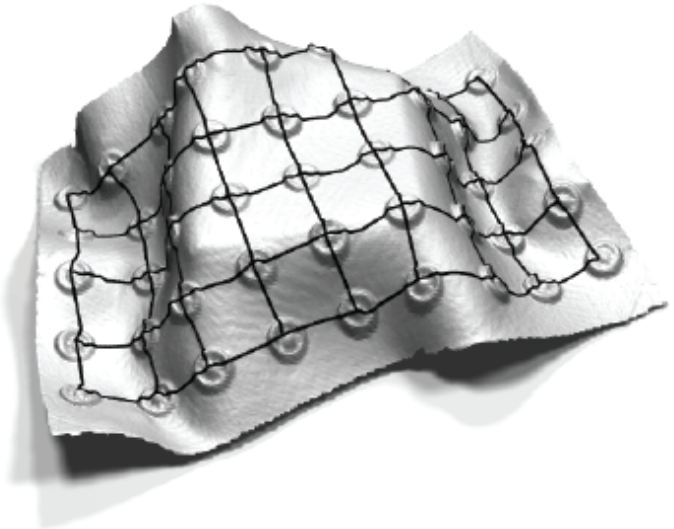
Intrinsic Symmetries



point-to-point
correspondences
Ovsjanikov et al. 2008

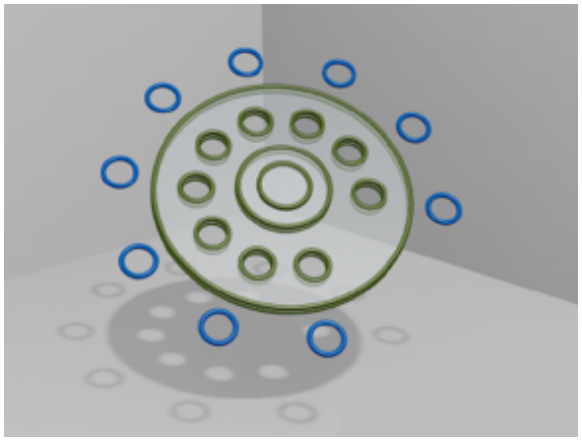


partial intrinsic
reflectional symmetries
Xu et al. 2009

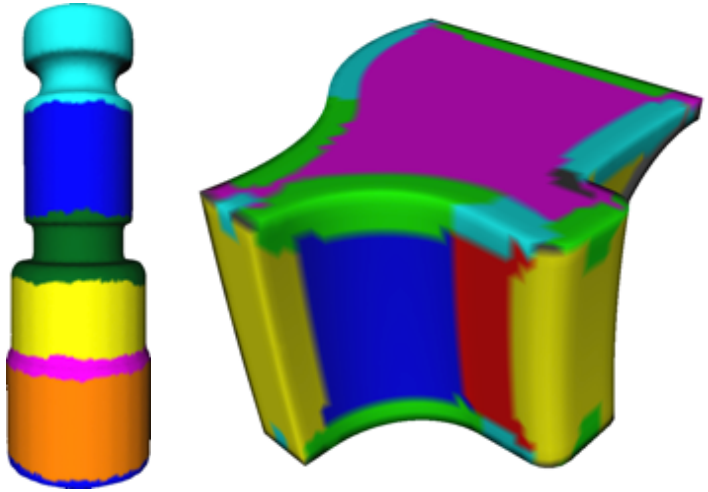


intrinsic regularities
Mitra et al. 2009

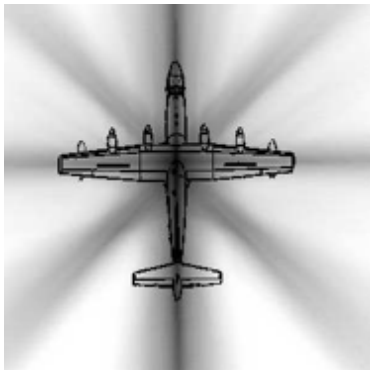
Discrete vs. Continuous



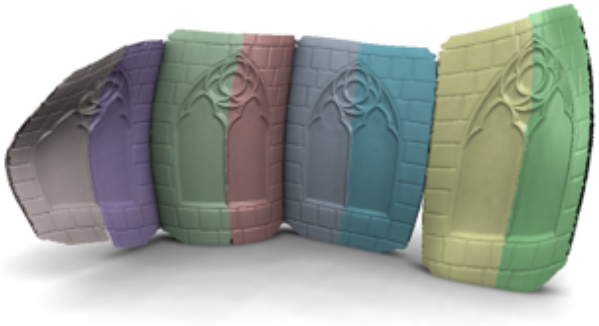
Gal et al. 2009



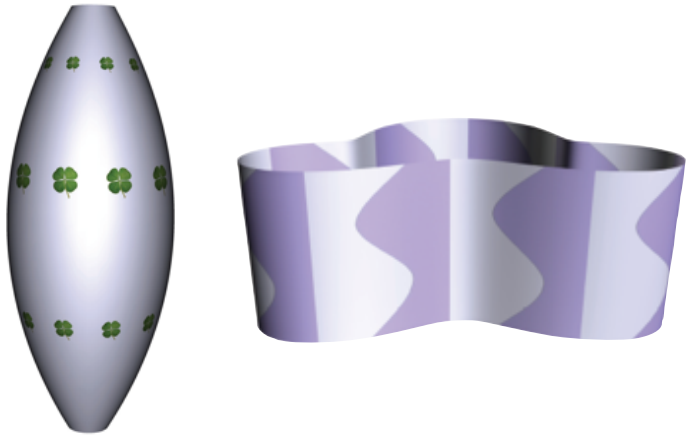
Gelfand et al. 2004



Podalak et al. 2006



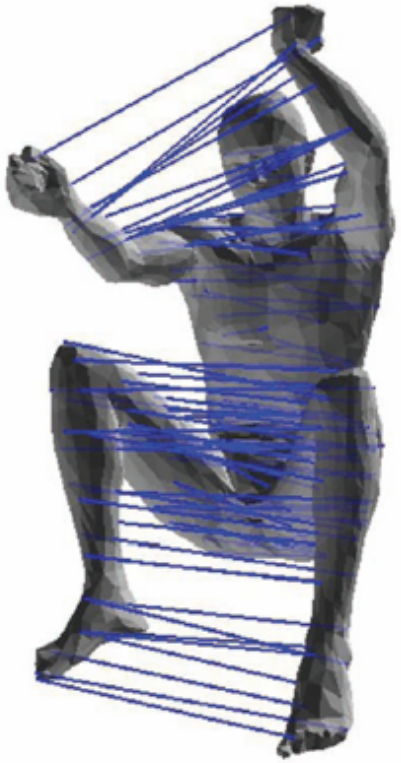
Berner et al. 2009



Ben-Chen et al. 2010

Lipman et al. 2010

Output Structure

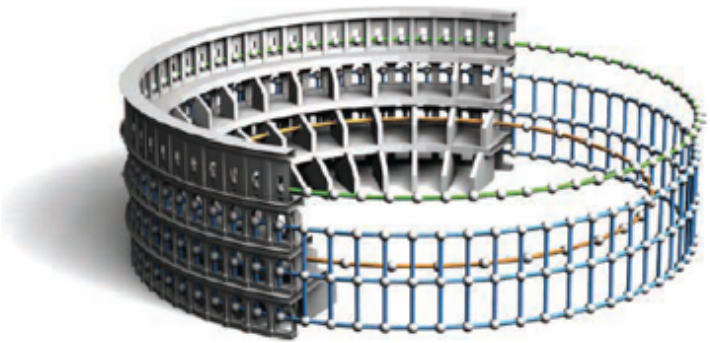


pairwise

Kim et al. 2010

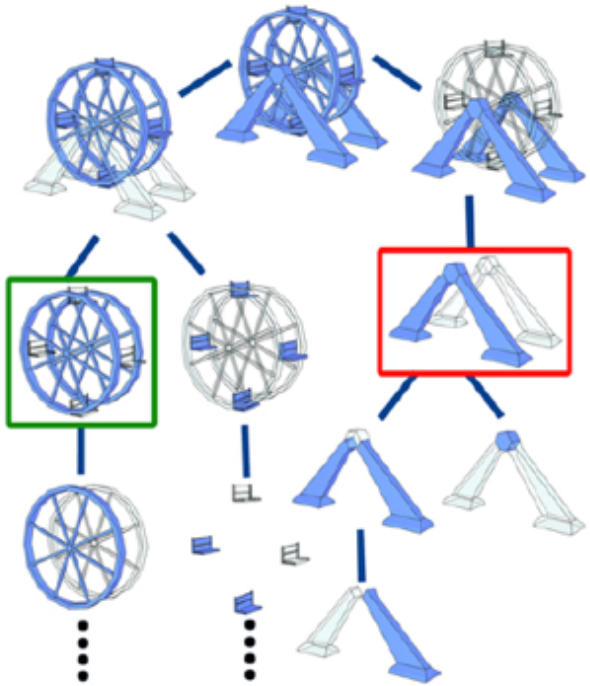
segmentation

Mitra et al. 2006



symmetry groups

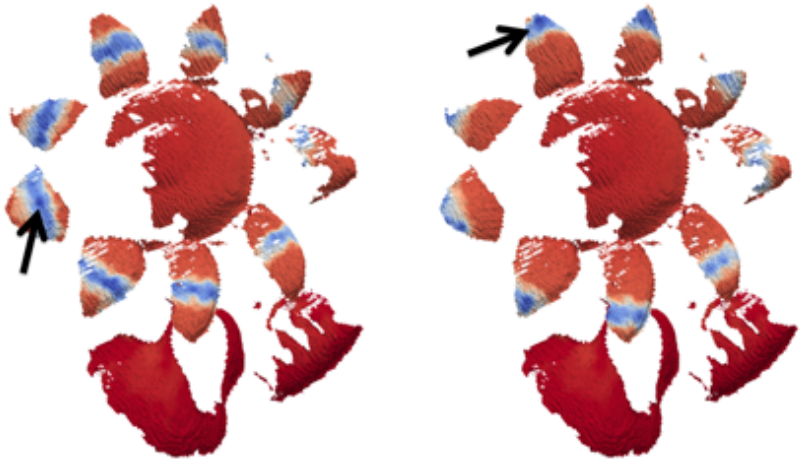
Pauly et al. 2008



hierarchy

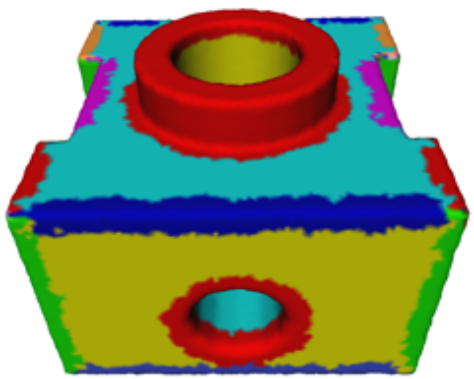
Wang et al. 2011

Output Structure



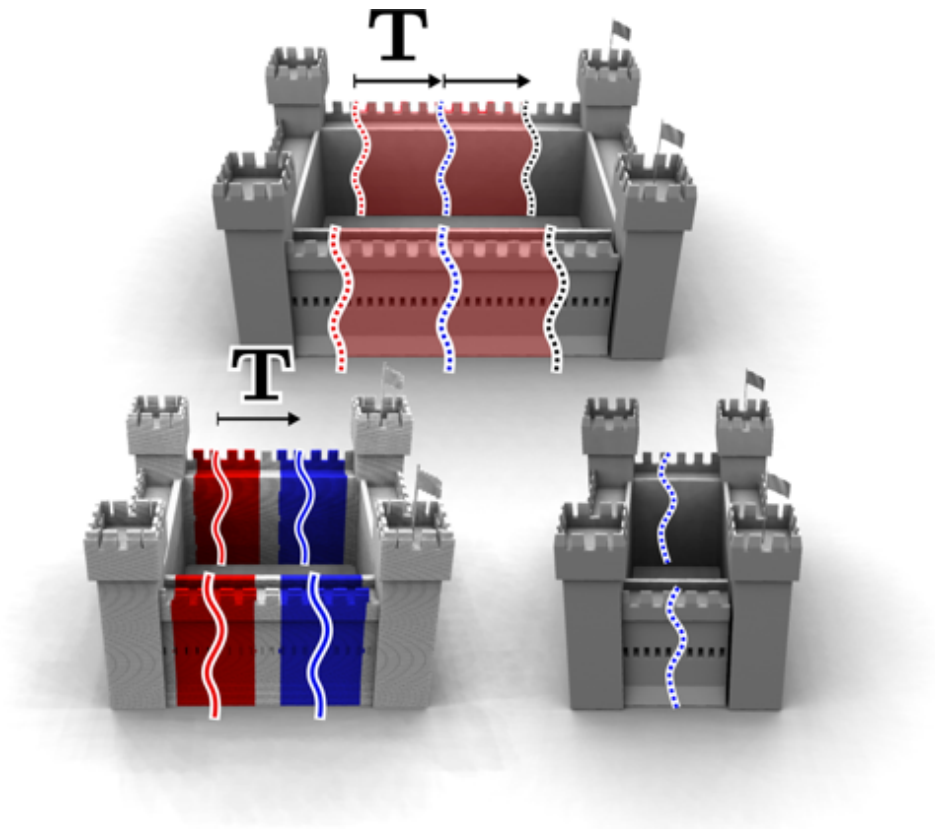
symmetry orbits

Lipman et al. 2010



slippable regions

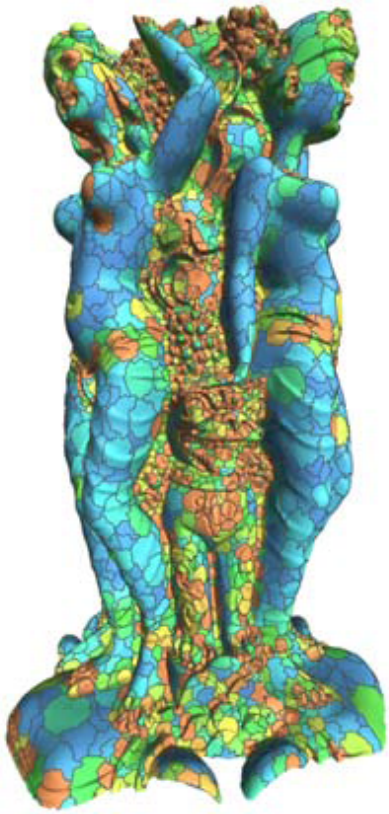
Gelfand et al. 2004



docking sites

Bokeloh et al. 2010

Type of Features

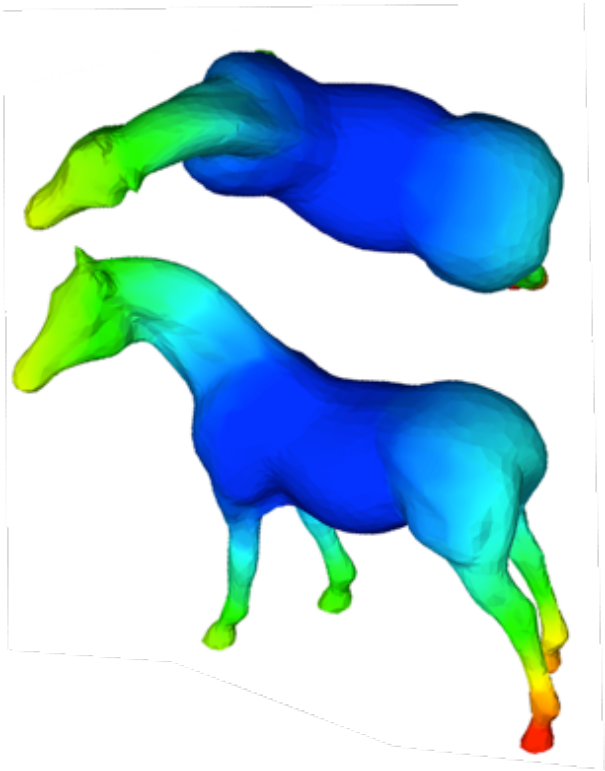


surface curvature

Gal et al. 2006

line features

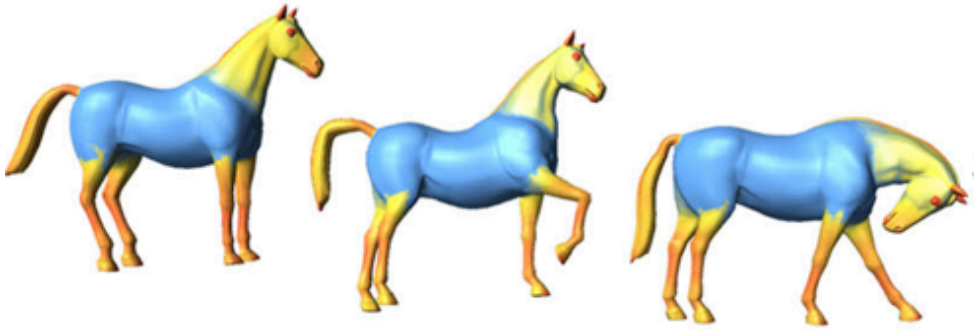
Bokeloh et al. 2009



geodesic distances

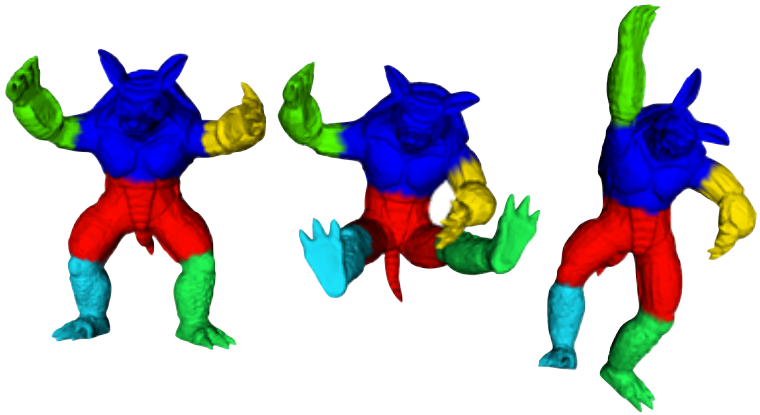
Kim et al. 2010

Type of Features



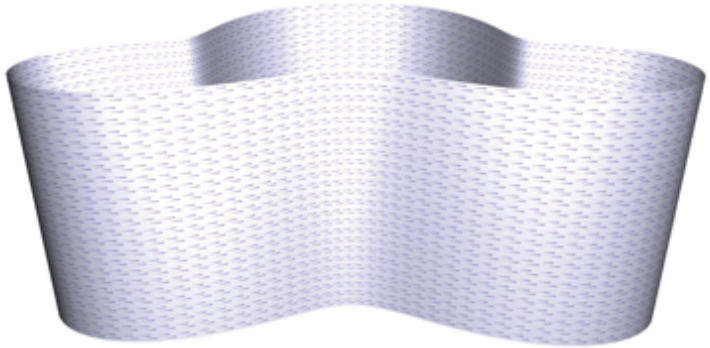
shape diameter functions (SDF)

Shapira et al. 2008



global point signatures (GPS)

Rustamov 2007



Killing vector fields

Ben-Chen et al. 2010

More?

Reference	Method	Input				Output								
		mesh	points	volume	image	global	partial	disc.	cont.	extrin.	intrin.	structure	class of transform.	Type of Features
Alt et al. 1988 [AMWW88]	object-space graph isomorph.		✓			✓		✓		✓		pairwise	rigid	
Atallah et al. 1985 [Ata85]	string pattern matching		✓			✓		✓		✓		pairwise	reflections	
Bermanis et al. 2010 [BAK10]	spectral analysis			✓		✓		✓		✓		pairwise	rotations, reflections	angular difference functions
Berner et al. 2008 [BBW*08]	feature-graph matching	✓	✓		✓		✓	✓		✓		segmentation	rigid	slippage features
Berner et al. 2009 [BBW*09a]	feature-graph matching	✓	✓				✓	✓		✓	✓	segmentation	(relaxed) isometries	Gaussian curvature, curvature lines
Bokeloh et al. 2009 [BBW*09b]	feature graph matching	✓	✓				✓	✓		✓		segmentation	rigid	lines
Ben-Chen et al. 2010 [BCBSG10]	flow of killing vector fields	✓					✓		✓		✓	continuous	continuous isometries	Killing vector fields
Bokeloh et al. 2011 [BWKS11]	RANSAC-based transformation verification	✓					✓	✓	✓	✓		symmetry groups, continuous	translations	sharp creases
Berner et al. 2011 [BWM*11]	feature-graph matching	✓	✓				✓	✓		✓		segmentation	subspace symmetries	lines of large principle curvature
Chertok et al. 2010 [CK10]	spectral analysis		✓		✓		✓	✓		✓		pairwise	rotations, reflections	local image features
Gal et al. 2006 [GCO06]	geometric hashing	✓					✓	✓		✓		segmentation	similarity transform.	curvature based salient features
Gelfand et al. 2004 [GG04]	slippage analysis	✓	✓				✓		✓	✓		continuous	rigid	local slippage signatures
Kazhdan et al. 2003 [KCD*03]	descriptor computation with Fourier methods			✓		✓			✓	✓		pairwise	reflections	
Kazhdan et al. 2004 [KFR04]	descriptor computation with Fourier methods			✓		✓			✓	✓		pairwise	rotations, reflections	
Kim et al. 2010 [KLCF10]	search in möbius transformations	✓				✓		✓			✓	pairwise	isometries	average geodesic distance
Lipman et al. 2010 [LCDF10]	spectral analysis in correspondence space	✓	✓				✓		✓	✓	✓	symmetry aware embedding	rigid	
Lasowski et al. 2009 [LTSW09]	belief propagation	✓	✓				✓		✓		✓	segmentation	isometries	
Mitra et al. 2010 [MBB10]	multi-dimensional scaling	✓					✓	✓			✓	symmetry groups	isometries	discrete Laplacians
Mitra et al. 2006 [MGP06]	transformation voting	✓	✓				✓	✓		✓		segmentation, hierarchy	similarity transform.	curvature
Martinet et al. 2006 [MSHS06]	generalized moment functions	✓	✓			✓		✓		✓		pairwise, hierarchy	rotations, reflections	moments
Ovsjanikov et al. 2008 [OSG08]	search in signature embedding	✓				✓		✓			✓	pairwise	isometries	global point signatures
Pauly et al. 2008 [PMW*08]	transformation voting	✓	✓				✓	✓		✓		symmetry groups	similarity transform.	curvature
Podolak et al. 2006 [PSG*06]	symmetry transform computation			✓	✓		✓		✓	✓		pairwise	reflections	
Raviv et al. 2007 [RBBK07]	generalized multi-dimensional scaling	✓				✓			✓		✓	pairwise	isometries	geodesic distances
Raviv et al. 2009 [RBBK09]	generalized multi-dimensional scaling	✓	✓				✓		✓		✓	pairwise	isometries	geodesic distances
Raviv et al. 2010 [RBS*10]	matching of distance histograms	✓					✓		✓		✓	pairwise	isometries	diffusion distances
Simari et al. 2006 [SKS06]	reweighted least squares auto alignment	✓					✓	✓		✓		hierarchy	reflections	PCA axes
Sun et al. 1997 [SS97]	search in orientation histograms		✓	✓	✓	✓		✓		✓		pairwise	reflections, rotations	extended Gaussian image
Thrun et al. 2005 [TW05]	symmetry space scoring			✓			✓		✓	✓		segmentation	reflections, rotations	
Xu et al. 2009 [XZT*09]	voting for symmetry transforms	✓					✓		✓		✓	segmentation	reflections	SDF
Zabrodsky et al. 1995 [ZPA95]	symmetry distance computation		✓		✓		✓		✓	✓		pairwise	isometries	