Geometry

Erosion Thickness on Medial Axes of 3D Shapes

Yajie Yan, Kyle Sykes, Erin Chambers, David Letscher, Tao Ju

Q-MAT: Computing Medial Axis Transform Using Quadratic Error Minimization

Pan Li, Bin Wang, Feng Sun, Xiaohu Guo, Wenping Wang

Mesh Arrangements for Solid Geometry

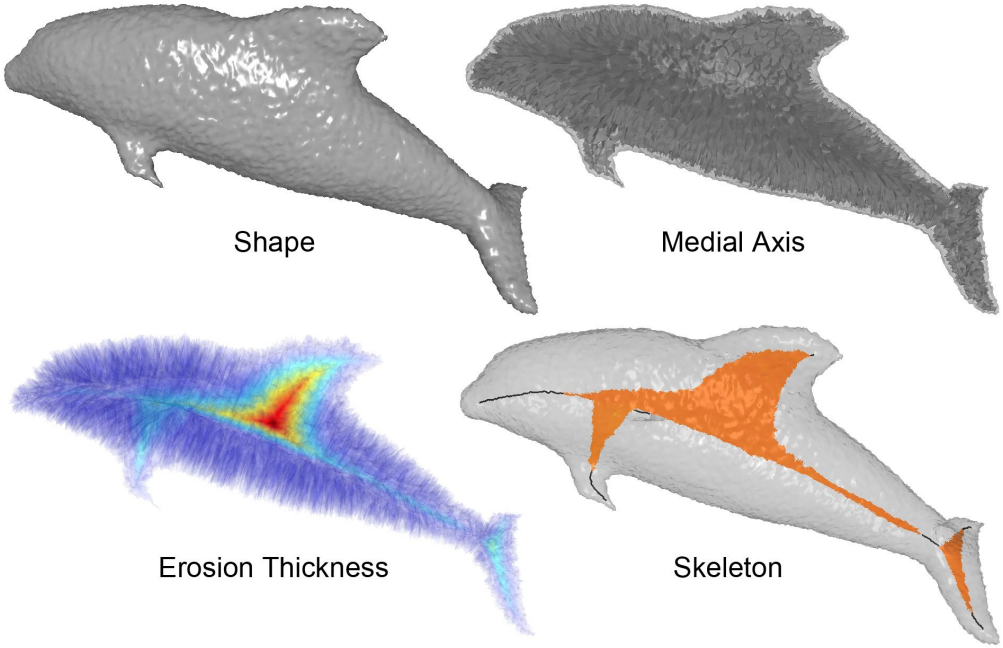
Qingnan Zhou, Eitan Grinspun, Denis Zorin, Alec Jacobson

Animated Mesh Approximation With Sphere-Meshes

Jean-Marc Thiery, Emilie Guy, Tamy Boubekeur, Elmar Eisemann

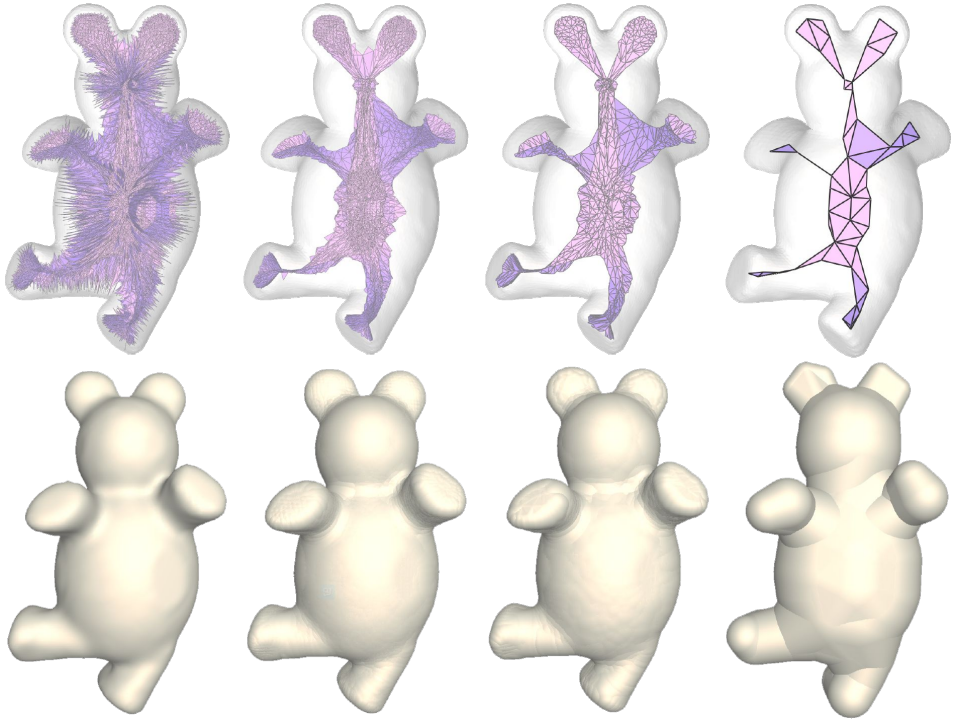
Erosion Thickness on Medial Axes of 3D Shapes

- Define Erosion Thickness metric in 3D
- Use it to prune Medial Axis of 3D objects
- Results in a simplified Medial Axis with clearer understanding of mesh topology

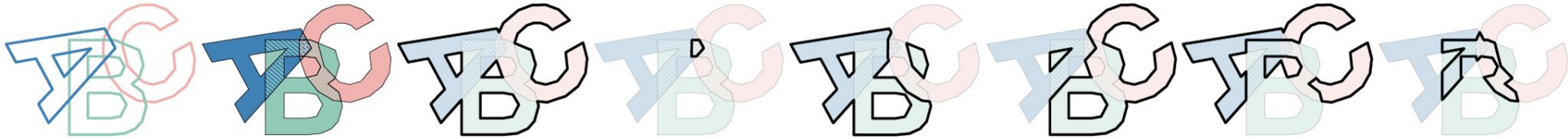


Q-MAT: Computing Medial Axis Transform Using Quadratic Error Minimization

- Efficiently computes Medial Axis Transform using quadratic error minimization
- Robust and geometrically accurate
- Removes unstable branches (spikes)



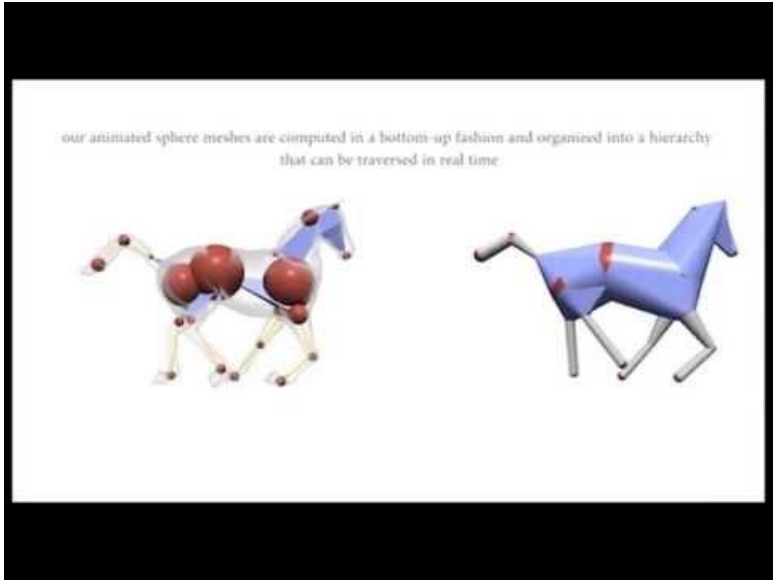
Mesh Arrangements for Solid Geometry



- Comprehensive algorithm for robust constructive solid geometry operations (e.g. boolean operations)
  - Makes no assumptions on input
  - Does not resort to perturbation of points (i.e. it's exact)
  - Generalizes to *n*-ary operations (e.g. find all regions inside *k* of *n* inputs)
- Tested on a database of 10,000 meshes "in the wild"

Animated Mesh Approximation With Sphere-Meshes

- Represents animated 3D surfaces as interpolated spheres
- Real-time adjustment of level of detail
- Can be applied to efficiently detect collisions



Shape Analysis

RAID: A Relation-Augmented Image Descriptor

Paul Guerrero, Niloy Mitra, Peter Wonka

Learning How Objects Function via Co-Analysis of Interactions

Ruizhen Hu, Oliver van Kaick, Bojian Wu, Hui Huang, Ariel Shamir, Hao Zhang

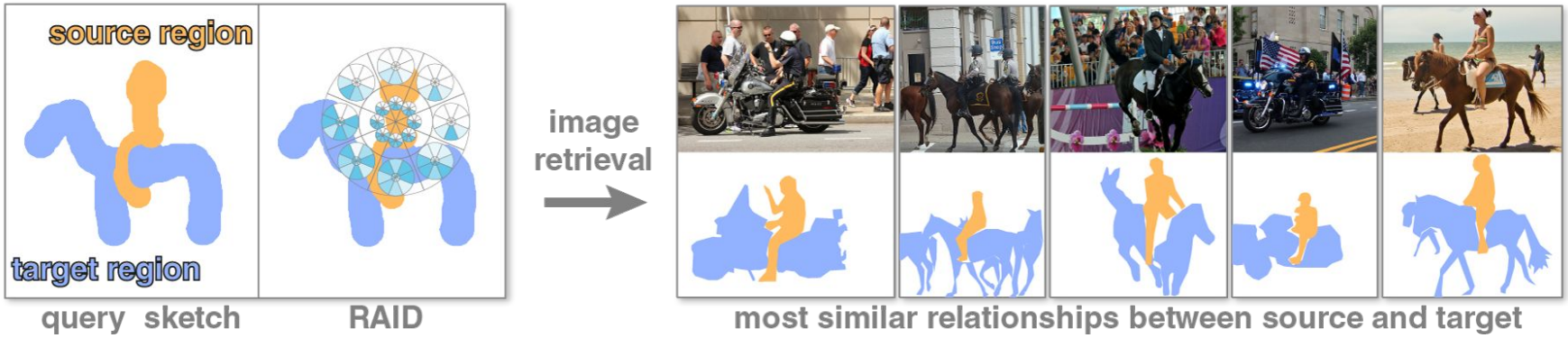
PATEX: Exploring Pattern Variations

Paul Guerrero, Gilbert Bernstein, Wilmot Li, Niloy Mitra

Efficient 3D Object Segmentation from Densely Sampled Light Fields with Applications to 3D Reconstruction

Kaan Yucer, Alexander Sorkine-Hornung, Oliver Wang, Olga Sorkine-Hornung

RAID: A Relation-Augmented Image Descriptor

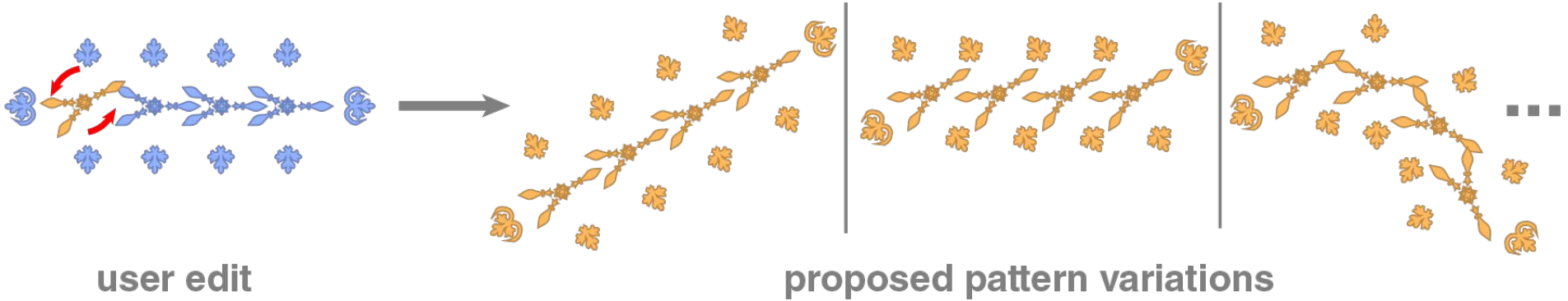


- Image descriptor to describe spatial relationship between image regions
- Search by verbal relationship or sketch

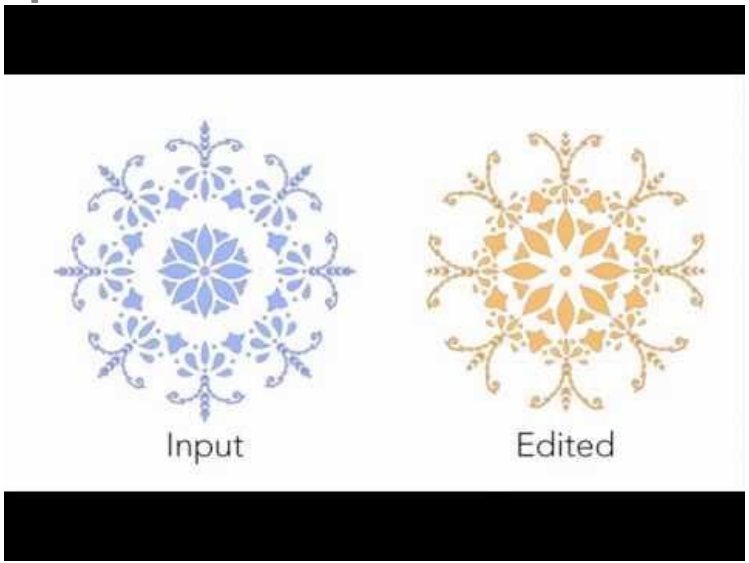
Learning How Objects Function via Co-Analysis of Interactions

- Defines *functionality model* for an object category (e.g. table, stroller)
- Trained on objects placed in contextual scenes
- Learns a set surface patches for a category
- Given an input model, can determine different uses for the object using patch localization

PATEX: Exploring Pattern Variations

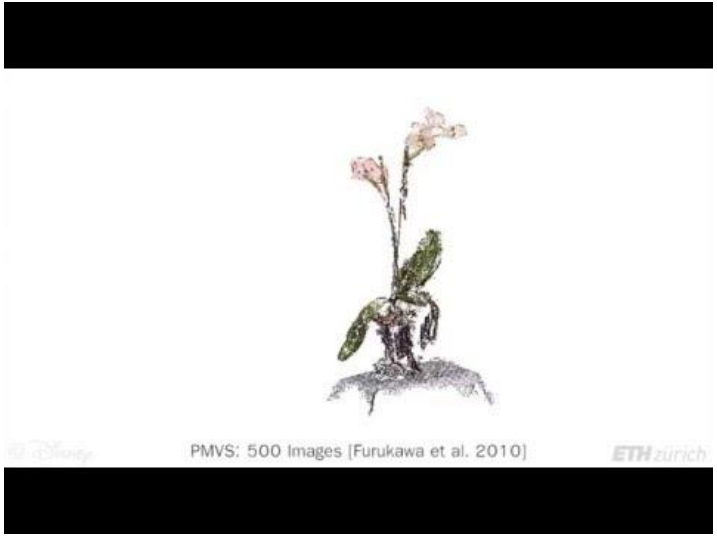


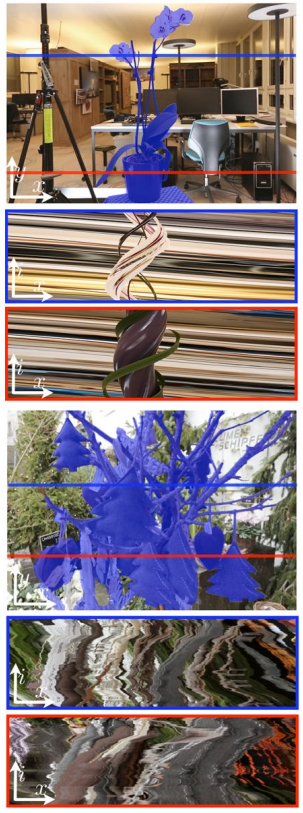
- Algorithm that identifies structure-preserving pattern variations in response to user input

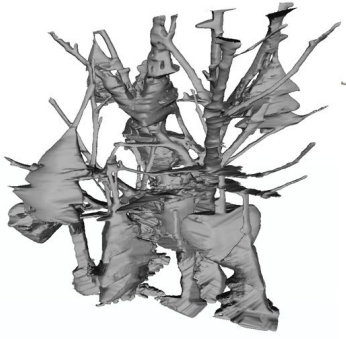


Efficient 3D Object Segmentation from Densely Sampled Light Fields with Applications to 3D Reconstruction

- Segmentation of foreground and background in videos
- High detail reconstructions, even with cluttered backgrounds







Rendering of Complex Microstructure

Position-Normal Distributions for Efficient Rendering of Specular Microstructure

Ling-Qi Yan, Milos Hasan, Steve Marschner, Ravi Ramamoorthi

Multi-Scale Rendering of Scratched Materials Using a Structured SV-BRDF Model

Boris Raymond, Gael Guennebaud, Pascal Barla

Multiple-Scattering Microfacet BSDFs with the Smith Model

Eric Heitz, Johannes Hanika, Eugene d'Eon, Carsten Dachsbacher

Predicting Appearance From Measured Microgeometry of Metal Surfaces

Zhao Dong*, Bruce Walter*, Steve Marschner, Donald P. Greenberg (*Joint first authors)

Position-Normal Distributions for Efficient Rendering of Specular Microstructure

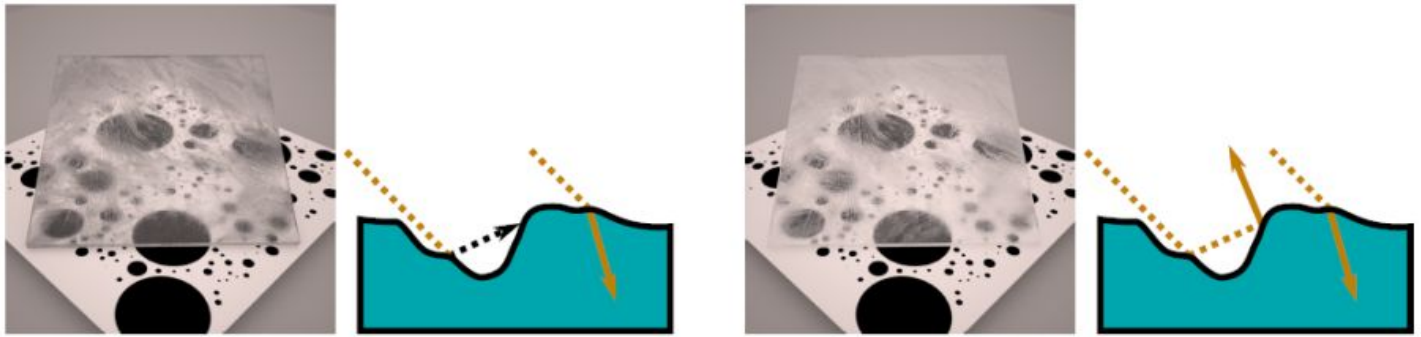
- Efficiently renders highlights on surface microstructure
- Treats microstructure surface as a 4D position-normal distribution
- Fits millions of 4D Gaussians to distribution, resulting in a closed-form solution

Multi-Scale Rendering of Scratched Materials Using a Structured SV-BRDF Model

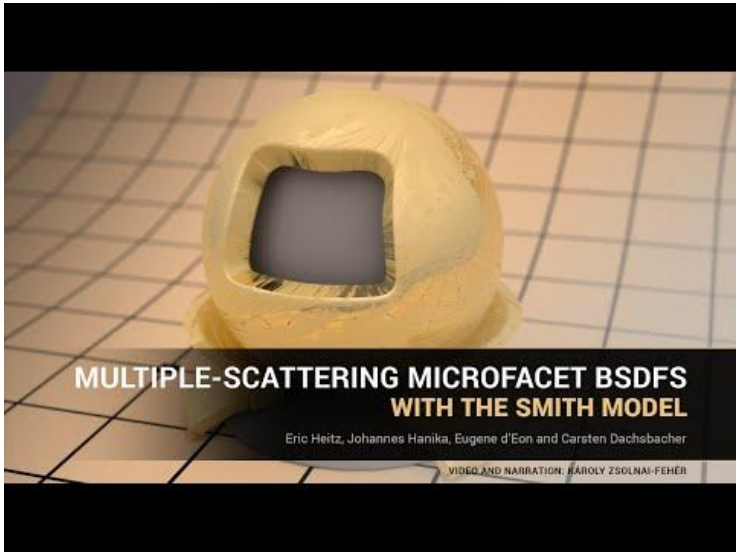
(a) Parallel scratches (BRDF) (b) Parallel scratches (**SV**-BRDF) (c) Deep layered scratches (**SV**-BRDF) (d) Thin layered scratches (**SV**-BRDF)

- Spatially varying BRDF for surface scratches
- Takes into account all interreflections
- Individual scratch BRDFs are linearly combined for a single pixel footprint

Multiple-Scattering Microfacet BSDFs with the Smith Model

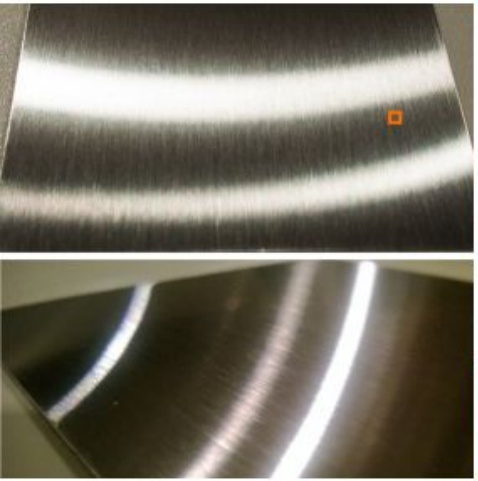


- Smith microfacet model only addresses single-bounce light rays
- Incorporates multiple ray bounces into the Smith microfacet model

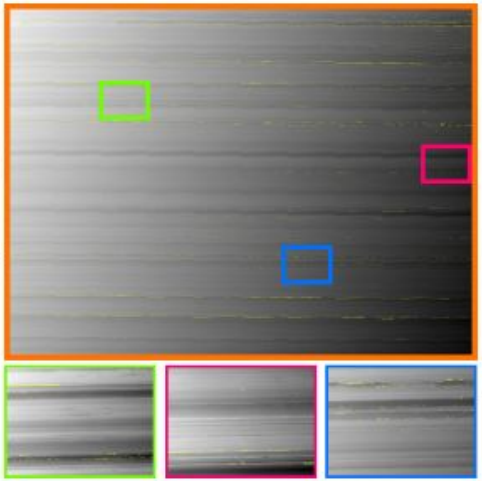


2:00, 6:05

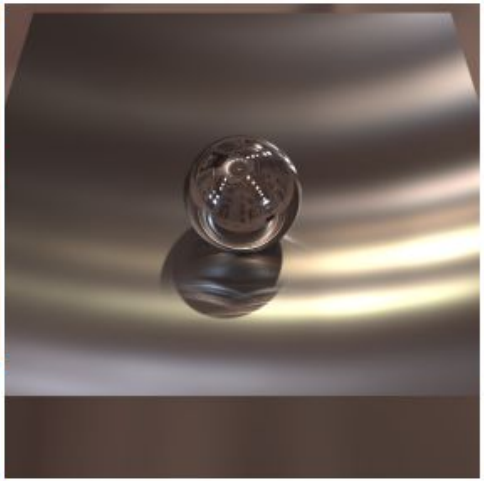
Predicting Appearance From Measured Microgeometry of Metal Surfaces



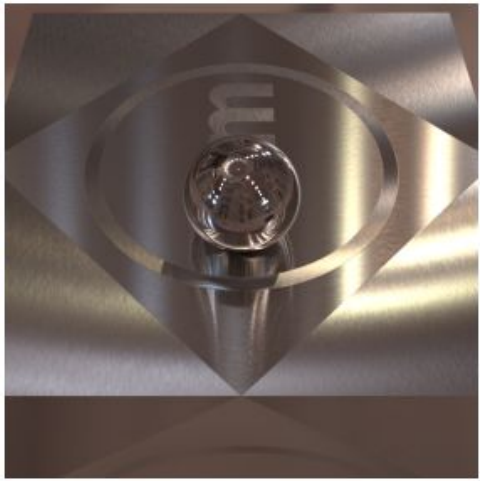
(a) Brushed stainless photographs



(b) Measured surface microgeometry



(c) Predicted anisotropic BRDF



(d) Spatially variant BRDF

- Predicts the BRDF of surfaces measured with a Profilometer

Materials

A Non-Parametric Factor Microfacet Model for Isotropic BRDFs

Mohammed Bagher Mahdi, John Snyder, Derek Nowrouzezahrai

Reflectance Modeling by Neural Texture Synthesis

Miika Aittala, Timo Aila, Jaakko Lehtinen

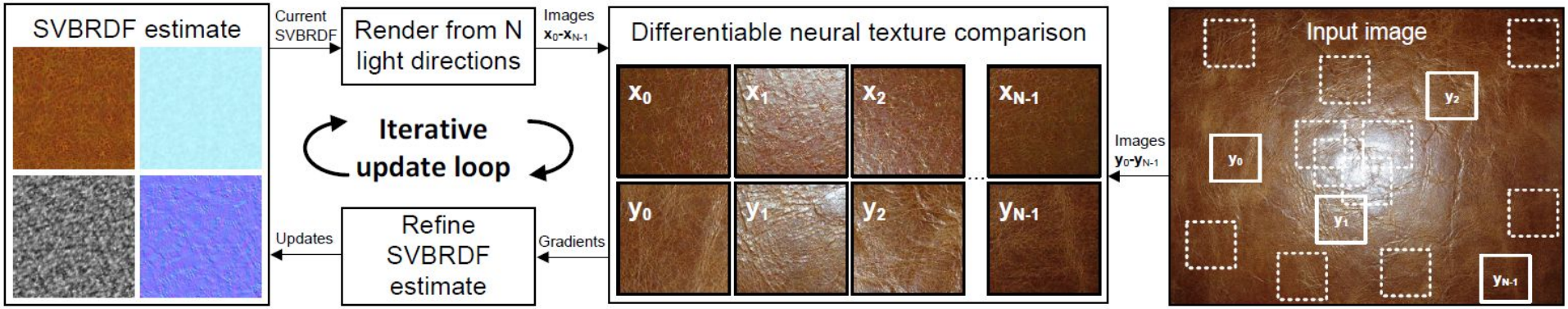
ZoeMatrope: A System for Physical Material Design

Leo Miyashita, K. Ishihara, Yoshihiro Watanabe, Masatoshi Ishikawa

A Non-Parametric Factor Microfacet Model for Isotropic BRDFs

- Introduces a non-parametric factor model for BRDFs
- Compactly represents a large variety of measured BRDFs

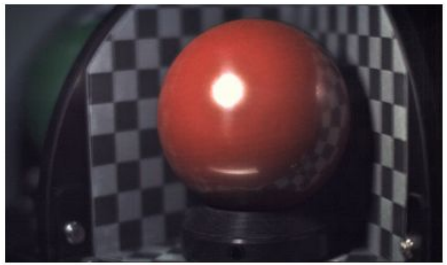
Reflectance Modeling by Neural Texture Synthesis

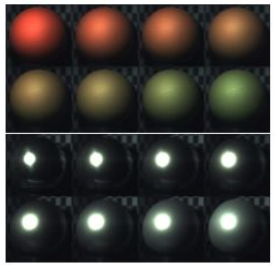


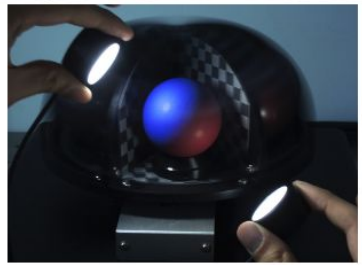
- Recover spatially varying reflectance model from a single lit photograph
- Synthesize texture patches using CNNs to match illumination in input photo

ZoeMatrope: A System for Physical Material Design

- Material display
- Turntable with base materials is illuminated by a synchronized strobe







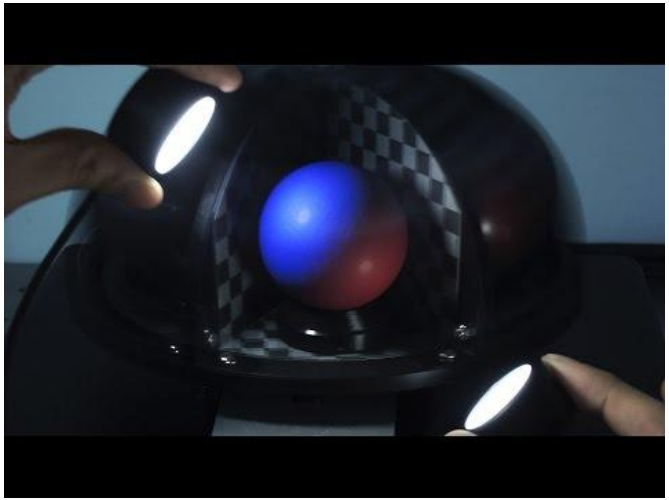


Image & Shape Manipulation

cSculpt: A System for Collaborative Sculpting

Claudio Calabrese, Gabriele Salvati, Marco Tarini, Fabio Pellacini

StyLit: Illumination-Guided Example-Based Stylization of 3D Renderings

Jakub Fiser, Ondrej Jamriska, Michal Lukac, Eli Shechtman, Paul Asente, Jingwan Lu, Daniel Sykora

Flow-Guided Warping for Image-Based Shape Manipulation

Romain Vergne, Pascal Barla, Georges-Pierre Bonneau, Roland W. Fleming

Transfiguring Portraits

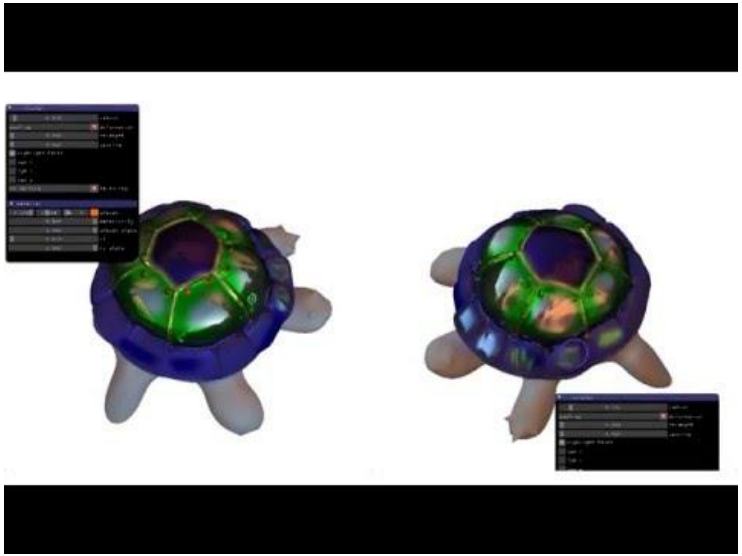
Ira Kemelmacher-Shlizerman

Band-Sifting Decomposition for Image Based Material Editing

Ivaylo Boyadzhiev, Kavita Bala, Sylvain Paris, Edward H. Adelson

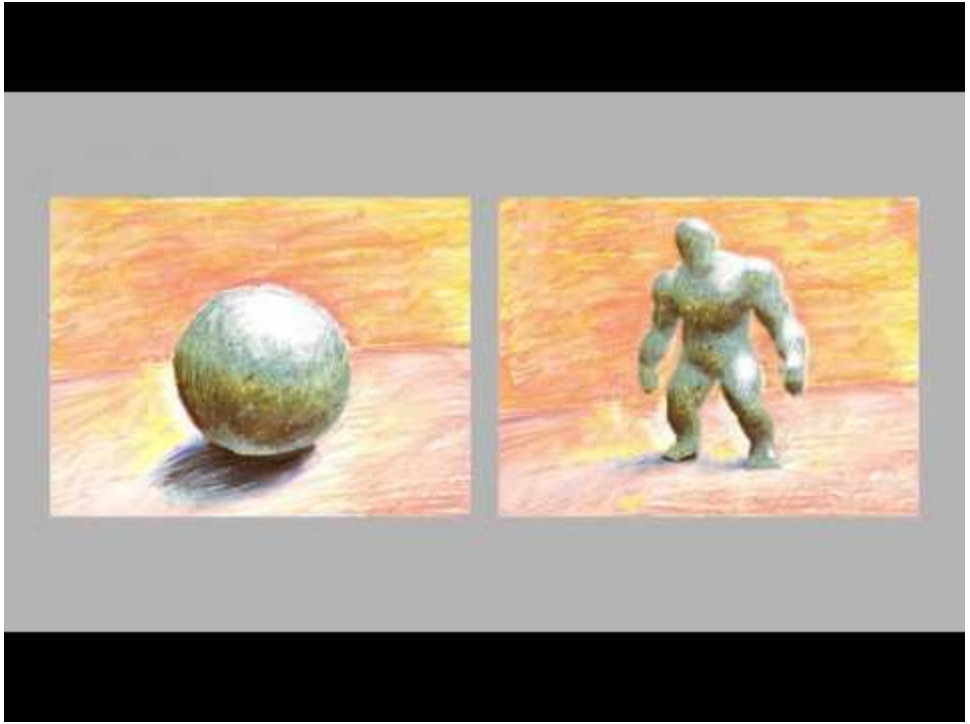
cSculpt: A System for Collaborative Sculpting

- Multiple artists concurrently sculpt a polygonal mesh
- Seamlessly merges edits and resolves conflicts
- Handles concurrent overlapping edits at different scales



StyLit: Illumination-Guided Example-Based Stylization of 3D Renderings

- Stylizes a 3D rendering using an artist’s example
- Based on light propagation instead of colors / normals
- Preserves realistic artistic quality



Flow-Guided Warping for Image-Based Shape Manipulation

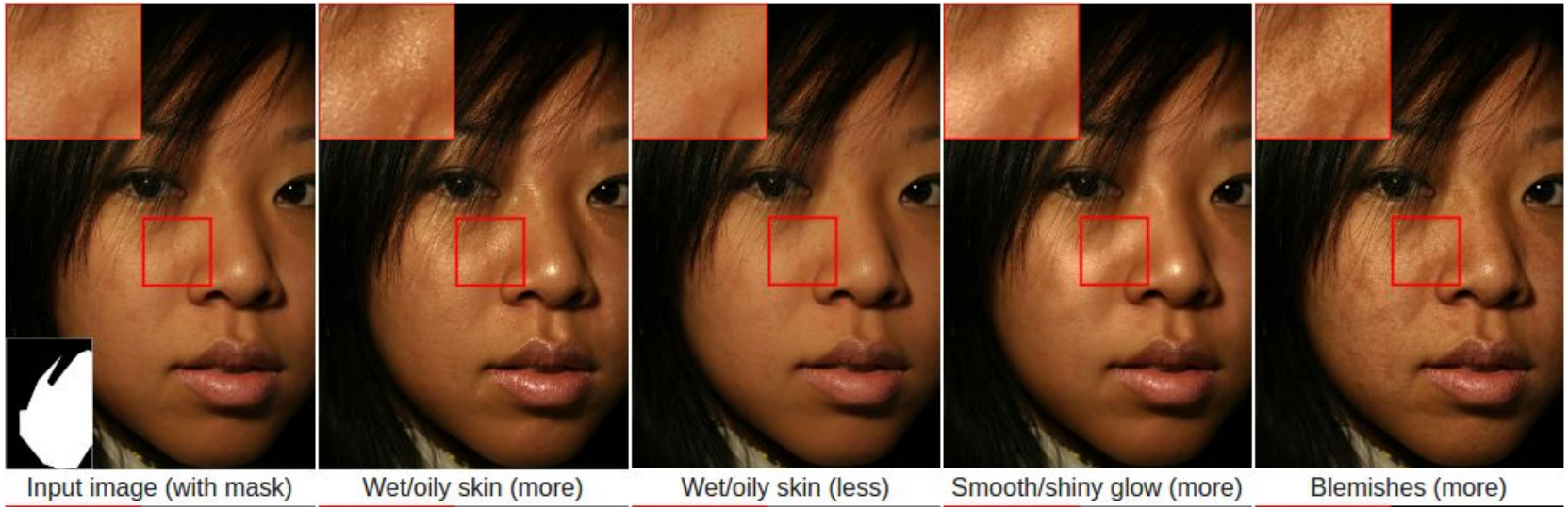
(a) Input image - ©Expertissim (b) Shape sharpening (c) Shape rounding

- Manipulate perceived shape of an object given a single input image
- Exaggerates orientation patterns correlated with surface curvature

Transfiguring Portraits

- Automatic synthesis of appearances given a set of input portraits
- User searches for a desired appearance and it is automatically generated

Band-Sifting Decomposition for Image Based Material Editing



- Set of 2D image operations based on multi-scale analysis
- Builds a sub-band decomposition and modifies the coefficients
- Consistent effects across image subjects
  - gloss, smoothness, pigmentation, weathering

Curve & Strut Networks for Fabrication

Synthesis of Filigrees for Digital Fabrication

Weikai Chen, Xiaolong Zhang, Shiqing Xin, Yang Xia, Sylvain Lefebvre, Wenping Wang

Designing Structurally Sound Ornamental Curve Networks

Jonas Zehnder, Stelian Coros, Bernhard Thomaszewski

Connected Fermat Spirals for Layered Fabrication

Haisen Zhao, Fanglin Gu, Qixing Huang, J. A. Garcia Galicia, Yong Chen, Changhe Tu, Bedrich Benes, Hao Zhang, Daniel Cohen-Or, Baoquan Chen

Printing Arbitrary Meshes With a 5DOF Wireframe Printer

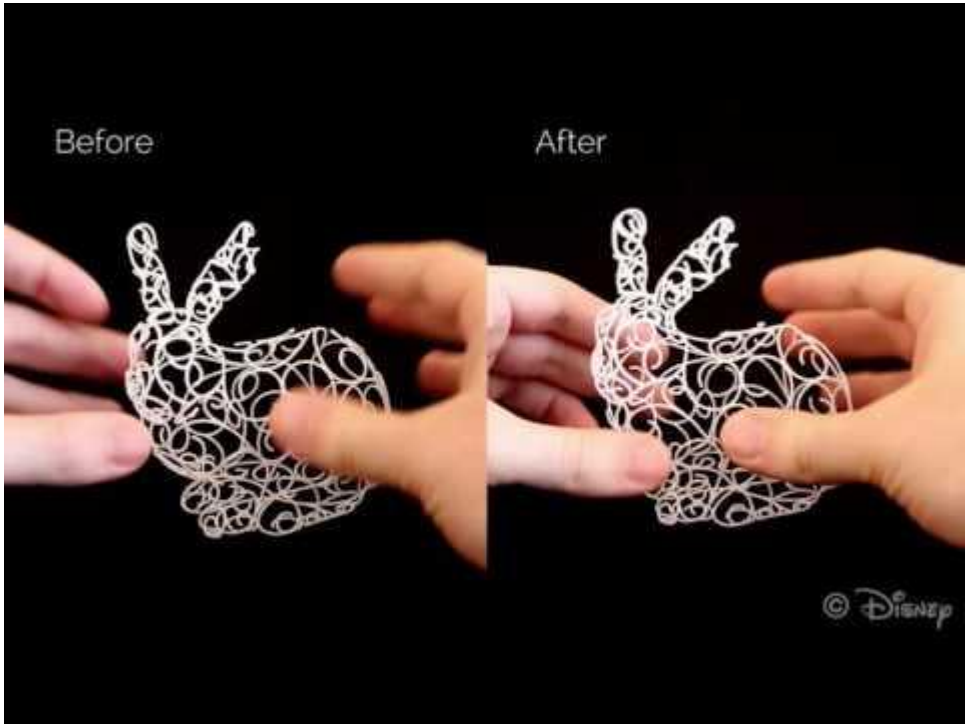
Rundong Wu, Huaishu Peng, Francois Guimbretiere, Steve Marschner

Synthesis of Filigrees for Digital Fabrication

- Covers a surface with a network of filigree base elements
- Ensures they are well connected for fabrication
- Allow overlaps and reuse good configurations during optimization

Designing Structurally Sound Ornamental Curve Networks

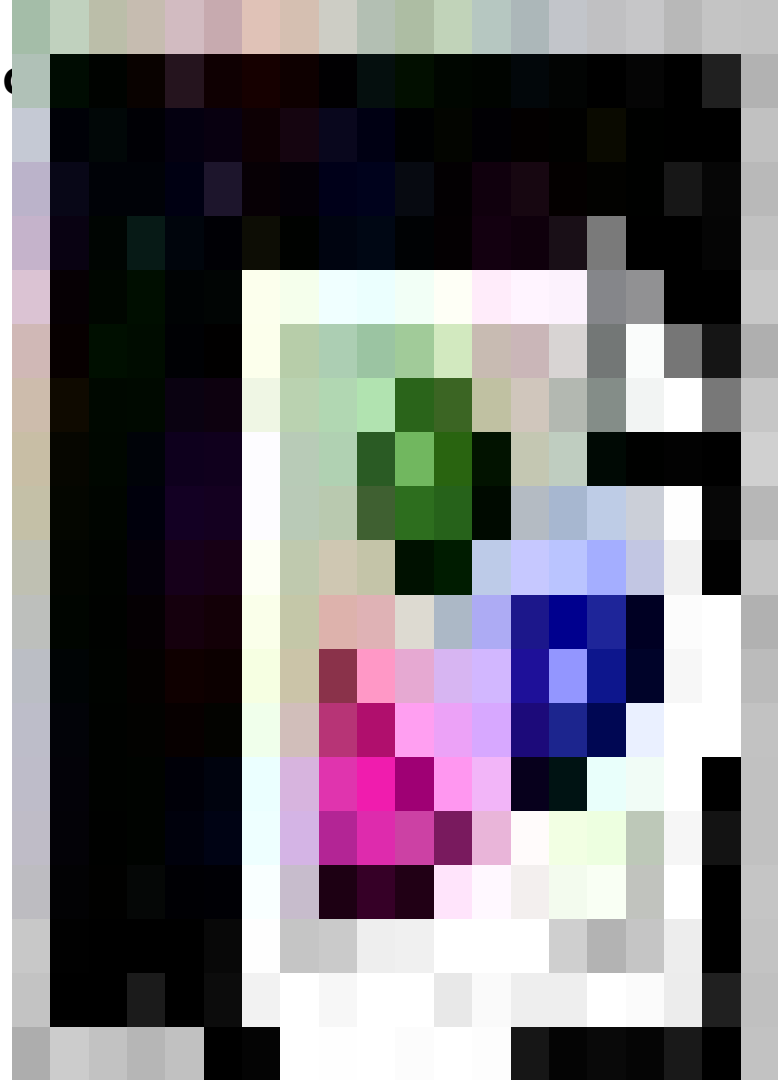
- Interactive system to design ornamental curve networks
- Includes semi-automated curve packing
- Enforces structural stability constraints



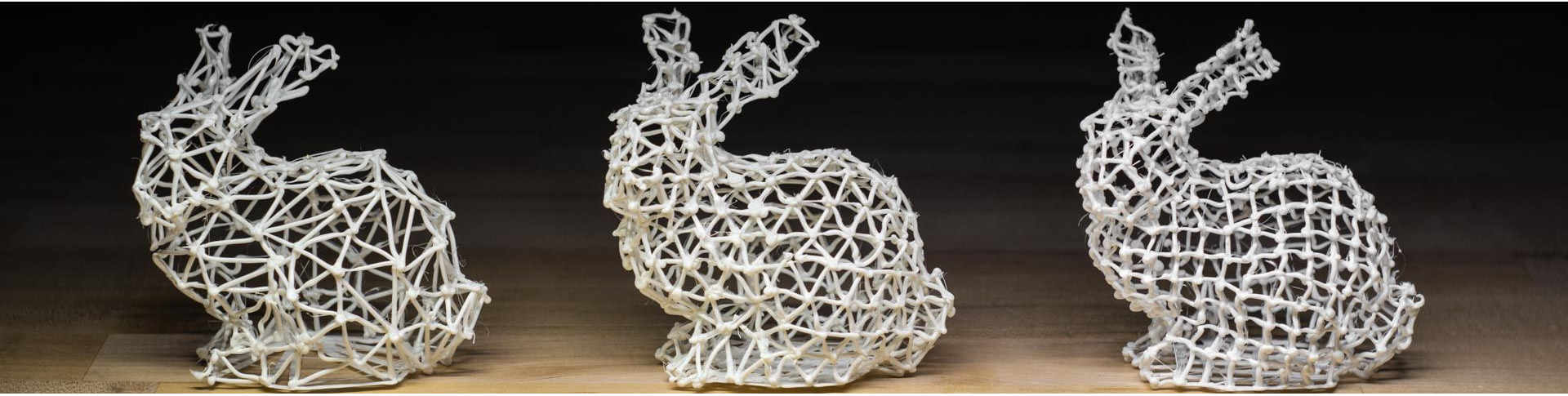
Connected Fermat Spirals for Layered Fabricati

- New kind of space filling curve for fabrication
- Fully connected and low-curvature paths

Video



Printing Arbitrary Meshes With a 5DOF Wireframe Printer



- Print mesh wireframes with a 5DOF printer
- Avoid collisions with already printed parts

Mappings

Bounded Distortion Harmonic Shape Interpolation

Edward Chien, Renjie Chen, Ofir Weber

On the Convexity and Feasibility of the Bounded Distortion Harmonic Mapping Problem

Zohar Levi, Ofir Weber

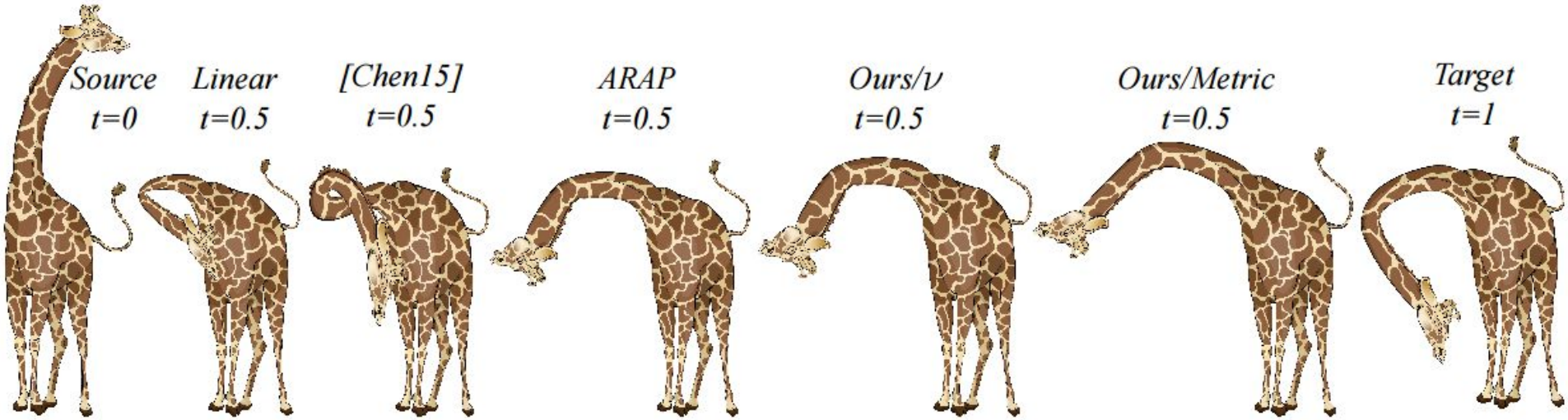
Volume-encoded UV-maps

Marco Tarini

Motion Graphs for Unstructured Textured Meshes

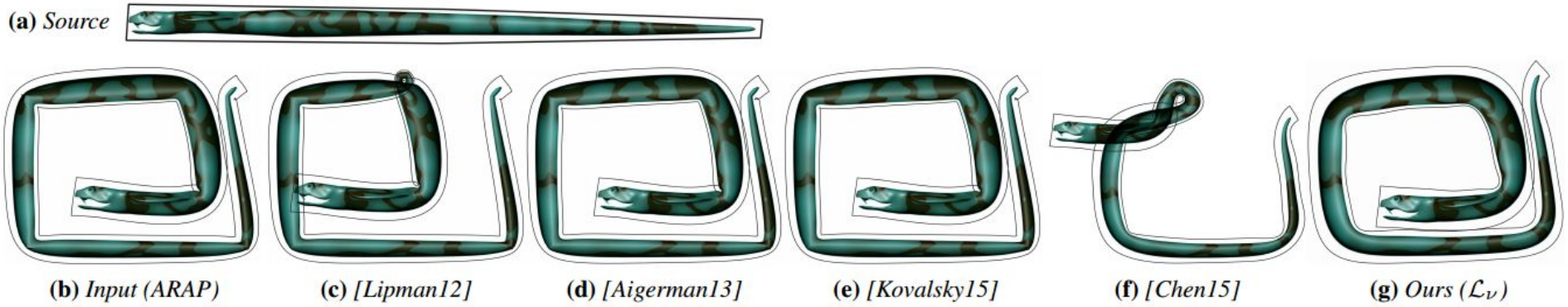
Fabian Prada, Michael Kazhdan, Ming Chuang, Alvaro Collet, Hugues Hoppe

Bounded Distortion Harmonic Shape Interpolation



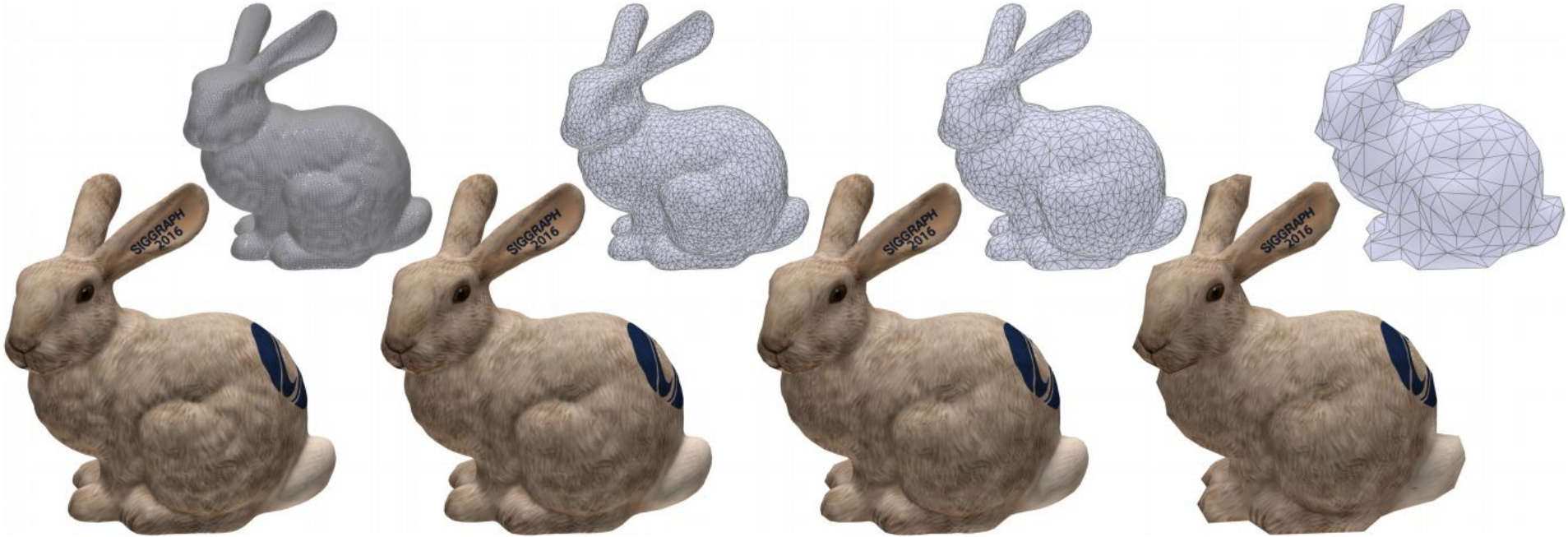
- Interpolates between 2D planar mappings
- Intermediate mappings guaranteed to be locally injective with bounded distortion
- Blended differentials have a closed form expression, making this method very efficient as well as accurate

On the Convexity and Feasibility of the Bounded Distortion Harmonic Mapping Problem



- Computes locally injective, bounded distortion harmonic mappings
- Formulates a convex problem, thus optimization is guaranteed to converge

Volume-encoded UV-maps



- Maps UV coordinates to vertices solely based on 3D position
- Removes the need for duplicate vertices on texture seams
- Works across different meshes with similar topology (e.g. LOD)
- Can also be used with non-meshes (e.g. point clouds)

Motion Graphs for Unstructured Textured Meshes

- Automatically synthesize motion graphs with smooth transitions between similar poses
- Creates natural periodic motion, stochastic playback, and user-directed animations
- Geometry processing addresses discontinuous alignment, textures, and connectivity