Xingyi Du

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Education

Washington University in St. Louis   *St. Louis, USA*

PH.D. IN COMPUTER SCIENCE   *Aug. 2018 - Aug. 2023*

- Advisor: Prof. Tao Ju · Graphics and geometry processing
- GPA: 4.0/4.0, Turner Dissertation Award

Tsinghua University   *Beijing, China*

M.E. IN SOFTWARE ENGINEERING   *Aug. 2015 - Jun. 2018*

- Advisor: Prof. Hui Zhang & Prof. Dong-Ming Yan · Triangle and quad remeshing
- GPA: 3.7/4.0, Rank: 1/131, Graduate with Honors

Tsinghua University   *Beijing, China*

B.E. IN MATERIAL SCIENCE AND ENGINEERING (PHYSICS BRANCH)   *Aug. 2011 - Jun. 2015*

- GPA: 91/100
- Minor in Computer Science

Research Interests

Computer graphics, Geometry processing, 3D modeling, Numerical optimization

Publications

Lifted Surfacing of Generalized Sweep Volumes

YIWEN JU, QINGNAN ZHOU, **XINGYI DU**, NATHAN CARR, TAO JU

ACM Transactions on Graphics (Proc. SIGGRAPH Asia 2025)

RL-ACD: Reinforcement Learning-based Approximate Convex Decomposition

YUZHE LUO, ZHERONG PAN, KUI WU, **XINGYI DU**, YUN ZENG, XIANGJUN TANG, YIQIAN WU, XIAOGANG JIN, XIFENG GAO

ACM Transactions on Graphics (Proc. SIGGRAPH Asia 2025)

Random Affine Transformation Feature Representation Learning for Fast Polygon Retrieval

ZHANGYU WANG, **XINGYI DU**, HAO LI, MARTIN WERNER

Proceedings of ACM SIGSPATIAL (2024) International Workshop on Searching and Mining Large Collections of Geospatial Data

Adaptive Grid Generation for Discretizing Implicit Complexes

YIWEN JU, **XINGYI DU**, QINGNAN ZHOU, NATHAN CARR, TAO JU

ACM Transactions on Graphics (Proc. SIGGRAPH 2024)

Isometric Energies for Recovering Injectivity in Constrained Mapping

XINGYI DU, DANNY M. KAUFMAN, QINGNAN ZHOU, SHAHAR Z. KOVALSKY, YAJIE YAN, NOAM AIGERMAN, TAO JU

SIGGRAPH Conference Proceedings (Proc. SIGGRAPH Asia 2022)

Robust Computation of Implicit Surface Networks for Piecewise Linear Functions

XINGYI DU, QINGNAN ZHOU, NATHAN CARR, TAO JU

ACM Transactions on Graphics (Proc. SIGGRAPH 2022)

Optimizing Global Injectivity for Constrained Parameterization

XINGYI DU, DANNY M. KAUFMAN, QINGNAN ZHOU, SHAHAR Z. KOVALSKY, YAJIE YAN, NOAM AIGERMAN, TAO JU

ACM Transactions on Graphics (Proc. SIGGRAPH Asia 2021)

Boundary-Sampled Halfspaces: A New Representation for Constructive Solid Modeling

Xingyi Du, Qingnan Zhou, Nathan Carr, Tao Ju

ACM Transactions on Graphics (Proc. SIGGRAPH 2021)

Lifting Simplices to Find Injectivity

Xingyi Du, Noam Aigerman, Qingnan Zhou, Shahar Kovalsky, Yajie Yan, Danny M. Kaufman, Tao Ju

ACM Transactions on Graphics (Proc. SIGGRAPH 2020)

Field-Aligned Isotropic Surface Remeshing

Xingyi Du, Xiaohan Liu, Dong-Ming Yan, Caigui Jiang, Juntao Ye, Hui Zhang

Computer Graphics Forum (Proc. Eurographics 2018)

Quad Mesh Generation via Field-Aligned Centroidal Voronoi Tessellation

Xingyi Du, Dong-Ming Yan, Juntao Ye, Hui Zhang

China CAD&CG (Proc. China CAD&CG 2017)

Research Projects

Implicit Shape Modeling

Collaboration: WashU, Adobe Research   *2020 - ongoing*

- Beyond a single implicit function (e.g., SDF), multi-function implicit representations better capture sharp features, surface segmentations, and spatial decompositions, thus facilitating higher-level shape understanding and editing. We proposed a novel representation for solid shapes with piecewise smooth surfaces (e.g., mechanical parts, furnitures, architectures). Compared to the traditional Constructive Solid Geometry (CSG), our representation is intuitive to understand and edit. It also simplifies the reverse engineering process (3D reconstruction from meshes or point clouds).
- Shape modeling using multiple implicit functions often needs to extract the mesh of a network of implicit surfaces. We proposed a unified approach to meshing two common types of implicit surface networks (implicit arrangement and material interfaces). Leveraging a novel robust predicate, our approach guarantees the correct combinatorial structure of the surface network and is tens of times faster than existing methods.
- Paper "Boundary-Sampled Halfspaces: A New Representation for Constructive Solid Modeling" is accepted to Siggraph 2021.
- Paper "Robust Computation of Implicit Surface Networks for Piecewise Linear Functions" is accepted to Siggraph 2022.
- Paper "Adaptive Grid Generation for Discretizing Implicit Complexes" is accepted to Siggraph 2024.

Injective Mapping under Constraints

Collaboration: WashU, Adobe Research, Meta Reality Labs   *2018 - ongoing*

- Many graphics applications (e.g., texture mapping, deformation, simulation) require one-to-one (injective) mapping of a mesh to another domain, possibly under positional constraints, such as a prescribed boundary or handles. We proposed novel energies that measure the non-injectivity of a mapping. The energies are simple to optimize, and their global minima have provable injectivity guarantees. Optimizing our energies produces injective mappings with a high success rate while satisfying positional constraints.
- Developed customized projected-Newton solvers for efficient optimization of our energies.
- Constructed two benchmark datasets (each containing thousands of meshes) for evaluating state-of-art injective mapping methods.
- Generalized the energies to produce injective mappings with low isometric distortion.
- Paper "Lifting Simplices to find Injectivity" is accepted to Siggraph 2020.
- Paper "Optimizing Global Injectivity for Constrained Parameterization" is accepted to Siggraph Asia 2021.
- Paper "Isometric Energies for Recovering Injectivity in Constrained Mapping" is accepted to Siggraph Asia 2022.
- The PhD dissertation "Injective Mapping under Constraints" won 2023 Turner Dissertation Award.

High Quality Surface Remeshing

Collaboration: Tsinghua University, Chinese Academy of Sciences   *2016 - 2018*

- Generating high-quality meshes or improving the quality of existing ones is crucial for many applications. We proposed a new approach for triangular remeshing by aligning mesh edges to a directional field. The resulting mesh has better angle quality and fewer singularity artifacts. We also extended the approach to generate quad-dominant meshes.
- Paper "Quad Mesh Generation via Field-Aligned Centroidal Voronoi Tessellation" is accepted to China CAD&CG 2017.
- Paper "Field-Aligned Isotropic Surface Remeshing" is accepted to Eurographics 2018.

Work Experience

Senior Researcher   *Tencent America LLC*

SENIOR RESEARCHER   *From August 2023*

- Developed industrial-grade occluder generation pipeline for game occlusion culling.
- Developed key sub-modules for LOD generation system in game assets.
- Optimized remeshing algorithms for Hierarchical LOD generation pipeline.

Computer Graphics and Geometry Processing   *Washington University in St. Louis*

RESEARCH ASSISTANT   *August 2018 - August 2023*

- Conducted advanced research on injective mapping under constraints and implicit shape modeling, developing novel algorithms and mathematical formulations to solve fundamental problems in computer graphics.

Meshing of Implicit Surface Networks   *Adobe Inc.*

INTERN - RESEARCH ENGINEER   *May - August, 2022*

- Developed a robust and efficient algorithm for meshing the network of multiple implicit surfaces, such as arrangements and material interfaces.

Shape Modeling using Implicit Representations   *Adobe Inc.*

RESEARCH INTERN   *May - August, 2021*

- Developed an interactive 3D modeling software based on our novel solid shape representation, which allows users to create 3D models from a set of parametric primitive shapes and a sparse set of points.

Morphable Human Face Reconstruction from RGB-D Images   *MEGVII (Face++) Research*

RESEARCH INTERN   *June - September, 2017*

- Developed a pipeline to reconstruct 3D mesh models of human faces from RGB-D images. The pipeline first converts RGB-D images to point clouds, then aligns face mesh models to the point clouds using Iterative Closest Point, and finally reduces reconstruction error by deforming the mesh models through numerical optimization. The reconstructed meshes are used to construct a 3D Morphable Model (3DMM) of human faces, which supports various face-related graphics and vision tasks.

Academic Activities

PEER REVIEW

2022-26	**Reviewer**, Siggraph and Siggraph Asia (ACM Transactions On Graphics)
2024	**Reviewer**, IEEE Transactions on Visualization and Computer Graphics
2023-24	**Reviewer**, Computer-Aided Design
2020	**Reviewer**, Computers & Graphics
2020	**Reviewer**, Solid and Physical Modeling (SPM)

TEACHING

2020	**TA**, CSE554: Geometric Computing for Bio-medicine	*WashU*
2019	**TA**, CSE546: Computational Geometry	*WashU*
2016	**TA**, Digital Media I: Graphics and Animation	*Tsinghua*

TALKS

2022	**Institute of Automation, Chinese Academy of Sciences**, 3D shape modeling and geometric computing based on multi-function implicit representations
2022	**Dynamic Graphics Project Lab, University of Toronto**, Shape Modeling using multiple implicit functions
2024	**GAMES (Graphics And Mixed Environment Symposium) Webinar**, Robust Computation of Implicit Surface Networks for Piecewise Linear Functions

Skills

Programming	C++ (5+ years in research/intern projects), Python, Mathematica (for prototyping)
Math	Linear Algebra, Calculus, Probability /Statistics, Numerical optimization