

# Xiangru Huang

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## RESEARCH AREA

- **Geometry Processing.** Applying robust optimization and machine learning techniques to geometry processing tasks including map synchronization, shape correspondence, shape generation and semantic segmentation.
- **3D vision.** Combining concepts and techniques from geometry processing to develop 3D vision algorithms and neural architectures that respect geometric priors and motion information for point cloud (sequence) data.
- **Efficient Optimization.** Developing and analyzing efficient optimization algorithms for machine learning problems that enjoy orders of magnitude speed up.

## EDUCATION

### University of Texas at Austin

- Doctor of Philosophy (Ph.D.) in Computer Science Aug 2014 – Dec 2020
- Thesis: Learning to Optimize for Geometry Reconstruction and Understanding

### Shanghai JiaoTong University

- Bachelor of Science (B.S.) in Computer Science. Sep 2009 – Jul 2013
  - [ACM Honored Class](#)

## WORK EXPERIENCE

### MIT Geometric Data Processing Group

- Postdoc Associate (working on geometry processing and 3D vision) Apr 2021 – Now
  - Supervisor: Justin Solomon

### Google

- Software Engineering Intern, Faster Training Team, Mountain View Jun 2018 – Aug 2018
  - Project: Efficiency Analysis of Gradient Descent: Deep Learning and Beyond
  - Supervisors: Hossein Mobahi and Shankar Krishnan

### eBay

- Research PhD Internship, New Product Development, San Jose. May 2017 – Aug 2017
  - Project: Bilingual Semantic Sequence Embedding Modeling Between Chinese and English.
  - Supervisors: Mingkuan Liu and Alan Lu

### Nanyang Technological University

- Research Assistant, Division of Mathematical Sciences Aug 2013 – Jul 2014
  - Project: Trial and Error in Influential Social Networks; game theoretical model of network formation
  - Supervisors: Professor Ning Chen and Xiaohui Bei

## TALKS

- **Learning from Unlabeled LiDAR Point Cloud Sequences** Oct 2022  
UIUC vision seminar.
- **Learning to Optimize for Geometry Reconstruction and Understanding** Nov 2021  
TechBeat [\[website\]](#).
- **Learning to Optimize for Geometry Reconstruction and Understanding** Mar 2021  
GAMES Webinar [\[video\]](#).
- **Translation Synchronization via Truncated Least Squares** Dec 2017  
Neurips 2017 Spotlight Presentation.
- **Dual Decomposed Learning with Factorwise Oracle for Structural SVM of Large Output Domain**  
Dec 2016  
NeurIPS workshop on Extreme Classification [\[website\]](#).

## PUBLICATIONS ON 3D VISION

- **LiDAR-Based 3D Object Detection via Hybrid 2D Semantic Scene Generation**  
Haitao Yang, Zaiwei Zhang, [Xiangru Huang](#), Min Bai, Bo Sun, Li Erran Li, Qixing Huang  
*In submission*
- **Surface Representation in Real Scenes**  
Haoxi Ran, [Xiangru Huang](#), Vitor Guizilini, Yue Wang  
*In submission*
- **Representation Learning for Object Detection from Unlabeled Point Cloud Sequences**  
[Xiangru Huang](#), Yue Wang, Vitor Guizilini, Rares Ambrus, Adrien Gaidon and Justin Solomon.  
*CoRL 2022*

**PUBLICATIONS  
ON  
GEOMETRY  
PROCESSING**

- **Hybrid Geometric Primitives for Point Clouds**  
Xiangru Huang\*, Marianne Arriola\*, Yue Wang, Vitor Guizilini, Rares Ambrus, and Justin Solomon. (Equal Contribution)  
*In submission*
- **ARAPReg: An As-Rigid-As Possible Regularization Loss for Learning Deformable Shape Generators**  
Bo Sun, Xiangru Huang, Zaiwei Zhang, Junfeng Jiang, Qixing Huang, and Chandrajit Bajaj.  
*ICCV 2021*
- **Dense Human Correspondence via Learning Transformation Synchronization on Graphs**  
Xiangru Huang, Haitao Yang, Etienne Vouga and Qixing Huang.  
*Neurips 2020*
- **Uncertainty Quantification for Multi-scan Registration**  
Xiangru Huang, Zhenxiao Liang and Qixing Huang.  
*SIGGRAPH 2020*
- **Learning Transformation Synchronization**  
Xiangru Huang, Zhenxiao Liang, Xiaowei Zhou, Yao Xie, Leonidas Guibas, and Qixing Huang.  
*CVPR 2019*
- **Joint Map and Symmetry Synchronization**  
Yifan Sun\*, Zhenxiao Liang\*, Xiangru Huang\*, and Qixing Huang  
*ECCV 2018*
- **Translation Synchronization via Truncated Least Squares**  
Xiangru Huang\*, Zhenxiao Liang\*, Chandrajit Bajaj and Qixing Huang (\* equal contribution).  
*NIPS 2017, Spotlight Presentation*

**PUBLICATIONS  
ON  
EFFICIENT  
OPTIMIZATION**

- **PPDSparse: A Parallel Primal and Dual Sparse Method to Extreme Classification**  
Ian E.H. Yen, Xiangru Huang, Wei Dai, Pradeep Ravikumar, Inderjit S. Dhillon and Eric P. Xing. *KDD 2017*
- **Greedy Direction Method of Multiplier for MAP Inference of Large Output Domain**  
Xiangru Huang, Ian En-Hsu Yen, Ruohan Zhang, Qixing Huang, Pradeep Ravikumar and Inderjit Dhillon.  
*AISTATS 2017*
- **Dual Decomposed Learning with Factorwise Oracle for Structural SVM of Large Output Domain**  
Ian En-Hsu Yen, Xiangru Huang, Kai Zhong, Ruohan Zhang, Pradeep Ravikumar and Inderjit Dhillon. *NIPS 2016*
- **PD-Sparse: A Primal and Dual Sparse Approach to Extreme Multiclass and Multilabel Classification**  
Ian En-Hsu Yen\*, Xiangru Huang\*, Kai Zhong, Pradeep Ravikumar and Inderjit Dhillon (\* equal contribution). *ICML 2016*

**MISCELLANEOUS  
PUBLICATIONS**

- **Applying deep learning to the cache replacement problem**  
Zhan Shi, Xiangru Huang, Akanksha Jain, Calvin Lin  
*MICRO 2019*
- **Trial and Error in Influential Social Networks**  
Xiaohui Bei, Ning Chen, Liyu Dou, Xiangru Huang, Ruixin Qiang, (ordered alphabetically by last name).  
*KDD 2013*

## SELECTED RESEARCH PROJECTS

- **Learning from Unlabeled LiDAR Point Cloud Sequences (CoRL 2022)**  
Point cloud sequence is a natural data modality that is underexplored. Due to high annotation expense, there is a large number of unlabeled LiDAR point cloud sequences. We developed unsupervised and self-supervised algorithms that can learn from unlabeled sequences for object detection task, achieving state-of-the-art performance.
- **Learning Transformation Synchronization (CVPR 2019)**  
Transformation Synchronization is a crucial step of 3D reconstruction. The major challenge in designing algorithms for this task is to tolerate unexpected errors. Existing algorithms guarantee exact recovery for certain prior error distributions such as i.i.d. gaussian or a very small fraction of arbitrary error, which hugely deviates from real-world error distribution. We propose to apply learning techniques to detect and prune unexpected error, which greatly advances previous approaches that use hand-crafted heuristic objective functions. We demonstrate that our approach can work even for extremely noisy input data with a dominating fraction ( $> 70\%$ ) of outliers.
- **Efficient Extreme Multiclass Classification (ICML 2016)**  
Multiclass classification of huge number of classes is still a challenge. Standard multiclass methods can hardly scale to  $K > 10^3$  where  $K = \text{\#classes}$ . Other state-of-the-art methods such as tree-hierarchical approach and low-rank approach loses test accuracy significantly when their assumptions are not satisfied. We observe that dual sparsity are natural since each sample has only "few confusing classes". Further adding L1-regularization can guarantee primal sparsity. Therefore, we propose a variant of Block-Coordinate Frank-Wolfe algorithm with fast greedy oracle that can simultaneously leverage the primal and dual sparsity. On problems of  $K > 10^3$ , without sacrificing accuracy, the proposed method can be orders of magnitude faster than existing methods, and also achieve running space and model size sublinear to the number of classes and features.

## MENTORING

- **MIT Summer Research Program (MSRP)** Jun 2022 – Aug 2022  
Hybrid Geometric Primitives for point clouds.
- **Summer Geometry Initiative (SGI 2022)** summer 2022  
Data augmentation for 3D point cloud data.
- **Summer Geometry Initiative (SGI 2021)** summer 2021  
Extract motion information from unlabeled point cloud sequences.

## TEACHING

- **CS311 Discrete Math** Fall 2014  
Teaching Assistant.
- **CS345 Programming Languages** Spring 2015  
Teaching Assistant.
- **CS371p Object-Oriented Programming** Fall 2015  
Teaching Assistant.
- **CS324E Elements of Graphics** Spring and Fall 2016  
Teaching Assistant.
- **CS395T Numerical Optimization for Graphics and AI** Fall 2017 and 2018  
Teaching Assistant.

## AWARDS

- University of Texas at Austin Graduate School Summer Fellowship 2019
- 2nd class Academic Excellence Scholarship in Shanghai JiaoTong University 2012
- 2nd class award of National Olympiad in Informatics (NOI) in China 2007

**PROGRAMMING SKILLS** C++, Matlab, Python, Tensorflow, PyTorch, Java, CUDA.