Tzu-Mao Li

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https://people.csail.mit.edu/tzumao/ https://github.com/BachiLi/

Research Areas

- Visual Computing
  - Light Transport Simulation
  - Inverse Rendering
  - Computational Photography
- Programming Systems
  - Automatic Differentiation
  - Domain-Specific Compilers
- Statistical Learning
  - Differentiable Programming
  - Monte Carlo Integration and Markov Chain Monte Carlo Methods

Education

Massachusetts Institute of Technology   **Cambridge, Massachusetts, United States**
    Ph.D.: *Computer Science*   *Sep 2014 - June 2019*
      Advisor: Frédo Durand

      Thesis: Differentiable Visual Computing
National Taiwan University   **Taipei, Taiwan**
    Master of Science: *Computer Science and Information Engineering*   *Sep 2011 - June 2013*
      Advisor: Yung-Yu Chuang

      Thesis: SURE-Based Optimization for Adaptive Sampling and Reconstruction
    Bachelor of Science: *Computer Science and Information Engineering*   *Sep 2007 - June 2011*

Work Experience

Assistant Professor at **UC San Diego**, San Diego, United States   *July 2021 -*

Postdoctoral Researcher at **UC Berkeley**, Berkeley, United States   *July 2019 - Now*
    Host: Jonathan Ragan-Kelley.

Research Internship at **Facebook Reality Labs**, Seattle, United States   *Jun 2018 - Aug 2018*
    I worked on applying differentiable rendering for material and light reconstruction from RGBD photos.

Research Internship at **NVIDIA Research**, Seattle, United States   *Jun 2017 - Aug 2017*
    I worked on a differentiable renderer.

Rendering Internship at **Weta Digital**, Wellington, New Zealand   *Jun 2016 - Aug 2016*
    I worked on the Manuka renderer.

Alternative Military Service at **National Palace Museum**, Taipei, Taiwan   *Aug 2013 - Jul 2014*

Internship at **Digimax**, Taipei, Taiwan   *Jul 2011 - Sep 2011*
    I developed an environment light editing system and implemented a physically-based hair shader.

Teaching Experience

Teaching Assistant at **Massachusetts Institution of Technology**, Cambridge, United States   *Fall 2017*
    Course: Digital and Computational Photography (6.815). Around 65 undergraduate and graduate students.
    I helped designing problem sets, grading, and holding office hours.
    Students were asked to write C++ image processing programs.

Teaching Assistant at **National Taiwan University**, Taipei, Taiwan   *Spring 2012*

Course: Compiler Design. Around 100 undergraduate students.
I helped designing problem sets, exams, grading, and holding office hours.
Students were asked to implement a compiler in Java that compiles a subset of C.

Publications

Unbiased Warped-Area Sampling for Differentiable Rendering

Sai Praveen Bangaru, **Tzu-Mao Li**, Frdo Durand
ACM Transactions on Graphics (Proceedings of SIGGRAPH Asia 2020)

Differentiable Vector Graphics Rasterization for Editing and Learning

Tzu-Mao Li, Michal Luk, Michal Gharbi, Jonathan Ragan-Kelley
ACM Transactions on Graphics (Proceedings of SIGGRAPH Asia 2020)

Physics-Based Differentiable Rendering: A Comprehensive Introduction

Shuang Zhao, Wenzel Jakob, **Tzu-Mao Li**
SIGGRAPH 2020 Course

DiffTaichi: Differentiable Programming for Physical Simulation

Yuanming Hu, Luke Anderson, **Tzu-Mao Li**, Jonathan Ragan-Kelley, Frédo Durand
International Conference on Learning Representation 2020

Taichi: A Language for High-Performance Computation on Spatially Sparse Data Structures

Yuanming Hu, **Tzu-Mao Li**, Luke Anderson, Jonathan Ragan-Kelley, Frédo Durand
ACM Transactions on Graphics (Proceedings of SIGGRAPH Asia 2019)

Learning to Optimize Halide with Tree Search and Random Programs

Andrew Adams, Karima Ma, Luke Anderson, Riyadh Baghdadi, **Tzu-Mao Li**, Michaël Gharbi,
Benoit Steiner, Steven Johnson, Kayvon Fatahalian, Frédo Durand, Jonathan Ragan-Kelley
ACM Transactions on Graphics (Proceedings of SIGGRAPH 2019)

Sample-based Monte Carlo Denoising using a Kernel-Splatting Network

Michaël Gharbi, **Tzu-Mao Li**, Jaakko Lehtinen, Frédo Durand
ACM Transactions on Graphics (Proceedings of SIGGRAPH 2019)

Inverse Path Tracing for Joint Material and Lighting Estimation

Dejan Azinović, **Tzu-Mao Li**, Anton Kaplanyan, Matthias Nießner
Conference on Computer Vision and Pattern Recognition 2019 (oral presentation)

Differentiable Monte Carlo Ray Tracing through Edge Sampling

Tzu-Mao Li, Miika Aittala, Frédo Durand, Jaakko Lehtinen
ACM Transactions on Graphics (Proceedings of SIGGRAPH Asia 2018)

Differentiable Programming for Image Processing and Deep Learning in Halide

Tzu-Mao Li, Michaël Gharbi, Andrew Adams, Frédo Durand, Jonathan Ragan-Kelley
ACM Transactions on Graphics (Proceedings of SIGGRAPH 2018)

Aether: An Embedded Domain Specific Sampling Language for Monte Carlo Rendering

Luke Anderson, **Tzu-Mao Li**, Jaakko Lehtinen, Frédo Durand
ACM Transactions on Graphics (Proceedings of SIGGRAPH 2017)

Anisotropic Gaussian Mutations for Metropolis Light Transport through Hessian-Hamiltonian Dynamics

Tzu-Mao Li, Jaakko Lehtinen, Ravi Ramamoorthi, Wenzel Jakob, Frédo Durand
ACM Transactions on Graphics (Proceedings of SIGGRAPH Asia 2015)

Dual-Matrix Sampling for Scalable Translucent Material Rendering

Yu-Ting Wu, **Tzu-Mao Li**, Yu-Hsun Lin, Yung-Yu Chuang
IEEE Transactions on Visualization and Computer Graphics, 2015

SURE-Based Optimization for Adaptive Sampling and Reconstruction

Tzu-Mao Li, Yu-Ting Wu, Yung-Yu Chuang

ACM Transactions on Graphics (Proceedings of SIGGRAPH Asia 2012)

Invited Talks

Beyond Convolutional Neural Networks: Differentiable Visual Computing
University of British Columbia, April 2020
University of Texas at Austin, April 2020
Cornell University, April 2020
University of California, San Diego, April 2020
Columbia University, March 2020
Brown University, Feburary 2020

Differentiable, Optimizable, and Retargetable Array Programming with Halide and Taichi
Magic Leap, Sunnyvale, Nov. 2019

Differentiable Visual Computing or
Differentiable Programming for Computer Graphics and Deep Learning
University of California, Berkeley, Oct. 2019 and Sep. 2019
Adobe Research, San Jose, Sep. 2019
National Taiwan University, Taipei, Nov. 2018

Hessian-Hamiltonian Monte Carlo Rendering
MCQMC 2016, Stanford
(12th International Conference on Monte Carlo and Quasi-Monte Carlo Methods in Scientific Computing)

Open-source software

redner: https://github.com/BachiLi/redner
A differentiable Monte Carlo path tracer with PyTorch and TensorFlow interfaces, that can differentiate with respect to arbitrary scene parameters, while taking geometric discontinuities into account. I wrote most of the code.

Halide: https://github.com/halide/Halide/
A domain-specific language for image and array processing. I helped maintenance, added automatic differentiation and atomic operation to the language, and developed automatic schedulers for optimizing Halide programs.

dpt: https://github.com/BachiLi/dpt/
A differentiable bidirectional path tracer that can compute Hessian of light path contribution with respect to path parameters. It implements our Hessian-Hamiltonian Monte Carlo Rendering algorithm. I wrote all of the code.

had: https://github.com/BachiLi/had/
A header-only automatic differentiation library, based on operator overloading, that implements the edge-pushing algorithm for Hessian computation. I wrote most of the code.

Aether: https://github.com/aekul/aether
An embedded domain-specific language for Monte Carlo rendering. I helped Luke Anderson with the development.

Professional Services

Program Committee:
Eurographics Symposium on Rendering 2020
SIGGRAPH 2021

Reviewer:
SIGGRAPH, SIGGRAPH Asia
Transaction on Graphics

Eurographics
Eurographics Symposium on Rendering
Pacific Graphics
Transactions on Pattern Analysis and Machine Intelligence
Computer Graphics Forum
The Visual Computer
High-Performance Graphics
Transactions on Visualization and Computer Graphics
Journal of Parallel and Distributed Computing

Languages

Chinese (native speaker), English, Japanese

References

Frédo Durand
Professor, Massachusetts Institute of Technology
fredo@mit.edu

Jonathan Ragan-Kelley
Assistant Professor, University of California, Berkeley
jrk@berkeley.edu

Jaakko Lehtinen
Associate Professor, Aalto University, Principal Research Scientist, NVIDIA Research
jaakko.lehtinen@aalto.fi

Ravi Ramamoorthi
Professor, University of California, San Diego
ravir@cs.ucsd.edu

Yung-Yu Chuang
Professor, National Taiwan University
cyy@csie.ntu.edu.tw