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PH. D.

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EDUCATION

Columbia University in the City of New York, New York, NY

Ph. D., Department of Computer Science, Jul. 12th, 2019

Thesis: Multi-Scale Models to Simulate Interactions between Liquid and Thin Structures

Advisors: Prof. Eitan Grinspun and Prof. Changxi Zheng

Columbia University in the City of New York, New York, NY

M. Sc., Department of Computer Science, Dec. 31th, 2014

Advisor: Prof. Changxi Zheng

Tsinghua University, Beijing, China

B. Eng., School of Software, Jul. 31th, 2013

Thesis: Research on GPU Acceleration of Incompressible Smoothed Particle Hydrodynamics and Applications

Advisor: Prof. Bin Wang

RESEARCH INTERESTS

- Physics-based animation and rendering of hairs, clothes, water, snow, sand and other complex phenomena
- Computing architectures and hardware (e.g., GPU) for the acceleration.

SKILLS

- Expertise on GPU programming with CUDA/OpenCL and OpenGL/DirectX/Vulkan
- Experienced with state-of-the-art research on physics simulation and real-time rendering
- Comprehensive understanding of C/C++, Python
- Familiar with deep learning and TensorFlow.
- Familiar with Unreal Engine and Houdini

HONORS AND AWARDS

- Honorable Mentions in the ACM SIGGRAPH Doctoral Dissertation Award, 2020
- Teaching Assistant Fellowship, Columbia University, 2014–2015.
- Excellent Graduation Thesis in Tsinghua University ranked 1st in department, 2013.
- Winning Prize in NVIDIA CUDA Programming Contest, 2012.
- Student Research Competition Semi-finalist Star in ACM SIGGRAPH 2012.
- 2nd Scholarship in Tsinghua University, 2009.
- 2nd Prize in the Great Challenge Champion in Tsinghua University, 2009.

WORK EXPERIENCE

Research Scientist, Sep. 2019 — Present

Tencent, Santa Monica, CA

- Explored combining deep learning with physics simulation
- Developed massive-scale physics simulation system on the GPU
- Integrated new simulation and rendering techniques into the production workflows of multiple video games

Research Intern, 2018 Summer

Pixar Animation Studios, Emeryville, CA

- Developed a workflow and corresponding algorithms to model and simulate complex rod assemblies.

Simulation Intern, 2017 Summer

Weta Digital, Wellington, New Zealand

- Developed a framework to simulate wet hairs, which has been used in the production of Alita: Battle Angel.

Research Assistant, 2015 Summer

Adobe Research, Seattle, WA

- Developed a tool for interactive character animation.

Software Engineer, Intern, 2014 Summer

NVIDIA, Santa Clara, CA

- Contributed to Regal, a framework enhancing the compatibility of modern OpenGL drivers.

Part-time Software Developer, Intern, 2012 Fall

GE Healthcare, Beijing, China

- Developed a tool for the layout verification during the installation of X-Ray machines.

Software Engineer, Intern, 2011 Summer

Microsoft Research Asia, Beijing, China

- Prototyped for real-time 1080p 3D teleconference; developed a real-time stereo matching framework for outdoors environment.

TEACHING EXPERIENCE

Columbia University, New York, NY

Teaching Assistant, 2014–2018

System maintenance and software development for *Physics-based Computer Animation* (COMS 4167), 2014–2018.

Instruct students in *Computer Graphics* (COMS W4160), 2015.

Tsinghua University, Beijing, China

Teaching Assistant, 2012–2013

In charge of the course The Fundamental of Computer Graphics, introduced both industrial and academic graphics techniques in video games and designed assignments about GPU programming.

MEDIA COVERAGES

Movement and Flow: Simulating Complexity of Fluids and Strands in the Virtual World

Association for Computing Machinery, Oct. 10th, 2019

https://www.eurekalert.org/pub_releases/2019-10/afcm-maf103119.php

This is How You Simulate Making Pasta

Two Minute Papers, Sep. 24th, 2019

<https://youtu.be/uVC5WowQxD8>

Those Dazzling Tricks in Alita: Battle Angel (in Chinese)

GeekiMovie, Feb. 23th, 2019

<https://mp.weixin.qq.com/s/ZnYBhbiC2DPziL1AjVQoMw>

Digital Wringing out of Wet Towels (in German)

Deutschlandfunk, Nov. 17th, 2018

https://www.deutschlandfunk.de/computergrafik-digitales-auswringen-von-nassen-handtuechern.684.de.html?dram:article_id=433457

Want to Simulate the Effect of Super-realistic Water-soaked Fabric? Look at the Results of this Research! (in Chinese)

CG World, May. 31st, 2018

<http://mp.163.com/v2/article/detail/DJ4GV1CO0516BJGJ.html>

The Coolest Tech Demos from SIGGRAPH 2017

PC Gamer, Aug. 08th, 2017

<https://www.pcgamer.com/the-coolest-tech-demos-from-siggraph-2017/>

Videos: the Best of SIGGRAPH 2017's Technical Papers

CG Channel, Jun. 19th, 2017

<http://www.cgchannel.com/2017/06/videos-the-best-of-siggraph-2017s-technical-papers/>

A Multi-Scale Model for Simulating Liquid-Hair Interactions

80.lv, Jun. 15th, 2017

<https://80.lv/articles/a-multi-scale-model-for-simulating-liquid-hair-interactions/>

Simulating Liquid-Hair Interactions

Two Minute Papers, May. 20th, 2017

<https://youtu.be/ugdciqeOPeM>

PUBLICATIONS

Solver-in-the-Loop: Learning from Differentiable Physics to Interact with Iterative PDE-Solvers

Kiwon Um, Yun (Raymond) Fei, Philipp Holl, Robert Brand, Nils Thuerey

Arxiv:2007.00016, June 2020.

A Multi-Scale Model for Coupling Strands with Shear-Dependent Liquid

Yun (Raymond) Fei, Christopher Batty, Eitan Grinspun and Changxi Zheng.

ACM Transactions on Graphics (SIGGRAPH ASIA 2019), Volume 38 Issue 6, November 2019.

Mechanics-Aware Modeling of Cloth Appearance

Zahra Montezeri, Chang Xiao, Yun (Raymond) Fei, Changxi Zheng and Shuang Zhao.
IEEE Transactions on Visualization and Computer Graphics, pp. 1–14, August 2019.

A Multi-Scale Model for Simulating Liquid-Fabric Interaction

Yun (Raymond) Fei, Christopher Batty, Eitan Grinspun and Changxi Zheng.
ACM Transactions on Graphics (SIGGRAPH 2018), Volume 37 Issue 4, August 2018.

A Multi-Scale Model for Simulating Liquid-Hair Interaction

Yun (Raymond) Fei, Henrique Maia, Christopher Batty, Changxi Zheng and Eitan Grinspun.
ACM Transactions on Graphics (SIGGRAPH 2017), Volume 36 Issue 4, July 2017.

Interactive Acoustic Transfer Approximation for Modal Sound

Dingzeyu Li, Yun (Raymond) Fei, and Changxi Zheng.
ACM Transactions on Graphics (SIGGRAPH 2016), Volume 35 Issue 1, December 2015.

Computational Design of Metallophone Contact Sounds

Gaurav Bharaj, David Levin, James Tompkin, Yun Fei, Hanspeter Pfister, Wojciech Matusik, and Changxi Zheng.
ACM Transactions on Graphics (SIGGRAPH Asia 2015), 2015.

Parallelize L-BFGS-B on the GPU

Yun Fei, Guodong Rong, Bin Wang and Wenping Wang.
Computers & Graphics, pp. 1–9, Volume 40, May 2014.

Towards Photo Watercolorization with Artistic Verisimilitude

Miaoyi Wang, Bin Wang, Yun Fei, Kang-lai Qian and Wenping Wang.
IEEE Transactions on Visualization and Computer Graphics, pp. 1–10, Feb. 2014.

Bilateral Blue Noise Sampling

Jiating Chen, Xiaoyin Ge, Li-Yi Wei, Bin Wang, Yusu Wang, Huamin Wang, Yun Fei, Kang-lai Qian, Jun-hai Yong and Wenping Wang.
ACM Transactions on Graphics (SIGGRAPH Asia 2013), Volume 32 Issue 6, Nov. 2013.

Research on GPU Acceleration of Incompressible Smoothed Particle Hydrodynamics and Applications

Bachelor Thesis of Tsinghua University (in Chinese), pp. 1–68, 2013.

Point-Tessellated Voxelization

Yun Fei, Bin Wang, and Jiating Chen.
Proceedings of Graphics Interface 2012, pp. 9–18, 2012.

FILM CREDIT

Alita: Battle Angel

Research & Development. Directed by Robert Rodriguez. 2019; 20th Century Fox, Lightstorm Entertainment and Troublemaker Studios.
<https://www.imdb.com/name/nm10481123/>

OPEN SOURCE REPOSITORIES

CreamyStrand

<https://github.com/nepluno/creamystrand>

An open source project for the physical simulation of the coupling between hairs and shear-dependent liquid, which contains the following parts:

- A strand simulator adapted from the code of ADONIS (<http://www.cs.columbia.edu/cg/adonis/>), which adopts discrete elastic rods and nonlinear integration to simulate hairs.
- A bulk liquid simulator for both shear-dependent and Newtonian liquid, discretized with augmented, moving least squares material point method (AMLS-MPM).
- A reduced-dimensional flow simulator that handles shear-dependent liquid on a strand's surface.
- A framework coupling the dynamics between strands, the bulk liquid, and reduced-dimensional flows.

libWetCloth

<https://github.com/nepluno/libwetcloth>

An open source project for the physical simulation of liquid and wet cloth or yarns, which contains the following parts:

- A liquid simulator implementing the affine-particle-in-cell method.
- A cloth simulator implementing the elastic thin shell model.
- A yarn simulator implementing the discrete viscous thread model.
- A cloth/yarn collision handler based on anisotropic elastoplasticity, discretized with augmented, moving least squares material point method (AMLS-MPM).
- A two-way coupling method based on mixture theory, between the cloth, yarn and liquid, handling dragging, buoyancy, capturing and dripping effect.

libWetHair

<https://github.com/nepluno/libWetHair>

An open source project for the physical simulation of Newtonian liquid and wet hairs, which contains the following parts:

- A liquid simulator implementing the affine-particle-in-cell method.
- A hair simulator implementing the elastic rods model.
- A reduced-liquid simulator for the simulation of flow on hairs.
- Cohesion effects between the hairs
- Coupling between the hairs and liquid, including dragging, capturing and dripping effect.

Note: The code in this repository has been re-implemented for Alita: Battle Angel (and possibly more movies) made by Weta Digital.

L-BFGS-B-GPU

<https://github.com/nepluno/lbfgsb-gpu>

An open source project implementing the limited memory Broyden-Fletcher-Goldfarb-Shanno algorithm with boundaries (L-BFGS-B) on the GPU. L-BFGS-B is a popular algorithm in nonlinear optimization, which is also at the heart of many algorithms in engineering. In this repository, a parallelized implementation of L-BFGS-B on the GPU is introduced, where we demonstrate its significant speed-up for practical applications.

SPH-Lloyd-3D

<https://github.com/nepluno/sph-lloyd-3d>

The repository contains C++ code and GPU shaders that perform Lloyd's relaxation for point sampling inside given 3D meshes. This functionality is often used for preparing data for physics simulations using particles.

APIC2D

<https://github.com/nepluno/apic2d>

An educational project to illustrate the affine-particle-in-cell algorithm in 2D, for water simulation.

BilateralBlueNoise

<https://github.com/nepluno/bilateralbluenoise>

This repository demonstrates the dart throwing and kernel-based relaxation of bilateral blue noise sampling on the GPU. Such sampling pattern is helpful for producing smooth rendering of caustics or accurate surface reconstruction.

PROFESSIONAL SERVICES

- Paper Reviewer, SIGGRAPH 2020
- Paper Reviewer, SIGGRAPH Asia 2019
- Paper Reviewer, SIGGRAPH 2019
- Paper Reviewer, SIGGRAPH Asia 2018
- Paper Reviewer, SIGGRAPH 2018
- Paper Reviewer, Eurographics 2020
- Paper Reviewer, Pacific Graphics 2019
- Paper Reviewer, Pacific Graphics 2018
- Paper Reviewer, Pacific Graphics 2017
- Paper Reviewer, ACM Transactions on Graphics
- Paper Reviewer, Computer Graphics Forum
- Paper Reviewer, Computer Animation & Virtual Worlds
- Paper Reviewer, Graphics Model
- Paper Reviewer, CAD/Graphics