Chen-Hsuan Lin

Research Scientist @ NVIDIA Research

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Research Interests

Computer vision − 3D reconstruction, view synthesis, neural rendering
Deep learning − self-supervised learning, generative modeling

Education

Carnegie Mellon University   Pittsburgh, PA, USA
Ph.D. in Robotics (School of Computer Science)   Aug. 2017 − Jun. 2021
- ○ Advisor: Simon Lucey
- ● Recipient of **NVIDIA Graduate Fellowship** (2019)
- ● Thesis: Learning 3D Registration and Reconstruction from the Visual World
- ● Thesis committee: Simon Lucey (chair), Deva Ramanan, Abhinav Gupta, Andrea Vedaldi

Carnegie Mellon University   Pittsburgh, PA, USA
M.S. in Robotics (School of Computer Science)   Aug. 2014 − Aug. 2016
- ○ Advisor: Simon Lucey
- ● Thesis: The Conditional Lucas & Kanade Algorithm

National Taiwan University   Taipei, Taiwan
B.S. in Electrical Engineering   Sep. 2009 − Jun. 2013
- ○ Advisor: Homer H. Chen

Research Experiences

NVIDIA Research   Santa Clara, CA, USA
Research Scientist   Aug. 2021 − present
- ○ Manager: Ming-Yu Liu
- ● Research in 3D reconstruction, 3D generation, and neural rendering [1][2]
- ● Co-lead in technical development of NVIDIA's text-to-3D generative AI service

Carnegie Mellon University   Pittsburgh, PA, USA
Graduate Research Assistant   Sep. 2014 − Jun. 2021
- ○ Advisor: Simon Lucey
- ● Learning registration and reconstruction of neural 3D scene representations [3]
- ● Self-supervised 3D shape reconstruction via differentiable and neural rendering [4] [9]
- ● Non-rigid 3D structure recovery from 2D keypoints of single objects [5][12]
- ● Structured optimization of image registration for visual tracking and recognition [8] [11] [13]
- ● Dense 3D reconstruction of faces from 2D self-captured monocular videos

Facebook AI Research (Meta AI)   Menlo Park, CA, USA
Research Intern   May 2019 − Aug. 2019
- ○ Mentors: Kaiming He, Georgia Gkioxari, Justin Johnson
- ● Learning 3D representations for improving 2D object detection systems

Adobe Research   Seattle, WA, USA
Research Intern   May 2018 – Nov. 2018
  ○ Mentors: Oliver Wang, Bryan Russell, Eli Shechtman, Vladimir Kim, Matthew Fisher
  ● Photometric optimization for 3D mesh reconstruction from RGB videos [6]

Adobe Research   Seattle, WA, USA
Research Intern   Apr. 2017 – Aug. 2017
  ○ Mentors: Eli Shechtman, Oliver Wang, Ersin Yumer
  ● Learning realistic geometric corrections of objects for image compositing [7]

National Taiwan University   Taipei, Taiwan
Undergraduate Research Assistant   Sep. 2011 – Aug. 2013
  ○ Advisor: Homer H. Chen
  ● Perceptual qualitative rate-distortion optimization for video compression

MediaTek Inc.   Hsinchu, Taiwan
Software Engineering Intern (computer vision)   Jul. 2012 – Sep. 2012
  ● Distributed algorithms for parallelized face detection on mobile devices

Publications

Conference Papers

[1] <u>Chen-Hsuan Lin</u>*, Jun Gao*, Luming Tang*, Towaki Takikawa*, Xiaohui Zeng*, Xun Huang, Karsten Kreis, Sanja Fidler[†], Ming-Yu Liu[†], and Tsung-Yi Lin
 Magic3D: High-Resolution Text-to-3D Content Creation
 In *IEEE Conference on Computer Vision and Pattern Recognition* (**CVPR**), 2023 (highlight)

[2] Zhaoshuo Li, Thomas Müller, Alex Evans, Russell H. Taylor, Mathias Unberath, Ming-Yu Liu, and <u>Chen-Hsuan Lin</u>
 Neuralangelo: High-Fidelity Neural Surface Reconstruction
 In *IEEE Conference on Computer Vision and Pattern Recognition* (**CVPR**), 2023

[3] <u>Chen-Hsuan Lin</u>, Wei-Chiu Ma, Antonio Torralba, and Simon Lucey
 BARF: Bundle-Adjusting Neural Radiance Fields
 In *IEEE International Conference on Computer Vision* (**ICCV**), 2021 (oral presentation)

[4] <u>Chen-Hsuan Lin</u>, Chaoyang Wang, and Simon Lucey
 SDF-SRN: Learning Signed Distance 3D Object Reconstruction from Static Images
 In *Conference on Neural Information Processing Systems* (**NeurIPS**), 2020

[5] Chaoyang Wang, <u>Chen-Hsuan Lin</u>, and Simon Lucey
 Deep NRS*f*M++: Towards Unsupervised 2D-3D Lifting in the Wild
 In *IEEE International Conference on 3D Vision* (**3DV**), 2020 (oral presentation)

[6] <u>Chen-Hsuan Lin</u>, Oliver Wang, Bryan C. Russell, Eli Shechtman, Vladimir G. Kim, Matthew Fisher, and Simon Lucey
 Photometric Mesh Optimization for Video-Aligned 3D Object Reconstruction
 In *IEEE Conference on Computer Vision and Pattern Recognition* (**CVPR**), 2019

[7] <u>Chen-Hsuan Lin</u>, Ersin Yumer, Oliver Wang, Eli Shechtman, and Simon Lucey
 ST-GAN: Spatial Transformer Generative Adversarial Networks for Image Compositing
 In *IEEE Conference on Computer Vision and Pattern Recognition* (**CVPR**), 2018

[8] Chaoyang Wang, Hamed Kiani Galoogahi, <u>Chen-Hsuan Lin</u>, and Simon Lucey
 Deep-LK for Efficient Adaptive Object Tracking
 In *IEEE International Conference on Robotics and Automation* (**ICRA**), 2018

[9] <u>Chen-Hsuan Lin</u>, Chen Kong, and Simon Lucey
Learning Efficient Point Cloud Generation for Dense 3D Object Reconstruction
In *AAAI Conference on Artificial Intelligence* (**AAAI**), 2018 (oral presentation)

[10] Rui Zhu, Chaoyang Wang, <u>Chen-Hsuan Lin</u>, Ziyan Wang, and Simon Lucey
Object-Centric Photometric Bundle Adjustment with Deep Shape Prior
In *IEEE Winter Conference on Applications of Computer Vision* (**WACV**), 2018

[11] <u>Chen-Hsuan Lin</u> and Simon Lucey
Inverse Compositional Spatial Transformer Networks
In *IEEE Conference on Computer Vision and Pattern Recognition* (**CVPR**), 2017 (oral presentation)

[12] Chen Kong, <u>Chen-Hsuan Lin</u>, and Simon Lucey
Using Locally Corresponding CAD Models for Dense 3D Reconstructions from a Single Image
In *IEEE Conference on Computer Vision and Pattern Recognition* (**CVPR**), 2017

[13] <u>Chen-Hsuan Lin</u>, Rui Zhu, and Simon Lucey
The Conditional Lucas & Kanade Algorithm
In *European Conference on Computer Vision* (**ECCV**), 2016

Patents

High-Resolution Neural 3D Surface Reconstruction from Video Capture   Nov. 2022
U.S. Patent Application No. 17/990614

3D Object Reconstruction using Photometric Mesh Representation   Sep. 2020
U.S. Patent No. 10769848

Image Composites using a Generative Adversarial Neural Network   Jul. 2020
U.S. Patent No. 10719742

Honors & Awards

Fellowships & Scholarships

- NVIDIA Graduate Fellowship   Dec. 2018
- Amazon Go Ph.D. Fellowship (declined)   Dec. 2018
- Study Abroad Scholarship, Ministry of Education, Taiwan   Jun. 2018

Awards & Prizes

- Top Poster Award finalist, NVIDIA GPU Technology Conference (**GTC**), 2020   Mar. 2020
- Outstanding Achievement Award, 2012 Altera InnovateAsia FPGA Design Competition   Sep. 2012

Paper Reviewing Recognition

- Highlighted Reviewer, International Conference on Learning Representations (**ICLR**), 2022   Apr. 2022
- Outstanding Reviewer, IEEE Conference on Computer Vision and Pattern Recognition (**CVPR**), 2021   May 2021

Selected Press Coverage

VentureBeat: *NVIDIA researchers use AI to turn 2D video clips into detailed 3D graphics*   Jun. 2023
The Verge: *NVIDIA's new Neuralangelo AI model creates 3D models from 2D video clips.*   Jun. 2023
Engadget: *NVIDIA's Neuralangelo is an AI model that can generate 3D objects from 2D videos*   Jun. 2023
Yahoo! News: *NVIDIA's Neuralangelo is an AI model that can generate 3D objects from 2D videos*   Jun. 2023
WIRED: *NVIDIA Research's Neuralangelo can build 3D structures from 2D videos*   Jun. 2023
BBC Science Focus: *Breakthrough AI could soon generate whole 3D worlds from 2D videos*   Jun. 2023
PetaPixel: *NVIDIA's Neuralangelo AI Turns iPhone Video into Detailed 3D Structures*   Jun. 2023

Computerworld: *NVIDIA Neuralangelo: A faster path to the industrial metaverse*	Jun. 2023
NVIDIA News: *Digital Renaissance: NVIDIA Neuralangelo Research Reconstructs 3D Scenes*	Jun. 2023
Forbes: *What NVIDIA's New Text-To-3D Means For Engineering & Product Design*	Nov. 2022
Ars Technica: *3D for everyone? NVIDIA's Magic3D can generate 3D models from text*	Nov. 2022
Gigazine: *NVIDIA announces AI "Magic3D" that generates high-resolution 3D models from text*	Nov. 2022

Invited Talks

Magic3D: High-Resolution Text-to-3D Content Creation
- Sea AI Labs & National University of Singapore — Singapore · Dec. 2022
- ByteDance Ltd. — Singapore · Dec. 2022

Learning 3D Registration and Reconstruction from the Visual World
- National Taiwan University — Taipei, Taiwan · Jan. 2022
- Massachusetts Institute of Technology — Cambridge, MA, USA · Sep. 2021
- Carnegie Mellon University — Pittsburgh, PA, USA · Apr. 2021
- MediaTek Inc. — Hsinchu, Taiwan · Apr. 2021
- Facebook (Meta) Reality Labs — Redmond, WA, USA · Mar. 2021
- Apple ML Research — Seattle, WA, USA · Mar. 2021
- Amazon Science — Seattle, WA, USA · Mar. 2021
- Magic Leap Inc. — Sunnyvale, CA, USA · Mar. 2021
- NVIDIA Research — Santa Clara, CA, USA · Mar. 2021
- CMU Argo AI Center for Autonomous Vehicle Research — Pittsburgh, PA, USA · Mar. 2021
- Google Research — Seattle, WA, USA · Mar. 2021

BARF: Bundle-Adjusting Neural Radiance Fields
- IEEE International Conference on Computer Vision (**ICCV**), 2021 — Montreal, Canada · Oct. 2021

SDF-SRN: Learning Signed Distance 3D Object Reconstruction from Static Images
- Massachusetts Institute of Technology — Cambridge, MA, USA · Jan. 2021
- Beijing Academy of Artificial Intelligence — Beijing, China · Nov. 2020

Learning Dense 3D Object Reconstruction without Geometric Supervision
- NVIDIA GPU Technology Conference (**GTC**), 2020 — San Jose, CA, USA · Mar. 2020
- Carnegie Mellon University — Pittsburgh, PA, USA · Jan. 2020

Learning to Align without Geometric Supervision
- Carnegie Mellon University — Pittsburgh, PA, USA · Apr. 2019

Learning Efficient Point Cloud Generation for Dense 3D Object Reconstruction
- AAAI Conference on Artificial Intelligence (**AAAI**), 2018 — New Orleans, LA, USA · Feb. 2018

Inverse Compositional Spatial Transformer Networks
- IEEE Conference on Computer Vision and Pattern Recognition (**CVPR**), 2017 — Honolulu, HI, USA · Jul. 2017
- Oculus Research (Meta Reality Labs) — Pittsburgh, PA, USA · Dec. 2016

The Conditional Lucas & Kanade Algorithm
- Carnegie Mellon University — Pittsburgh, PA, USA · Jun. 2016
- MathWorks Inc. — Natick, MA, USA · Apr. 2016
- Oculus VR (Meta Platforms Inc.) — Menlo Park, CA, USA · Feb. 2016

Academic Services

Journal Paper Reviewer
- IEEE Transactions on Visualization and Computer Graphics (**TVCG**) — 2023
- IEEE Transactions on Pattern Analysis and Machine Intelligence (**TPAMI**) — 2021, 2022

- Transactions on Machine Learning Research (**TMLR**) · 2022
- IEEE Transactions on Image Processing (**TIP**) · 2020
- International Journal of Computer Vision (**IJCV**) · 2019, 2020
- IEEE Transactions on Circuits and Systems for Video Technology (**TCSVT**) · 2019
- Journal of Machine Vision and Applications (**MVAP**) · 2017
- IEEE Transactions on Affective Computing (**TAFFC**) · 2015

Conference Paper Reviewer

- ACM Conference on Computer Graphics and Interactive Techniques in Asia (**SIGGRAPH Asia**) · 2023
- Conference on Neural Information Processing Systems (**NeurIPS**) · 2020 − 2023
- IEEE International Conference on Computer Vision (**ICCV**) · 2019 − 2023
- IEEE Conference on Computer Vision and Pattern Recognition (**CVPR**) · 2018 − 2023
- International Conference on Learning Representations (**ICLR**) · 2022, 2023
- International Conference on Robotics and Automation (**ICRA**) · 2023
- IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS**) · 2023
- European Conference on Computer Vision (**ECCV**) · 2018 − 2022
- International Conference on Machine Learning (**ICML**) · 2022
- IEEE International Conference on 3D Vision (**3DV**) · 2021
- IEEE International Symposium on Circuits and Systems (**ISCAS**) · 2014

CMU Institutional Services

- Ph.D. in Robotics Research Qualifier Committee · 2019, 2020
  Examinee: Nathaniel Chodosh, Wei Dong, Ming-Fang Chang, Chaoyang Wang
- M.S. in Robotics Thesis Committee · 2018
  Examinee: Chaoyang Wang
- M.S. in Robotics Admission Committee · 2019

Teaching Experiences

Carnegie Mellon University · Pittsburgh, PA, USA

- **Graduate Student Instructor / Teaching Assistant** · Spring 2019
  Course: Visual Learning and Recognition (CMU 16-824)
  Instructor: Abhinav Gupta
  Full lectures: 3D Vision & 3D Reasoning, Semantic Segmentation & Pixel Labeling
- **Head Teaching Assistant** · Fall 2017
  Course: Computer Vision (CMU 16-720)
  Instructors: Srinivasa Narasimhan, Simon Lucey, Yaser Sheikh
- **Teaching Assistant** · Fall 2015
  Course: Designing Computer Vision Apps (CMU 16-423)
  Instructor: Simon Lucey

Selected Academic Projects

Carnegie Mellon University · Pittsburgh, PA, USA

- **Towards a More Curious Agent** · Spring 2018
  Reinforcement learning with intrinsic rewards based on causality modeling
- **Disentangler Networks with Absolute and Relative Attributes** · Spring 2016
  Disentangled image representations learnable from relative attribute ranking
- **Video Summarization via Convolutional Neural Networks** · Spring 2015
  K-means clustering of image features using a summarization objective function

- **Real-time SLAM with Geometric Features**   Fall 2014
  Indoor SLAM system by plane/edge extraction and alignment from point clouds

National Taiwan University   Taipei, Taiwan

- **Medical 3D Reconstruction of Skin Tissue Sectioning**   Spring 2013
  3D recalibration and realignment of deformed specimen slices for infection diagnosis
- **Webcam Gaze Tracking System**   Spring 2013
  Gaze prediction on laptop screens by learning from semi-auto collected data
- **Virtual Paper Piano Keyboard System**   Spring & Fall 2012
  Touch instrumental system using finger/keyboard pattern recognition on FPGA

Selected Academic Coursework

Carnegie Mellon University   Pittsburgh, PA, USA

Computer Vision (A), Machine Learning (A), Visual Learning and Recognition (A+), Convex Optimization (A), Intermediate Statistics (A), Mathematics Fundamentals for Robotics (A), Deep Reinforcement Learning and Control (A)

National Taiwan University   Taipei, Taiwan

Multimedia Signal Processing (A+), Digital Image Processing (A+), Digital Video Technology (A), Machine Learning (A), Multimedia Analysis and Indexing (A+), Information Theory (A+), Data Structure and Programming (A+)

Proficient Skills

Programming languages
- Primary: Python, C/C++, LaTeX, MATLAB
- Secondary: CUDA, Lua, HTML, Javascript

Software libraries
- Primary: PyTorch, TensorFlow, Blender, COLMAP
- Secondary: OpenAI Gym, Torch, Caffe, OpenCV, VLFeat, Pthread