

# YUNZHI LIN

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## SUMMARY

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I am an ECE Ph.D. candidate at Georgia Tech, specializing in integrating computer vision with robotics to address real-world challenges. My expertise includes 6-DoF object pose estimation, object grasping, and human-robot interaction, enriched by collaborations with NVIDIA Research and Meta FAIR.

## RESEARCH INTEREST

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- Computer Vision: Object Pose Estimation, Object Pose Tracking, Keypoint Tracking, Neural Radiance Field
- Robotics: Object Grasping, Robot Manipulation, Robot Simulation, Human-Robot Interaction

## ACADEMIC EXPERIENCE

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- **Georgia Institute of Technology** *Atlanta, USA 08/2018 - Present*  
*Ph.D. Candidate & M.S. in ECE*
- **University of Alberta** *Edmonton, Canada 09/2017 - 12/2017*  
*Research Intern in Applied Nonlinear Control Lab*
- **Southeast University** *Nanjing, China 09/2014 - 06/2018*  
*B.E. in Automation, Overall GPA: 3.86/4.0 (Rank: 3/104)*

## INDUSTRY EXPERIENCE

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- **Meta AI** *Menlo Park, USA 05/2023 - 11/2023*  
*Research Intern in FAIR Accel*
- **NVIDIA Research** *Remote, USA 05/2022 - 12/2022*  
*Research Intern in Learning and Perception Research Group*
- **NVIDIA Research** *Remote, USA 05/2020 - 05/2021*  
*Research Intern in Learning and Perception Research Group*

## RESEARCH EXPERIENCE

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- **Generalized Object Pose Tracking** *05/2023 - 11/2023*  
*Advisor: Kevin Liang, Fu-Jen Chu, Yipu Zhao, Xingyu Chen, Weiyao Wang, Hao Tang, Patricio A. Vela, Matt Feiszli*  
*Ego-HowTo Team, Meta FAIR Accel*
  - Developed a streamlined pipeline combining video segmentation, uncertainty-aware keypoint refinement, and structure from motion, effectively tracking 6-DoF poses from short-term monocular RGB video
  - Generated a large-scale photo-realistic synthetic dataset of 40K clips (4M frames) using BlenderProc2, including RGB/depth/mask/normal/pose annotations, facilitating object pose tracking in dynamic settings
- **Neural Radiance Fields for Robust Pose Estimation** *05/2022 - 09/2022*  
*Advisor: Thomas Müller, Jonathan Tremblay, Bowen Wen, Stephen Tyree, Alex Evans, Patricio A. Vela, Stan Birchfield*  
*Learning and Perception Research Group, NVIDIA Research*

- Developed a parallelized, momentum-based optimization method using NeRF models to estimate 6-DoF poses from monocular RGB input
- Achieved improved generalization and robustness on both synthetic and real-world benchmarks

- **Human-Robot Interaction: Playing Jigsaw Puzzles with A Robot** 06/2021 - 12/2022

*Advisor: Patricio A. Vela*

*Intelligent Vision and Automation Laboratory, Georgia Institute of Technology*

- Developed a human-robot system that allows a robot to interact and play jigsaw puzzles with human players
- Created a cost-effective robot platform (\$1K) with RealSense D415 and Dynamixel servomotor
- Funded by National Science Foundation (NSF) for research and development [#2026611]

- **Category-level Object Pose Estimation and Tracking** 11/2020 - 09/2021

*Advisor: Jonathan Tremblay, Stephen Tyree, Patricio A. Vela, Stan Birchfield*

*Learning and Perception Research Group, NVIDIA Research*

- Developed a keypoint-based RGB-only 6-DoF and size pose estimator for category-level objects
- Extended to support robust object pose tracking with uncertainty estimation
- SOTA results on the Objectron benchmark, improving average precision at 0.5 3D IoU from 72% to 80%
- Integrated into [NVIDIA Isaac Robot Operating System (ROS)]

- **Multi-level Scene Understanding** 05/2020 - 10/2020

*Advisor: Jonathan Tremblay, Stephen Tyree, Patricio A. Vela, Stan Birchfield*

*Learning and Perception Research Group, NVIDIA Research*

- Proposed a multi-level robotic scene understanding system, including dense 3D reconstruction, shape estimation and fitting of objects with primitive shapes, and full 6-DoF pose estimation of known object instances

- **Object Grasping via Primitive Shapes** 02/2019 - 05/2020

*Advisor: Patricio A. Vela*

*Intelligent Vision and Automation Laboratory, Georgia Institute of Technology*

- Developed an automated strategy to generate primitive shape data in the V-REP simulation
- Designed a grasping pipeline that segments objects from depth input, identifies optimal shape parameters through shape fitting, and selects and executes the most feasible grasp
- Achieved over 93% success rate on static grasping task using a 7-DoF robotic arm

## PATENTS

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- **Object pose tracking from video images**  
Yunzhi Lin, Jonathan Tremblay, Stephen Tyree, Stan Birchfield  
Number: US20240005547A1
- **Single-stage category-level object pose estimation**  
Stan Birchfield, Jonathan Tremblay, Yunzhi Lin, Stephen Tyree  
Number: US20220277472A1
- **Determining a three-dimensional representation of a scene**  
Yunzhi Lin, Jonathan Tremblay, Stephen Tyree, Stan Birchfield  
Number: US20220068024A1

## SELECTED PUBLICATIONS [Google Scholar]

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## Preprints

- [P1]. **Primitive Shapes Recognition for Object Grasping**  
Yunzhi Lin, Chao Tang, Fujen Chu, Ruinian Xu, Patricio A. Vela  
*arXiv:2201.00956*
- [P2]. **OmniPose6D: Towards Short-Term Object Pose Tracking in Dynamic Scenes from Monocular RGB Input**  
Yunzhi Lin, Kevin Liang, Fu-Jen Chu, Yipu Zhao, Xingyu Chen, Weiyao Wang, Hao Tang, Patricio A. Vela, Matt Feiszli  
*In Submission*

## Conferences

- [C1]. **WDiscOOD: Out-of-Distribution Detection via Whitened Linear Discriminative Analysis**  
Yiye Chen, Yunzhi Lin, Ruinian Xu, Patricio A. Vela  
*International Conference on Computer Vision (ICCV 2023)*
- [C2]. **KGNv2: Separating Scale and Pose Prediction for Keypoint-based 6-DoF Grasp Pose Synthesis on RGB-D input**  
Yiye Chen, Ruinian Xu, Yunzhi Lin, Patricio A. Vela  
*IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2023)*
- [C3]. **Parallel Inversion of Neural Radiance Fields for Robust Pose Estimation**  
Yunzhi Lin, Thomas Müller, Jonathan Tremblay, Bowen Wen, Stephen Tyree, Alex Evans, Patricio A. Vela, Stan Birchfield  
*IEEE International Conference on Robotics and Automation (ICRA 2023)*
- [C4]. **Keypoint-GraspNet: Keypoint-based 6-DoF Grasp Generation from the Monocular RGB-D input**  
Yiye Chen, Yunzhi Lin, Patricio A. Vela  
*IEEE International Conference on Robotics and Automation (ICRA 2023)*
- [C5]. **Keypoint-based Category-level Object Pose Tracking from an RGB Sequence with Uncertainty Estimation**  
Yunzhi Lin, Jonathan Tremblay, Stephen Tyree, Patricio A. Vela, Stan Birchfield  
*IEEE International Conference on Robotics and Automation (ICRA 2022)*
- [C6]. **Single-Stage Keypoint-based Category-level Object Pose Estimation from an RGB Image**  
Yunzhi Lin, Jonathan Tremblay, Stephen Tyree, Patricio A. Vela, Stan Birchfield  
*IEEE International Conference on Robotics and Automation (ICRA 2022)*
- [C7]. **Multi-view Fusion for Multi-level Robotic Scene Understanding**  
Yunzhi Lin, Jonathan Tremblay, Stephen Tyree, Patricio A. Vela, Stan Birchfield  
*IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2021)*
- [C8]. **A Joint Network for Grasp Detection Conditioned on Natural Language Commands**  
Yiye Chen, Ruinian Xu, Yunzhi Lin, Patricio A. Vela  
*IEEE International Conference on Robotics and Automation (ICRA 2021)*
- [C9]. **Using Synthetic Data and Deep Networks to Recognize Primitive Shapes for Object Grasping**

**Yunzhi Lin\***, Chao Tang\*, Fujen Chu, Patricio A. Vela  
*IEEE International Conference on Robotics and Automation (ICRA 2020)*

- [C10]. **Blind Deblurring Using Discriminative Image Smoothing**  
Wenze Shao, **Yunzhi Lin**, Bingkun Bao, Liqian Wang, Qi Ge, Haibo Li  
*Pattern Recognition and Computer Vision (PRCV 2018)*

### Journals

- [J1]. **SGL: Symbolic Goal Learning in a Hybrid, Modular Framework for Human Instruction Following**  
Ruinian Xu, Hongyi Chen, **Yunzhi Lin**, Patricio A. Vela  
*IEEE Robotics and Automation letters*
- [J2]. **Gradient-based discriminative modeling for blind image deblurring**  
Wenze Shao, **Yunzhi Lin**, Yuanyuan Liu, Liqian Wang, Qi Ge, Bingkun Bao, Haibo Li  
*Nerocomputing*  
*Journal of Mathematical Imaging and Vision*

### Workshops

- [W1]. **NViSII: A Scriptable Tool for Photorealistic Image Generation**  
Nathan Morrical, Jonathan Tremblay, **Yunzhi Lin**, Stephen Tyree, Stan Birchfield, Valerio Pascucci, Ingo Wald  
*International Conference on Learning Representations Workshop (ICLR workshop 2021)*

### TEACHING EXPERIENCE

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- Teaching Assistant, ECE 3005 Professional and Technical Communications, Gatech *Spring 2023*
- Teaching Assistant, ECE 4560 Introduction to Automation & Robotics, Gatech *Fall 2022*

### ACADEMIC SERVICE

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- Conference reviewer for CoRL'19, ICRA'21-24, IROS'21-23, ECCV'22
- Journal reviewer: Neurocomputing, IEEE Robotics and Automation Letters, IEEE/ASME Transactions on Mechatronics, IEEE/CAA Journal of Automatica Sinica, IEEE Computer Graphics and Applications, IEEE Transactions on Circuits and Systems for Video Technology, IEEE Transactions on Automation Science and Engineering

### HONORS AND AWARDS

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- NVIDIA Patent Award (3x), NIVIDA Corp. *04/2021-03/2022*
- Outstanding Graduates (top 5%), Southeast University *06/2018*
- National Undergraduate Exchange Scholarship, China Scholarship Council *06/2017*
- National Scholarship (top 3%), Southeast University *09/2015*

### SKILLS

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- **Programming Languages:** C/C++, Python, Matlab
- **Softwares & Tools:** OpenCV, V-REP, ROS, Caffe, TensorFlow, PyTorch