

## **Education**

#### University of Illinois Urbana-Champaign

Bachelor of Science in Electrical Engineering & Minor in Computer Science August 2020 - May 2024

- o Dean's List: Fall 2020, Spring 2021, Fall 2021, Spring 2022
- GPA: 3.88/4.0; Technical GPA: 3.86/4.0
- Relevant courses: Introduction to Robotics, Introduction to Machine Perception, Artificial Intelligence,
   Control Systems, Digital & Analog Signal Processing

#### **Publications**

- 1. **J. Xiang**, H. Dinkel, H. Zhao, N. Gao, B. Coltin, T. Smith, and T. Bretl, "TrackDLO: Tracking Deformable Linear Objects Under Occlusion with Motion Coherence", *IEEE Robotics and Automation Letters*, August 2023.
- 2. **J. Xiang** and H. Dinkel, "Simultaneous Shape Tracking of Multiple Deformable Linear Objects with Global-Local Topology Preservation", in *IEEE ICRA Workshop on Representing and Manipulating Deformable Objects*, May 2023.
- 3. H. Dinkel\*, **J. Xiang**\*, H. Zhao, B. Coltin, T. Smith, and T. Bretl, "Wire Point Cloud Instance Segmentation from RGBD Imagery with Mask R-CNN", in *IEEE ICRA Workshop on Representing and Manipulating Deformable Objects*, May 2022.
- \* Equal Contribution

# Research Experience

#### **Bretl Research Group**

Advisor: Timothy Bretl, Professor of Aerospace Engineering

Undergraduate Research Assistant

January 2022 - Present

o Tracking Deformable Linear Objects in RGB-D Imagery

August 2022 - Present

- Developed a new deformable linear object tracking algorithm, TrackDLO, for robust deformable linear object tracking under occlusion without external state information or physics simulation.
- Developed a non-rigid point set registration based method for tracking multiple deformable linear objects simultaneously.
- Created open-source C++ ROS (Robot Operating System) packages for the tracking methods developed.
- Automated Data Generation and Annotation for Deep Learning January 2022 December 2022
  - Implemented the Copy-Paste Augmentation method in an automated dataset generation process to scale the amount of available training data and to eliminate the time-consuming process of manual image annotation.
  - Collaborated with other researchers in the group to create COCOpen, an open-source library that automatically generates datasets of color images with objects of interest, labeled with object instance segmentation masks, bounding boxes, and category identification.
- Eye-In-Hand Extrinsic Camera Calibration for Industrial Robots May 2022 July 2022
  - Designed and 3D printed custom camera mounts for linking the camera and the robot end-effector.
  - Calibrated our hardware system with fiducial markers and two eye-in-hand camera calibration algorithms: the Tsai-Lenz algorithm and a recently published method based on pose graph optimization.
- Instance Segmentation of Deformable Linear Objects
   February 2022 May 2022
  - Identified, implemented, and evaluated two state-of-the-art deformable linear object instance segmenta-

tion algorithms.

• Used the instance segmentation masks output from Mask R-CNN to segment featureless point clouds in stereo depth imagery.

#### **Honors and Awards**

#### **OpenCV AI Competition 2022**

• First Prize Winner (Awarded to the top 10% submissions)

January 2023

#### **UIUC Electrical and Computer Engineering Scholarships and Awards**

Indira Gunda Saladi Engineering Research Prize

August 2023

Ellery B. Paine Outstanding Junior Award

March 2023

• A.R. "Buck" Knight Scholarship

September 2022, August 2023

Oakley Scholarship in Electrical and Computer Engineering

September 2021

## **VEX Robotics Competition World Skills Standing College Division**

• Top 5 Worldwide, Top 3 in the US

May 2021, May 2022

#### VEX Robotics Competition World Skills Standing High School Division

o 18th Overall, 3rd in Programming

May 2020

#### **VEX Robotics Competition Maryland State Championship**

• Excellence Award, Robot Skills Champion, Tournament Division Finalist

March 2020

# **Projects**

## Tracking Deformable Linear Objects with Geodesic-Based Bayesian Coherent Point Drift

CS 498 Machine Perception Final Project

April 2023 - May 2023

- $\circ$  Implemented a recently published non-rigid registration algorithm, Geodesic-Based Bayesian Coherent Point Drift, in both Python and C++.
- Integrated the Geodesic-Based Bayesian Coherent Point Drift algorithm into existing deformable linear object tracking algorithms to improve the tracking performance in edge cases.

# **Skills**

**Operating Systems:** Windows, Linux

**Programming Languages:** Python, C++, LaTeX, C, MATLAB

**Software:** Robot Operating System (ROS), Autodesk Fusion 360, PyTorch, OnShape, Autodesk Inventor **Hardware:** Intel RealSense Camera, ABB IRB120 Industrial Robot Arm, UR5e Industrial Robot Arm,

OnRobot 2FG7 Gripper

# Mentoring and Outreach

#### Illinois Office of Undergraduate Research

Illinois Undergraduate Research Ambassador

March 2023 - Present

- Worked as a peer mentor to guide underclassmen through the process of finding research opportunities.
- Assisted workshops that aim to introduce undergraduate research to new students.
- Represented and assisted the Illinois Office of Undergraduate Research in campus-wide events to promote undergraduate research on campus.

#### Illini VEX Robotics at UIUC

Co-Founder & Competition Team Lead

December 2020 - March 2023

- Mentored multiple high school teams in the community to help them get started in robot programming.
- Collaborated with teams from other institutions to create a knowledge base for competitive robotics.
- o Created guides and documentation for new member onboarding.
- Organized and held weekly team events such as build meetings, social events, workshops, and general meetings to create team bonding.
- o Oversaw robot design, manufacturing, and programming.

#### John Carroll School Robotics Team

Alumni Mentor

June 2020 - April 2022

- Produced a series of tutorial videos on how to use Autodesk Fusion 360 to design robot mechanisms.
- o Produced tutorial documents on basic robot programming and control algorithms.
- o Created guides and documentation for new member onboarding.
- Held mentoring appointments with the current team members to provide guidance on various technical topics.

#### **Presentations**

## Bretl Research Group Weekly Seminar, UIUC.

 1-hour slide presentation: "Deformable Linear Object Tracking as Non-Rigid Point Set Registration"

February 2023

1-hour slide presentation: "Tracking Deformable Linear Objects Under Occlusion"
 September 2022

 15-minute slide presentation: "Wire Instance Perception from RGBD Imagery with Mask R-CNN"

April 2022

### Undergraduate Research Symposium, UIUC.

 Poster presentation: "TrackDLO: Tracking Deformable Linear Objects Under Occlusion with Motion Coherence"

April 2023

Poster presentation: "Wire Instance Perception from RGBD Imagery with Mask R-CNN" April 2022

### Undergraduate Research Opportunity Program Symposium, UIUC.

15-minute slide presentation: "Perceiving and Tracking Deformable Linear Objects"

August 2022