Brian E. Okorn

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Robotic Researcher focused on zero-shot and self-supervised vision for manipulation.

Research Interests

Robotics, Object Centric Perception, Computer Vision, Artificial Intelligence

Education

Carnegie Mellon University (Pittsburgh, PA)
- PhD: Robotics (2016 - 2022)

Vanderbilt University (Nashville, TN)
- Master of Science: Computer Science (2010 - 2011)
- Bachelor of Engineering: Computer Engineering (2007 - 2010)

Publications

Pan*, C., Okorn*, B., Zhang*, H., Eisner* B., and Held, D.,
TAX-Pose: Task-Specific Cross-Pose Estimation for Robot Manipulation
Conference on Robotic Learning (CoRL). November 2022, Auckland, New Zealand

Okorn*, B., Pan*, C., Hebert, M., and Held, D.,
Deep Projective Rotation Estimation through Relative Supervision
Conference on Robotic Learning (CoRL). November 2022, Auckland, New Zealand

Gu, Q., Okorn, B., Held, D.,
OSSID: Online Self-Supervised Instance Detection by (and for) Pose Estimation
Robotics and Automation Letters (RA-L) with presentation at the International Conference of Robotics and Automation (ICRA), May 2022, New York, NY.

Goyal, A., Mousavian, A., Paxton, C., Chao, Y., Okorn, B., Deng, J., Fox, D.,
IFOR: Iterative Flow Minimization for Robotic Object Rearrangement
Conference on Computer Vision and Pattern Recognition (CVPR), June 2022, New Orleans, LA.

Mittal, H., Okorn, B., Jangid, A., Held, D.,
Self-Supervised Point Cloud Completion via Inpainting
British Machine Vision Conference (BMVC), November 2021

Okorn, B.*, Gu, Q.*, Hebert, M., Held, D.,
ZePHyR: Zero-shot Pose Hypothesis Rating
International Conference on Robotics and Automation (ICRA), May 2021, Xi'an, China.

Wang Y., Narayan Narasimhan G., Lin X., Okorn B., Held D.,
ROLL: Visual Self-Supervised Reinforcement Learning with Object Reasoning.
Conference on Robotic Learning (CoRL). November 2020, London, England

Okorn, B., Xu, M., Herbert, M., Held, D.,
Learning Orientation Distributions for Object Pose Estimation
International Conference on Intelligent Robots and Systems (IROS), October 2020, Las Vegas, NV.

Qian J., Weng T., Zhang L., Okorn B., Held D.
Cloth region segmentation for robust grasp selection.
International Conference on Intelligent Robots and Systems (IROS), October 2020, Las Vegas NV.

Mittal, H., Okorn, B., Held, D.,
Just go with the flow: Self-supervised scene flow estimation
Conference on Computer Vision and Pattern Recognition (CVPR), June 2020, Seattle, WA.

Madaan R., Zeng S., Okorn B., Scherer S.
Learning Adaptive Sampling Distributions for Motion Planning by Self-Imitation.
International Conference on Intelligent Robots and Systems (IROS), *Workshop on Machine Learning in Robot Motion Planning*, October 2018, Madrid, Spain

Okorn, B., Harguess, J.,
Ego-Motion Estimation on Range Images Using High-Order Polynomial Expansion
Conference on Computer Vision and Pattern Recognition (CVPR): *Perception Beyond the Visible Spectrum Workshop*, 2014, Columbus, OH.

Larson, J., Okorn, B., Pastore, T., Hooper, D., Edwards, J.,
Counter tunnel exploration, mapping, and localization with an unmanned ground vehicle
SPIE Unmanned Systems Technology, June 2014, Baltimore, MD.

Okorn, B., Harguess, J.,
Polynomial expansion for range image segmentation and classification of the environment
Position, Localization and Navigation Symposium (PLANS), May 2014, Monterey, CA.

Okorn, B.,
Smuggling Tunnel Mapping using Slide Image Registration
Master's Thesis, 2011, Vanderbilt University

Huber, D., Akinci, B., Tang, P., Adan, A., Okorn, B., Xiong, X.,
Using laser scanners for modeling and analysis in architecture, engineering, and construction
Conference on Information Sciences and Systems, March 2011, Princeton, NJ.

Okorn, B., X. Xiong, K. Akinci, and D. Huber.
Toward automated modeling of floor plans
3D Data Processing, Visualization and Transmission Conference (3DPVT), Espace Saint Martin, Paris, France, May 2010.

Okorn, B.,
KSU Urban Operation Lab and Vanderbilt Human Machine Teaming Lab: Single Human – Multiple Robot Interface
Vanderbilt University Technical Report, 2009

Engineering Experience

9/2016 – 9/2022 Carnegie Mellon Robotics Institute
Ph.D. Student: Robots Perceiving and Doing, Martial Hebert and David Held

- Research, develop, implement, and publish computer vision algorithms for robotic tasks.
- Mentored Masters students and interns on robotics and computer vision projects.

Task Specific Relative Pose Estimation

- Designed and published an algorithm to learn task specific relative pose between two objects using dense residual correspondences from very few examples.

Self-Supervised Rotation

- Designed and published an algorithm to avoid the local minima common when using relative supervision for orientation estimation through the use of stereographic projections.

Zero-Shot Pose Estimation

- Designed and published an algorithm to combine learned and classical pose estimation techniques to produce a hypothesis scoring network capable of estimating the pose of novel objects.

Learning Orientation Distributions

- Designed and published an orientation distribution estimation algorithm to augment existing estimators with algorithm and input dependent uncertainty estimates.

Self-Supervised Scene Flow Estimation

- Developed and published the first self-supervised method of scene flow estimation.
- Showed equivalent accuracy on real world KITTI dataset when compared to fully supervised methods

6/2021 – 10/2021 NVIDIA
Research Intern: Robotics, Dieter Fox, Arsalan Mousavian, Lucas Manuelli
- Developed photorealistic rendering pipeline for object centric learning.
- Developed zero-shot object detection, segmentation, and relocation.

9/2018 – 6/2021 NASA Johnson Space Center
Research Intern: Robotic Systems Technology Branch, Philip Strawser
- Implement perception algorithms for the dexterous humanoid, Robonaut 2.
- Design uncertainty aware surgical tool pose estimation system for robot assisted surgery.
- Improved usability and accuracy of fiducial tracking system.
- Designed localization for Robonaut 2 on the International Space Station.

9/2011 – 8/2016 SPAWAR Systems Center Pacific
Computer Scientist: Unmanned Systems Branch, Tracy Pastore
- Secret Clearance
- Write, present, and review proposals.
- Research, develop, implement, and publish advanced perception algorithms.

Radar Coastline Localization - Technical Lead
- Developed bidirectional Furuno Radar ROS driver.
- Developed nodes for processing radar, coastline model, and digital elevation model data.
- Developed pointcloud and image-based radar coastline matching algorithms.

Lidar Camera Calibration
- Developed Ibeo lidar to single camera calibration in ROS.
- Developed ROS visualization of calibration progress.

Wave Glider Obstacle Avoidance
- Developed obstacle avoidance software for Liquid Robotics Wave Glider.
- Implemented SOAP interface to Liquid Robotics' WGMS interface for positioning and control.
- Implemented Iridium satellite communication node.

Range Image Odometry - Principal Investigator
- Developed and published an algorithm to calculate 3D flow from lidar range imagery.
- Managed team and ensured spending was within 5% or projected.

Counter Tunnel - 3D Perception Subject Matter Expert
- Developed 3D perception and localization algorithms for use in subterranean tunnels.
- Developed tunnel meshing and volumetric analysis tools
- Implemented the 3D Normal Distributions Transform (3DNDT) algorithm and open sourced it, with tutorials to PCL.

Teaching Experience

Teaching Assistant:
16 - 881: Deep Reinforcement Learning for Robotics (Spring 2019)
16 - 720: Computer Vision (Fall 2017)

Guest Lecturer:
16 - 831: Statistical Techniques in Robotics (Fall 2019, Fall 2020)

Academic Service

Carnegie Mellon University Master of Science in Computer Vision (MSCV) Admissions Committee, (2018, 2019, 2020)

Reviewer for International Journal of Computer Vision (VISI 2021, 2022)
Reviewer for Robotics and Automation Letters (RA-L 2022)
Reviewer for International Conference on Intelligent Robots and Systems (IROS 2022)
Reviewer for Conference on Computer Vision and Pattern Recognition (CVPR 2021)
Reviewer for International Conference on Robotics and Automation (ICRA 2015, 2018, 2021, 2022)
Reviewer for Robotics: Science and Systems (RSS 2020)

Reviewer for Conference on Robotic Learning (CoRL 2019, 2021, 2020, 2022)
Reviewer for Black in AI (NeurIPS 2018, 2019)

Student Committee Member for Masters Thesis Defense (2019, 2021)
Student Committee Member for Speaking Qualifier Assessment (2021, 2022)
Student Committee Member for Writing Qualifier Assessment (2021, 2022)
Student Committee Member for Research Qualifier Assessment (2021, 2022)

Awards

NASA Space Technology Research Fellowship, NASA (2018)
Science, Math and Research for Transformation Scholar, Department of Defense (2010)
Ford PAS Engineering Scholarship and 1st Ford Motor Co. Blue Oval Scholar (2007)

Volunteer Work

Instructor, Robotics Programming, Point Loma High School, Point Loma, CA (2015)
Coach High School FIRST Tech Challenge Robotics Team (2011 - 2015)
Judge FIRST LEGO League Regional Competitions (2011 - 2013)
Boy Scouts of America, Eagle Scout (2006)