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David J. Watkins

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Education

PhD in Computer Science, *Columbia University* — Sep 2017 — May 2022
Advisor: *Prof. Peter Allen*, Thesis: *Learning Mobile Manipulation*
Army Research Lab Research Fellow — Sep 2018 — July 2022
MPhil in Computer Science, *Columbia University* — Sep 2017 — May 2019
MS in Computer Science, *Columbia University*, 4.0 GPA — Sep 2016 — May 2017
CA Fellowship — Sep 2016 — Jan 2017
BS in Computer Science, *Columbia University*, 3.7 GPA — Sep 2012 — May 2016
Marian High School — Oct 2010 — May 2012
Class President
Salutatorian
National Honors Society

Professional Experience

Research Scientist — **Dec 2022 — Present**
Boston Dynamics AI Institute — *Cambridge, MA*

- Researching novel methodologies for robotics to enable the future of machine learning to solve the world's challenges

Co-Founder / Odefi Inc. — **Mar 2019 — Present**
Columbia IBM Blockchain Accelerator — *New York, NY*

- Created a startup company Odefi to deliver liquidity to the MakerDAO network by auto terminating expired contracts as part of the Columbia IBM Blockchain Accelerator in 2019
- Learned the lean launchpad startup process and pitched to several investors: https://www.youtube.com/watch?v=kGa5QHL28FE

Research Fellow — **Sep 2018 — July 2022**
Army Research Lab — *Aberdeen, MD*

- Participating in drone, robotic navigation, robotic grasping, and simulation research for the Army Research Lab
- Developing hardware acquisition and deployment strategies for research in ARL facilities

Engineering Intern — **Jun 2016 — Aug 2016**
Goldman Sachs — *New York, NY*

- Worked in Margin Technology to prioritize calculations using a graph DBMS and provided an interface to adjust the prioritizations
- Developed in Java and Angular.js to build both the database queries and the user experience

Engineering Intern — **May 2015 — Aug 2015**
Goldman Sachs — *New York, NY*

- Worked in Valuations Technology to rebuild an FVA Gating Tool which allowed Operations Users to give clients info statements
- Developed in Angular.js and Slickgrid to build a convenient user experience while collaborating with fellow interns

Engineering Intern — **Jun 2014 — Sep 2014**
Streakfire LLC — *Wayland, MA and Dorado, PR*

- Producing an ad campaign in Puerto Rico to promote a technical accelerator to help create jobs for graduated college students
- Coordinating with local government to leverage their expertise in publicity and existing infrastructure

Technical Experience

Multiple View Performers for Shape Completion — **Dec 2021 — Present**
Robotics at Google, Army Research Lab, Columbia University — *New York, NY*

- Researched novel deep learning approach for multiple view completion without registering views
- Developed a process to leverage Performer attention layers developed by Google to encode multiple reconstruction images
- Work submitted to ICRA 2023

Data Driven Strand Simulation — **Dec 2021 — Present**
Columbia University — *New York, NY*

- Researched hair simulation algorithms to run in graph neural networks offering a 400% speedup
- Developed methods to compare python vs. C++ pytorch models
- In submission to TOG (ACM Transaction on Graphics)

MineRL Basalt Competition **Jul 2021 — Dec 2021**
Neurips 2021 *New York, NY*

- Researched the intersection of engineered and learned knowledge to develop an autonomous Minecraft agent using human demonstration data and won first place at MineRL Basalt at Neurips 2021 in collaboration with ARL and UMBC
- Researched learned visual navigation methods and developed a CNN state classifier using human-labeled data
- Work published at AAAI-Make 2022 and presented at Neurips 2021

Mobile Manipulation Leveraging Multiple Views **Jan 2020 — Oct 2022**
Columbia Robotics Lab *New York, NY*

- Researched deep learning approaches to mobile manipulation without localizing the robot at runtime
- Explored novel simulation based techniques for generating data with real-world scanned environments
- Improved previous navigation work via predicted panoramic target goals from nearby environment reconstruction
- Published to IROS 2022 and nominated for best paper in mobile manipulation

Learning from Electromyography Synergies to Grasp Novel Objects by Superquadric Representation **Jun 2018 — May 2020**
Columbia Robotics Lab *New York, NY*

- Collaborated with students to create a system for learning grasp synergies using a CTRL-Labs arm band and mapping the EMG signals to an anthropomorphic Seed robotic hand
- Helped develop an algorithm for planning and executing grasps using superquadric representations of novel objects with successful real-world demonstrations
- Work presented at Columbia Data Science Day 2019

Learning Your Way Without Map or Compass: Panoramic Target Driven Visual Navigation **Jan 2018 — Sep 2019**
Columbia Robotics Lab *New York, NY*

- Researched novel visual navigation methodology using RGBD panoramic target goals and behavioral cloning
- Developed a system architecture to embed images using an autoencoder and a policy model to control the robot
- Explored optimization strategies to develop training data from real-world environments without human intervention
- Work published to IROS 2020 and presented at NERC 2019

Multi-Modal Geometric Learning for Grasping and Manipulation **Sep 2017 — Sep 2019**
Columbia Robotics Lab *New York, NY*

- Incorporated tactile information to estimate shape geometry using vision and touch via deep learning
- Created a novel machine learned model for estimating shape via multi-modal information
- Work published to ICRA 2019 and to a RSS 2017 workshop

Human Robot Interface for Assistive Grasping **Jan 2017 — Dec 2018**
Columbia Robotics Lab and CUMC *New York, NY*

- Created a novel interface for enabling robot control for spinal cord injury patients using an sEMG device
- Benchmarked the sEMG interface against other modalities including an Amazon Echo and a toggle switch
- Work presented at Columbia Data Science Day 2018

Research in Bit Width Resolution **Jan 2016 — Dec 2016**
Columbia University *New York, NY*

- Worked with Professor Stephen Edwards at Columbia University to add Z3's SMT framework to an existing compiler project in order to resolve variable bit widths at compile time

Research in Shape Completion **Sep 2016 — May 2017**
Columbia Robotics Lab *New York, NY*

- Worked with Professor Peter Allen in the Columbia Robotics Lab at Columbia University to optimize an existing platform utilizing CUDA
- Evaluated the ability to utilize a semantic pre-processor to identify objects in a scene to be completed using the existing tool

Research in Data Visualization **Sep 2015 — Dec 2015**
Columbia University *New York, NY*

- Worked with Professor John Kender at Columbia University to provide visualization of the correlation between visual and textual memes in online video data and provided an analysis on the most effective ways of visualizing co-clustered data

Research in the Production of Litecoin ASICs **Jan 2014 — May 2014**
Columbia University *New York, NY*

- Cooperated with Professor Simha Sethumadhavan on the feasibility of producing Litecoin Mining ASICs
- Independently designed all of the ASIC schematics, performed cost-benefit analysis of the ASIC and maintained knowledge on which crypto-currencies were most profitable at any time

Written Values Affirmation Intervention to Identify the Unique Linguistic Features of Stigmatized Groups **Sep 2014 — Jan 2015**
LIRSM *New York, NY*

- Responsible for developing web application in Node.js and Mongo to easily add and retrieve information from csv files
- Participated in IT work and assisted with sessions in informing individuals on using UNIX
- Developed strategies to acquire study data more efficiently and help audit costs on services

Walking in Their Shoes: Poverty in America **Sep 2014 — Jan 2015**
Yale *New Haven, CT*

- Developed interface and game for flexible assignment of agency to test subjects to explore the impact that games have on depictions of poverty
- Worked with MongoDB and Angular.js to create flexible tiled gameplay

Publications

1. Milani, S., Kanervisto, A., Ramanauskas, K., Schulhoff, S., Houghton, B., Mohanty, S., ... Shah, R. (2023). Towards Solving Fuzzy Tasks with Human Feedback: A Retrospective of the MineRL BASALT 2022 Competition. arXiv preprint arXiv:2303.13512.

2. Choromanski K, Sehanobish A, Lin H, Zhao Y, Berger E, Parshakova T, Pan A, **Watkins D**, Zhang T, Likhosherstov V, Chowdhury SB. Efficient Graph Field Integrators Meet Point Clouds. arXiv e-prints. 2023 Feb:arXiv-2302.

3. Hu, Jiaheng, **David Watkins**, and Peter Allen. "Teleoperated Robot Grasping in Virtual Reality Spaces." arXiv preprint arXiv:2301.13064 (2023).

4. **Watkins-Valls, D.**, Allen, P., Choromanski, K., Varley, J., Waytowich, N. (2022). Multiple View Performers for Shape Completion. arXiv preprint arXiv:2209.06291. In review at ICRA 2023.

5. **Watkins, David Joseph.** (2022). Learning Mobile Manipulation. Columbia University. https://doi.org/10.7916/V9YM-TQ84

6. **Watkins-Valls, D.**, Maia H., Varley J., Seshadri M., Sanabria J., Waytowich, N., & Allen, P. (2022). Mobile Manipulation Leveraging Multiple Views. 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems, IROS 2022

7. Goecks, Vinicius G., et al. “Combining Learning from Human Feedback and Knowledge Engineering to Solve Hierarchical Tasks in Minecraft.” ArXiv:2112.03482 [Cs], Dec. 2021. arXiv.org, http://arxiv.org/abs/2112.03482. Accepted to AAAI-Make 2022.

8. **Watkins-Valls, D.**, Xu, J., Waytowich, N., & Allen, P. (2020). Learning your way without map or compass: Panoramic target driven visual navigation. 2020 IEEE/RSJ International Conference on Intelligent Robots and Systems, IROS 2020

9. Akinola, Iretiayo, Zizhao Wang, Junyao Shi, Xiaomin He, Pawan Lapborisuth, Jingxi Xu, **David Watkins-Valls**, Paul Sajda, and Peter Allen. "Accelerated Robot Learning via Human Brain Signals." In 2020 IEEE International Conference on Robotics and Automation (ICRA), pp. 3799-3805. IEEE, 2020.

10. Wu, B., Akinola, I., Gupta, A., Xu, F., Varley, J., **Watkins-Valls, D.**, & Allen, P. K. (2020). Generative Attention Learning: a “GenerAL” framework for high-performance multi-fingered grasping in clutter. Autonomous Robots, 1-20.

11. **Watkins-Valls, D.**, Varley, J. & Allen, P. Multi-Modal Geometric Learning for Grasping and Manipulation. 2019 IEEE International Conference on Robotics and Automation (ICRA). IEEE, 2019.

12. Abhi Gupta, Jingya Bi, Ashwin Jayaraman, Max Xu, **David Watkins** and Professor Peter Allen. “Learning from Electromyography Synergies to Grasp Novel Objects by Super Quadric Representation (Poster)” In: Columbia Data Science Day (2019).

13. Jacob Varley, **David Watkins-Valls**, and Peter Allen. “Multi-Modal Geometric Learning for Grasping and Manipulation (Poster)”. In: Columbia Data Science Day (2018).

14. Jacob Varley, **David Watkins**, and Peter Allen. “Visual-Tactile Geometric Reasoning (Abstract and Poster)”. In: Data-Driven Manipulation workshop, Robotics: Science and Systems (2017).

15. **David Watkins-Valls**, Chaiwen Chou, Caroline Weinberg, Jacob Varley, Lynne Weber, Adam Blanchard, Peter Allen, Joel Stein "Human Robot Interface for Assistive Grasping (Poster)". In: New England Manipulation Symposium (2017).

16. **David Watkins-Valls** "Scrypt Mining With ASICs" (2014).

Awards

Best Paper in Mobile Manipulation Finalist, *Kyoto, Japan* Oct 2022
Selected for my work titled Mobile Manipulation Leveraging Multiple Views submitted to IROS 2022
International House Member, *New York, NY* Sep 2016 — May 2018
Competitively selected scholars and young professionals from around the world who are challenged to become globally-minded leaders
CA Fellowship, *Columbia University* Sep 2016 — Dec 2016
MS students who have proven themselves to be exceptional will receive paid tuition and stipend
Goldman Sachs Code Golf Champion, *New York, NY* Aug 2016
Awarded for shortest possible source code that implements a certain algorithm
Dean's List, *Columbia University* Spring 2013, Spring 2015, Spring 2016
A list of students recognized for academic achievement during a semester by the dean of the college they attend
Residential Incubator Fellow, *Columbia University* Sep 2012 — May 2014
Students interested in entrepreneurship participating in a student incubator

Activities

IJRR Reviewer	2023
NSF Reviewer	2023
ICRA Paper Reviewer	2022
Computer Science Student Faculty Representative	2018 — 2020
IEEE RA-L Paper Reviewer	2021
IROS Paper Reviewer	2018, 2021, 2023
CoRL Paper Reviewer	2020

Skills

Languages	Python, C++, ROS, Tensorflow, PyTorch, CUDA, Javascript, Bash, LaTeX, MarkDown, Angular.js
Software	Gazebo, PyBullet, GraspIt!, MoveIt!, OpenCV, Blender, Windows, Ubuntu, Jetbrains, Git, Docker
Quantitative Research	Robotics, Machine Learning, Simulation, Grasping, Navigation, Graphics, GPUs, EMG
Communication	English, Spanish

Volunteer Work

Multisensory Reading Centers of Puerto Rico, *San Juan, PR* Sep 2017 — Present
Over 150 hours of volunteer service by performing IT help to provide access to effective literacy instruction for struggling readers
Watkins-Valls Family Foundation, *Boston, MA* Sep 2013 — Present
Providing scholarships and academic support to underprivileged students in Massachusetts, New York, and Puerto Rico
Pine St. Inn, *Boston, MA* Dec 2010 — May 2012
Over 25 hours of volunteer service at a soup kitchen for the homeless
Sisters of St. Joseph, *Cambridge, MA* Dec 2010 — May 2012
Over 25 hours of volunteer service through entertaining and assisting retired nuns

Presentations

From One to Many: How to leverage multiple views in shape completion, *Robotics at Google* Dec 2022
A discussion on how to leverage multiple views for shape completion presented to researchers at Robotics at Google
Learning Mobile Manipulation, *Harvard - Harvard Biorobotics Laboratory* Nov 2022
Presented an abbreviated version of my thesis enabling mobile robots to manipulate objects to professor Robert Howe's lab
Learning Mobile Manipulation, *Tufts - Human Robotics Interaction Laboratory* Nov 2022
Presented an abbreviated version of my thesis enabling mobile robots to manipulate objects to professor Matthias Scheutz's lab
Learning Mobile Manipulation, *MIT - Improbable AI Lab* Nov 2022
Presented an abbreviated version of my thesis enabling mobile robots to manipulate objects to professor Pulkit Agrawal's lab
Learning Mobile Manipulation, *Boston Dynamics* Nov 2022
Presented an abbreviated version of my thesis enabling mobile robots to manipulate objects
Learning Mobile Manipulation, *Boston Dynamics AI Institute* Nov 2022
Presented a collection of works done during my Ph.D.
Learning Mobile Manipulation, *MITRE* Nov 2022
Presented an abbreviated version of my thesis enabling mobile robots to manipulate objects
Learning Mobile Manipulation, *Rotor.ai* Oct 2022
Presented an abbreviated version of my thesis enabling mobile robots to manipulate objects
Learning Mobile Manipulation, *STR* Oct 2022
Presented an abbreviated version of my thesis enabling mobile robots to manipulate objects
Mobile Manipulation Leveraging Multiple Views, *IROS 2022* Oct 2022

Presented work on localization free mobile manipulation that was nominated for best paper in mobile manipulation

P.h.D. Defense: Learning Mobile Manipulation, *Columbia University* May 2022
Presented my dissertation defense enabling mobile robots to manipulate objects

Minecraft Basalt Interview, *Yannic Kilcher YT* Jan 2022
Interviewed on recent first place win in Minecraft Basalt RL competition.

Learning Mobile Manipulation, *ROAM Lab* Dec 2021
Presented work done in preparation of defense of my thesis to the ROAM lab at Columbia University.

Learning Mobile Manipulation, *CAIR Lab* Feb 2021
Presented my thesis proposal to the CAIR lab at Columbia University.

IROS 2020: Learning Your Way Without Map or Compass, *IROS 2020* Oct 2020
Presented my Learning Your Way work at IROS 2020 via the online conference.

Demystifying the Dissertation, *Columbia University* Jun 2020
Presented my thesis proposal and help current graduate students understand the process of completing a PhD.

Thesis Proposal: Learning Mobile Manipulation, *New York, NY* Jan 2020
Presented and defended my thesis proposal in learning mobile manipulation in January 2020.

Research Talk, *Harlem Children's Zone STEM Exposure* Nov 2019
Shared my research as part of an initiative to help teach children in Harlem methods in STEM research.

Learning Your Way Talk, *NYU Reading Group* Oct 2019
Presented Learning Your Way work to the NYU robotics reading group.

Learning Your Way Talk, *NERC 2019* Oct 2019
Presented Learning Your Way work in front of audience of robotics researchers at NERC 2019 conference.

Visual Tactile Completion, *Emptor Lightning Talks* Sep 2019
Presented work on visual tactile grasping as well as next steps as part of Emptor's lightning talks.

Odefi Pitch, *Columbia IBM Blockchain Accelerator Demo Day 2019* May 2019
Enabling credit default swaps on the ethereum network pitched to investors at the capstone event for the Columbia IBM Blockchain Accelerator.

Visual Tactile Grasping, *Samsung Research NYC* July 2019
Presented work on visual tactile grasping as well as next steps.

Candidacy Exam: Simulation for Real World Robotics, *New York, NY* May 2019
A high-level overview of how real-world robotics can be enabled through simulation.

Using Simulation to Enable Generated Art and Robotics, *Making Art in the Age of Algorithms* Dec 2018
A high-level overview of how robotics can be enabled through simulation as part of a series of lightning talks about art and algorithms.

Visual Tactile Completion Poster, *Data Science Day 2018* Mar 2018
This work provides an architecture that incorporates depth and tactile information to create rich and accurate 3D models useful for robotic manipulation tasks presented at Data Science Day 2018 at Columbia University.

Lecture: ROS Tutorial, *New York, NY* Jan 2018
An introductory tutorial on ROS and use of robotics in the Columbia Robotics Lab to aspiring roboticists.

Providing Context to Startup Culture, *New York, NY* May 2016
An analysis on the effectiveness of a startup based on the type of culture it maintains as well as effects on profit/loss.

Memberships

ACM	2016 — Present
IEEE	2016 — Present
SHPE	2018 — Present
AAAI	2022 — Present

Teaching Experience

Humanoid Robotics (COMSW 6731), Teaching Assistant, Graduate Level Spring 2018
Computational Aspects of Robotics (COMSW 4733), Teaching Assistant, Graduate Level Fall 2017
Programming Languages and Translators (COMSW 4115), Teaching Assistant, Graduate Level Fall 2016
Object Oriented Programming and Design in Java (COMS 1007), Teaching Assistant, Undergraduate Level Fall 2016
Programming Languages and Translators (COMSW 4115), Teaching Assistant, Graduate Level Spring 2016
Object Oriented Programming and Design in Java (COMS1007), Teaching Assistant, Undergraduate Level Fall 2014
Fundamentals of Computer Systems (CSEE3827), Teaching Assistant, Undergraduate Level Spring 2014
Object Oriented Programming and Design in Java (COMS1007), Teaching Assistant, Undergraduate Level Fall 2013

References

Michael Reed Manager of AI/ML Engineering, Disney StudioLab reedmichaelk@gmail.com
Peter Allen Professor Emeritus, Computer Science at Columbia University allen@cs.columbia.edu
Matei Ciocarlie Professor, Mechanical Engineering at Columbia University matei.ciocarlie@columbia.edu
Nicholas Waytowich Ph.D., Researcher at ARL nick.waytowich@gmail.com
Jacob Varley Ph.D., Robotics Researcher at Google Research jakevarley@google.com
John Kender Professor, Computer Science at Columbia University jrk@columbia.edu