MARK VAN DER MERWE

EDUCATION

University of Michigan, Ann Arbor — *Aug 2020 - Current*
PhD in Robotics — Advisors: Dmitry Berenson, Nima Fazeli

University of Utah — *Aug 2016 - May 2020*
Honors BSc in Computer Science — GPA: 3.983

Academy for Math, Engineering, and Science — *Aug 2012 - May 2016*
High School — GPA: 4.0

EXPERIENCE

NASA Jet Propulsion Laboratory — May 2020 - July 2020
Project: Mars Sample Return Perception Systems — *Intern (Mentor: Dr. Renaud Detry)*

- Developed simulation pipeline to demonstrate end-to-end integration testing of Mars Sample Return (MSR) perception pipeline. Gazebo, ROS; Python, C++.
- Demonstrated rover localization applying team-developed Sparse Feature Matching and Synthetic Template Matching localization techniques.
- Ran preliminary qualitative tests applying learned 3D-2D correspondence technique to MSR localization problem.
- Related Research Outcomes: 2 co-author papers (see Publ. [5,6]).

Mila - Quebec Artificial Intelligence Institute — Sep 2019 - Dec 2019
Project: Dense 3D Correspondence Models for Robot Manipulation — *Intern (Mentor: Prof. Liam Paull)*

- Investigated dense 3D geometric correspondences across category-level objects (e.g., mugs, bottles) for robotic manipulation tasks via unsupervised learning.

LL4MA Lab (University of Utah) — Jan 2019 - Aug 2019; Dec 2019 - May 2020
Project: Learning Reconstructions for Geometrically Aware Grasping — *Advisor: Prof. Tucker Hermans*

- Developed novel 3D reconstruction algorithm that performs implicit surface reconstruction.
- Utilized reconstruction in a novel grasp synthesis formulation that enables geometrically-aware grasping via 1) a learned, reconstruction-aware grasp metric and 2) explicit collision constraints in grasp metric optimization.
- Related Research Outcomes: 1 paper; 2 co-author papers; Oral presentation (see Publ. [7,8,9]).

Center for Parallel Computing (University of Utah) — May 2018 - February 2019
Project: Message Scheduling for Belief Propagation on the GPU — *Advisor: Prof. Ganesh Gopalakrishnan*

- Explored existing message-passing approaches for Belief Propagation (BP) on the GPU, showing that tradeoffs existed between massive parallelism and sequentialism in terms of speed of convergence.
- Introduce randomized, low-overhead message scheduling that outperforms existing approaches on the GPU, converging faster and more often while maintaining accuracy.
- Research Outcomes: Poster and Oral presentation; one paper (see Publ. [10]).

Lucid Software — May 2017 - Aug 2017
Project: Lucidchart Android App — *Software Engineer Intern*

- Lucidchart mobile team doing Android front-end development. Scala, some Javascript.
- Projects in production include adding shapes to flowchart, creating new flowcharts, creating from template, managing shape libraries, and sharing documents.

PUBLICATIONS

1. Y. Wi, **M. Van der Merwe**, P. Florence, A. Zeng, N. Fazeli, "CALAMARI: Contact-Aware and Language conditioned spatial Action MApping for contact-RIch manipulation," *Conference on Robot Learning, 2023*
2. **M. Van der Merwe**, Y. Wi, D. Berenson, N. Fazeli, "Integrated Object Deformation and Contact Patch Estimation from Visuo-Tactile Feedback," *Robotics: Science and Systems, 2023*

3. **M. Van der Merwe**, D. Berenson, N. Fazeli, "Learning the Dynamics of Compliant Tool-Environment Interaction for Visuo-Tactile Contact Servoing," *Conference on Robot Learning, 2022*
4. Y. Chen, A. Sipos, **M. Van der Merwe**, Nima Fazeli, "Visuo-Tactile Transformers for Manipulation," *Conference on Robot Learning, 2022*
5. T. Pham, W. Seto, S. Daftry, B. Ridge, J. Hansen, T. Thrush, **M. Van der Merwe**, G. Maggiolino, A. Brinkman, J. Mayo, Y. Cheng, C. Padgett, E. Kulczycki, R. Detry, "Rover Relocalization for Mars Sample Return by Virtual Template Synthesis and Matching," *IEEE Robotics and Automation Letters 2021*
6. S. Daftry, B. Ridge, W. Seto, T. Pham, P. Illhardt, G. Maggiolino, **M. Van der Merwe**, A. Brinkman, J. Mayo, E. Kulczyski, R. Detry, "Machine Vision based Sample-Tube Localization for Mars Sample Return," *IEEE Aerospace Conference 2021*
7. Q. Lu, **M. Van der Merwe**, T. Hermans, "Multi-Fingered Active Grasp Learning," *IEEE International Conference on Intelligent Robots and Systems (IROS), 2020*
8. **M. Van der Merwe**, Q. Lu, B. Sundaralingam, M. Matak, T. Hermans, "Learning Continuous 3D Reconstructions for Geometrically Aware Grasping," *IEEE International Conference on Robotics and Automation (ICRA), 2020*
9. Q. Lu, **M. Van der Merwe**, B. Sundaralingam, T. Hermans, "Multi-Fingered Grasp Planning via Inference in Deep Neural Networks," *IEEE Robotics and Automation Magazine 2020 Special Issue: Deep Learning and Machine Learning in Robotics*
10. **M. Van der Merwe**, V. Joseph, and G. Gopalakrishnan, "Message Scheduling for Performant, Many-Core Belief Propagation," *IEEE High Performance Extreme Computing Conference (HPEC), 2019*, **(Best Student Paper Finalist)**

PRESENTATIONS

- **Poster:** "CALAMARI: Contact-Aware and Language conditioned spatial Action MApping for contact-RIch manipulation," *Conference on Robot Learning, 2023*
- **Oral Presentation:** "Integrated Object Deformation and Contact Patch Estimation from Visuo-Tactile Feedback," *Robotics: Science and Systems, 2023*
- **Lightning Talk/Poster:** "Learning the Dynamics of Compliant Tool-Environment Interaction for Visuo-Tactile Contact Servoing," *Conference on Robot Learning, 2022*
- **Poster:** "Visuo-Tactile Transformers for Manipulation," *Conference on Robot Learning, 2022*
- **(Virtual) Oral Presentation:** "Learning Continuous 3D Reconstructions for Geometrically Aware Grasping," *IEEE ICRA*, 2020
- **Oral Presentation:** "Message Scheduling for Performant, Many-Core Belief Propagation," *IEEE HPEC*, 2019
- **Poster:** "Effective Parallelization of Belief Propagation on the GPU," *Nvidia GPU Technology Conference (Silicon Valley)*, 2019

SERVICES

- Reviewer for IEEE RA-L/IROS 2020, 2021, 2022, RSS 2021, IEEE ICRA 2022, 2023, 2024, CoRL 2023.

AWARDS

NSF Graduate Research Fellow, 2020.

Best Student Paper Finalist, IEEE High Performance Extreme Computing Conference 2019.

University of Utah Dean's List - Fall 2016, Spring 2017, Fall 2017, Spring 2018, Fall 2018, Spring 2019.

LEADERSHIP EXPERIENCE

Robotics Graduate Student Council Feb 2023 - Current
Colloqium Chair

· Organize practice sessions for qualification examinations for PhD students.

University of Utah Association for Computing Machinery Chapter Aug 2018 - August 2019
Chair

· Lead organization of club and events including resume reviews, tech talks, and programming challenges. Communicated and coordinated with local companies and sponsors for events.

Lassonde Make Program Aug 2016 - May 2017; Aug 2017 - Dec 2017
Tool Mentor

· Mentor students who come to the make space/workshop with their projects, help teach tools (3D printers, laser cutters, wood-working tools, etc.), provide support for students looking to prototype.

SELECTED CLASSES

Robotics	Robotic Manipulation, Motion Planning, Unsupervised Visual Learning, Linear Systems Theory, Applied Optimal Control
Computer Science	Parallel Programming, Computer Networks, Data Mining, Operating Systems, Database Systems, Robotics, Machine Learning, Artificial Intelligence, Computer Vision
Math	Linear Algebra, Foundations of Real Analysis

TECHNICAL STRENGTHS

Programming Languages	Python, C++
Tools	Git, ROS, Pytorch, LaTeX