

# Guillaume SARTORETTI

Assistant Professor, National University of Singapore, Mechanical Engineering Dpt. (2019-)

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<http://www.sartoretti.science>

<https://scholar.google.com/citations?user=n7NzZ0sAAAAJ>

## Education

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|--------------------------|--|
| June 2018<br>– June 2019 | <b>Manufacturing Futures Initiative (MFI) Postdoctoral Fellow, Robotics Institute, CMU</b><br><u>Project Title:</u> <i>Distributed Learning for large-scale multi-robot path planning in complex environments.</i> <u>Advisor:</u> Prof. Howie Choset. |
| June 2016<br>– June 2018 | <b>Postdoctoral Fellow, Robotics Institute, Carnegie Mellon University</b><br><u>Advisor:</u> Prof. Howie Choset.  |
| April 2016               | <b>PhD in <i>Robotics, Control and Intelligent Systems</i>, EPFL, Switzerland</b><br><u>Title:</u> <i>Control of Agent Swarms in Random Environments</i><br><u>Advisor:</u> Prof. Max-Olivier Hongler.   |
| March 2012               | <b>Master of Science in Mathematics and Computer Science, University of Geneva.</b>  |
| June 2010                | <b>Bachelor of Science in Mathematics and Computer Science, University of Geneva.</b>  |

## Professional and Teaching Experience

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| 2019 - Current | <b>Lecturer Activities, Mechanical Engineering Department, NUS.</b> <ul style="list-style-type: none"><li>▪ “Microprocessor applications”, ME3241, (Bachelor, 3<sup>rd</sup> year).</li><li>▪ “Deep learning for robotics”, ME5406, (Master’s level course).</li><li>▪ “Machine Vision”, ME5405 (Master’s level course).</li></ul> |
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## Student Mentoring

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|             | <b><u>Postgraduate students supervised to date</u></b>                                     |
| 2020 - 2021 | WANG Yutong, M.Sc, <i>Communication Learning for Multi-Agent Cooperation.</i>              |
| 2020 - 2021 | ZHANG Yifeng, M.Sc, <i>dRL for Decentralized Traffic Management in Urban Environments.</i> |
| 2020 - 2021 | WANG Yizhuo, M.Sc, <i>Reinforcement Learning for Multi-Agent Search and Rescue.</i>        |
| 2020 - 2021 | ZHANG Xiaoyang, M.Sc, <i>Visual/LiDAR-based SLAM on legged articulated robot.</i>          |
| 2020 - 2021 | HUANG Jiangeng, M.Sc, <i>Multi-agent Search based on Distributed RL.</i>                   |
| 2020 - 2021 | LI Aijia, M.Sc, <i>Urban Traffic Management and Optimization for Pedestrians.</i>          |
| 2019 - 2020 | LUO Zhiyao, M.Sc, <i>Deep Reinforcement Learning Based Multi-Agent Pathfinding.</i>        |
| 2019 - 2020 | DAI Weiheng, M.Sc, <i>Multi-Agent Search based on distributed Deep RL.</i>                 |
| 2019 - 2020 | XIA Yixuan, M.Sc, <i>Obstacle Avoidance for A Legged Robot Based on FFT Control.</i>       |
| 2019 - 2020 | GE Sun, M.Sc, <i>Bio-inspired Visual Servoing for a Legged Robot.</i>                      |
| 2019 - 2020 | XING Yan, M.Sc, <i>Model-based Dynamic Obstacle Avoidance on Inclined Surface.</i>         |

## Grants and Awards

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| 2021 - 2022 | <p><b>Seed Research Project, T-Lab@NUS (main PI).</b></p> <p><u>Project Title:</u> <i>Learning Based Approaches for Advanced Multi-Agent Search Problems.</i></p> <p><u>Co-PIs:</u> Dr. Jiawei CAO. <span style="float: right;"><u>Amount:</u> S\$ 60k.</span></p>   |
| 2021 - 2024 | <p><b>MOE Academic Research Fund (AcRF) Tier 1 FRC Research Grant (main PI).</b></p> <p><u>Title:</u> <i>Communication-Based AI Methods for Multi-Robot Decentralized Cooperation.</i></p> <p><u>Amount:</u> S\$ 226,5k.</p>   |
| 2020 - 2022 | <p><b>Work Package 3 of “Urban Traffic Flow Smoothing Models” (Co-PI).</b></p> <p><u>Project Title:</u> <i>Traffic Light Control for Optimal Traffic Flow.</i></p> <p><u>Co-PIs:</u> Profs. Kien Ming Ng (PI), Marcelo ANG, and Gerard LENG. <span style="float: right;"><u>Amount:</u> S\$ 780k.</span></p> |
| 2020 - 2021 | <p><b>Seed Research Project, T-Lab@NUS (main PI).</b></p> <p><u>Project Title:</u> <i>Scalable Decentralized Multi-Robot Search via Distributed RL.</i></p> <p><u>Co-PIs:</u> Drs. Swee Huat Rodney TEO and Jiawei CAO. <span style="float: right;"><u>Amount:</u> S\$ 60k.</span></p>                       |
| 2018 - 2019 | <p><b>Manufacturing Futures Initiative (MFI) Postdoctoral Fellowship.</b></p> <p><u>Project Title:</u> <i>Distributed Learning for large-scale multi-robot path planning in complex environments.</i> <span style="float: right;"><u>Advisor:</u> Prof. Howie Choset.</span></p>                             |
| 2018 - 2019 | <p><b>Extreme Science and Engineering Discovery Environment (XSEDE)</b></p> <p>Startup grant in the form of 2’500 additional hours of GPU computation at the PSC.</p>  |

## Invited Lectures, Seminars and Colloquia

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| 27/09/2021 | ETHZ Autonomy Talk, 1h Invited Seminar (virtual), <a href="https://youtu.be/2Jts4uFbbBM">https://youtu.be/2Jts4uFbbBM</a> |
| 02/12/2019 | National University of Singapore, Invited Seminar, Temasek Laboratory.  |
| 06/11/2019 | Case Western Reserve University, Invited Seminar, Mechanical & Aerospace Eng. Dpt.  |
| 09/19/2018 | Invited Seminar at the National Robotics Engineering Center (NREC).   |
| 08/09/2018 | Tufts University, Invited Seminar, Computer Science Department.   |
| 01/28/2016 | EPFL, Informal private presentation, DISAL laboratory.  |
| 09/29/2015 | Drexel University, Private presentation, SAS and GRASP laboratories.  |

## Other Academic Activities

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| 2021 - Current | Senior Program Committee Member (SPC) for the International Joint Conference on Artificial Intelligence (IJCAI) and the International Symposium on Multi-Robot and Multi-Agent Systems (MRS). |
| 2020 - Current | Associate Editor for IEEE RA-L (in the <i>Multiple and Distributed Systems</i> area).   |
| 2019 - Current | Guest Editor for Springer Nature Applied Sciences’ topical collection on “Distributed Mobile Robotic Systems.”  |

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| 2019 - Current | Reviewer for <i>Science Robotics</i> (ScienceMag), <i>JAAMAS</i> (Springer), <i>SICOMP</i> (Sage), <i>Robotics and Automation Letters</i> (RA-L, IEEE), as well as various international conferences on robotics and AI (ICRA, IROS, WAFR, AAMAS, ECC, ACC, IJCAI, CASE). |
| 2018           | Session chair at the Int. Symp. on Distributed Autonomous Robotic Systems (DARS).   |
| 2015           | Session chair at the <i>Inter. Symposium on Swarm Behavior and Bio-Inspired Robotics</i> .  |
| 2013           | Session chair at the <i>International Conference on Agents and Artificial Intelligence</i> .  |

### Publications: Thesis and Refereed Book Chapters

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| 2016 | <u>PhD Thesis</u> : G. Sartoretti and M.-O. Hongler. <i>Control of Agent Swarms in Random Environments</i> . EPFL, Lausanne (CH).  |
| 2013 | G. Sartoretti and M.-O. Hongler. Soft control of self-organized locally interacting Brownian planar agents. <i>Lecture Notes in Computer Science</i> , pp.45-52. Springer. |
| 2012 | G. Sartoretti, J.-L. Falcone, B. Chopard, and M. J. Gander. Decentralized method for traffic monitoring. <i>Lecture Notes in Computer Science</i> , pp.464-473. Springer.  |

### Publications: Refereed Journal Papers

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| 2022 | S. Shaw, E. Wenzel, A. Walker, and G. Sartoretti. ForMIC: Foraging via Multiagent RL with Implicit Communication. <b>Submitted to <i>Swarm Intelligence</i></b> .  |
| 2021 | M. Damani, Z. Luo, E. Wenzel, and G. Sartoretti. PRIMAL <sub>2</sub> : Pathfinding via Reinforcement and Multiagent Imitation Learning - Lifelong. <i>IEEE Robotics and Automation Letters (RA-L)</i> , 6(2):2666-2673.  |
| 2021 | B. Chong, Y.O. Aydin, C. Gong, G. Sartoretti, Y. Wu, J.M. Rieser, H. Xing, P.E. Schiebel, J.W. Rankin, K.B. Michel, A. Nicieza, J.R. Hutchinson, D.I. Goldman and H. Choset. Coordination of lateral body bending and leg movements for sprawled posture quadrupedal locomotion. <i>The International Journal of Robotics Research</i> . |
| 2020 | B. Freed, G. Sartoretti, and H. Choset. Simultaneous policy and discrete communication learning for multi-agent cooperation. <i>IEEE RA-L</i> , 5(2):2498-2505.  |
| 2019 | G. Sartoretti, W. Paivine, Y. Shi, Y. Wu, H. Choset. Distributed learning of decentralized control policies for articulated mobile robots. <i>Transactions in Robotics</i> , 35(5):1109-1122.  |
| 2019 | G. Sartoretti, J. Kerr, Y. Shi, G. Wagner, T. K. S. Kumar, S. Koenig, H. Choset. PRIMAL: Pathfinding via Reinforcement and Imitation Multi-Agent Learning. <i>IEEE RA-L</i> , 4(3):2378-2385.  |
| 2016 | G. Sartoretti. Leader-based versus soft control of multi-agent swarms. <i>Artificial Life and Robotics</i> , 21(3):302-307.  |
| 2016 | G. Sartoretti and M.-O. Hongler. Interacting Brownian swarms: Analytical results. <i>Entropy</i> , 18, 27.   |
| 2014 | G. Sartoretti, M.-O. Hongler, M. Elias de Oliveira, and F. Mondada. Decentralized self-selection of swarm trajectories: From dynamical system theory to robotic implementation. <i>Swarm Intelligence</i> , vol. 8(no. 4):329-351.   |

2013 **G. Sartoretti** and M.-O. Hongler. Self-organized mixed canonical-dissipative dynamics for Brownian planar agents. *Cybernetics and Physics*, 2(1):41-46.

2013 B. Barbieri, **G. Sartoretti**, J.-L. Falcone, B. Chopard, and M. J. Gander. Traffic prediction based on a local exchange of information. *Journal of Cellular Automata*, 8(5-6):429-441.

## Publications: Refereed Conference Papers

2021 **G. Sartoretti**, A. Rao, and H. Choset. Spectral-based distributed Ergodic coverage for heterogeneous multi-agent search. *15th International Symposium on Distributed Autonomous Robotics Systems (DARS 2021)*. **Best Paper Award**.

2021 **G. Sartoretti**, T. Wang, G. Chuang, Q. Li, and H. Choset. Autonomous decentralized shape-based navigation for snake robots in dense environments. *International Conference on Robotics and Automation (ICRA 2021)*.

2020 B. Freed, R. James, **G. Sartoretti**, and H. Choset. Sparse discrete communication learning for multi-agent cooperation through backpropagation. *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2020)*.

2020 B. Freed, **G. Sartoretti**, J. Hu, and H. Choset. Communication learning via backpropagation in discrete channels with unknown noise. *Proceedings of AAAI 2020 - 34th Conference on Artificial Intelligence*, pp.7160-7168.

2019 B. Chong, Y. Ozkan Aydin, **G. Sartoretti**, J. Rieser, C. Gong, H. Xing, H. Choset, and D. Goldman. A hierarchical geometric framework to design locomotive gaits for highly articulated robots. *Proceedings of Robotics: Science and Systems (RSS)*.

2019 S. Shaw, **G. Sartoretti**, J. Olkin, W. Paivine, and H. Choset. Workspace CPG with body pose control for stable, directed vision during omni-directional locomotion. *International Conference on Robotics and Automation (ICRA) 2019*, pp.6316-6322.

2018 **G. Sartoretti**, Y. Wu, W. Paivine, T. K. Satish Kumar, S. Koenig, and H. Choset. Distributed reinforcement learning for multi-robot decentralized collective construction. *International Symposium on Distributed Autonomous Robotic Systems (DARS)*, pp.35-49.

2018 B. Chong, Y. Ozkan Aydin, C. Gong, **G. Sartoretti**, Y. Wu, J. Rieser, H. Xing, J. Rankin, K. Michel, A. Nieceza, J. Hutchinson, D. Goldman, and H. Choset. Coordination of back bending and leg movements for quadrupedal locomotion. *RSS 2018*.

2018 **G. Sartoretti**, Y. Shi, W. Paivine, M. Travers, and H. Choset. Distributed learning for the decentralized control of articulated mobile robots. *ICRA 2018*, pp.3789-3794.

2018 **G. Sartoretti**, S. Shaw, K. Lam, N. Fan, M. Travers, and H. Choset. Central pattern generator with inertial feedback for stable locomotion and climbing in unstructured terrain. *ICRA 2018*, pp.5769-5775.

2018 F. Ruscelli, **G. Sartoretti**, J. Nan, Z. Feng, M. Travers, and H. Choset. Proprioceptive-inertial autonomous locomotion for articulated robots. *ICRA 2018*, pp.3436-3441.

2016 **G. Sartoretti**, S. Shaw, and M. Ani Hsieh. Distributed planar manipulation in fluidic environments. *ICRA 2016*, pp.5322-5327.

2015 **G. Sartoretti**. Leader-based versus soft control of multi-agent swarms. *SWARM 2015 - International Symposium on Swarm Behavior and Bio-Inspired Robotics*.

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| 2014 | <b>G. Sartoretti</b> , M.-O. Hongler, and R. Filliger. The estimation problem and heterogenous swarms of autonomous agents. <i>SMTDA 2014 - Stochastic Modeling Techniques and Data Analysis International Conference</i> , volume 1. |
| 2013 | <b>G. Sartoretti</b> and M.-O. Hongler. Self-organized mixed canonic-dissipative dynamics for Brownian planar agents. <i>EUROCAST 2013 - International Conference on Computer Aided Systems Theory</i> , volume 1, pp.45-52.          |
| 2013 | <b>G. Sartoretti</b> and M.-O. Hongler. Soft control of swarms: Analytical approach. <i>ICAART 2013 - Proceedings of the 5th International Conference on Agents and Artificial Intelligence</i> , volume 1, pp.147-153.               |
| 2012 | <b>G. Sartoretti</b> , J.-L. Falcone, B. Chopard, M. J. Gander. Decentralized method for traffic monitoring. <i>ACRI 2012: Cellular Automata for Research and Industry</i> , Vol. 1, pp.464-73.                                       |

## Languages

|                |                |                  |                         |
|----------------|----------------|------------------|-------------------------|
| <i>French</i>  | mother tongue  | <i>Spanish</i>   | oral comprehension      |
| <i>English</i> | fluent         | <i>Hungarian</i> | weak oral comprehension |
| <i>German</i>  | good knowledge |                  |                         |

## References for Guillaume Sartoretti

Available upon request.