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Yoonchang Sung
University of Texas at Austin
yooncs8@cs.utexas.edu

Zhiang Chen
California Institute of Technology
chen256@caltech.edu

Jnaneshwar Das
Arizona State University
jdas5@asu.edu

Pratap Tokekar
University of Maryland
tokekar@umd.edu

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A Survey of Decision-Theoretic Approaches for Robotic Environmental Monitoring

Yoonchang Sung[1], Zhiang Chen[2], Jnaneshwar Das[3] and Pratap Tokekar[4]

[1]*Department of Computer Science, The University of Texas at Austin, USA; yooncs8@cs.utexas.edu*
[2]*Division of Geological and Planetary Sciences, California Institute of Technology, USA; zchen256@caltech.edu*
[3]*School of Earth and Space Exploration, Arizona State University, USA; jdas5@asu.edu*
[4]*Department of Computer Science, University of Maryland, College Park, USA; tokekar@umd.edu*

ABSTRACT

Robotics has dramatically increased our ability to gather data about our environments, creating an opportunity for the robotics and algorithms communities to collaborate on novel solutions to environmental monitoring problems. To understand a taxonomy of problems and methods in this realm, we present the first comprehensive survey of decision-theoretic approaches that enable efficient sampling of various environmental processes. We investigate representations for different environments, followed by a discussion of using these presentations to solve tasks of interest, such as learning, localization, and monitoring. To efficiently implement the tasks, decision-theoretic optimization algorithms consider:

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(1) where to take measurements from, (2) which tasks to be assigned, (3) what samples to collect, (4) when to collect samples, (5) how to learn environment; and (6) who to communicate. Finally, we summarize our study and present the challenges and opportunities in robotic environmental monitoring.

1

Introduction

Environmental monitoring is a crucial field encompassing diverse applications, including marine exploration, wildlife conservation, ecosystem assessment, and air quality monitoring. Collecting accurate and timely data from inaccessible locations and challenging environments is essential for understanding and addressing environmental issues. Robots offer a promising solution by enabling data collection at unprecedented spatio-temporal scales. However, relying solely on teleoperation is impractical and limits the efficiency and effectiveness of environmental monitoring efforts. Autonomy plays a pivotal role in unlocking the full potential of robots, allowing them to operate independently and intelligently in complex environments.

This survey focuses on high-level decision-making problems in autonomous environmental monitoring robots. Decision-making at the high level involves strategic planning and coordination to optimize data collection. Addressing these challenges allows robots to autonomously navigate, explore, and gather scientific data in a wide range of environmental monitoring applications.

Despite the potential benefits of autonomous environmental monitoring, several research challenges must be overcome. The first challenge lies in the development of effective high-level decision-making algorithms capable of handling environmental complexities and uncertainties within resource constraints. These algorithms enable robots to make informed decisions on task prioritization, sensor selection, path planning, and collaboration with other robots or human operators. Additionally, ensuring the robustness, adaptability, and scalability of decision-making systems is critical and challenging for real-world deployments. This survey delves into the current state-of-the-art decision-making algorithms, compares their strengths and limitations, and discusses their applicability to environmental monitoring, aiming to shed light on the progress made and highlight the open research problems in this field.

By focusing on high-level decision-making, this survey aims to provide insights and understanding for researchers and practitioners in the field of autonomous environmental monitoring robotics. The knowledge gained from this survey can guide the development of advanced decision-making techniques, paving the way for more effective and efficient environmental monitoring efforts and contributing to the broader goal of sustainable resource management and conservation.

Environmental monitoring encompasses a wide range of applications. Despite the diversity of these applications, many decision-making problems share common characteristics. For example, robotic systems in environmental monitoring applications face complex decision-making challenges, requiring high-level planning to optimize resource utilization and data collection. Effective decision-making in these scenarios requires abstractions to model these environments and formulate efficient solutions. By identifying these commonalities, we can uncover general principles and techniques that can be adapted and applied across different environmental monitoring applications.

Particularly, we focus on three typical decision-making tasks in the scientific studies of environmental monitoring. First, environmental scientists wish to efficiently *learn* representations for environmental processes. Second, they want to *localize* phenomena such as hotspots using these representations. Third, they want to *monitor* change in the phenomena, *e.g.*, movement in the boundary of an oil spill and the change in tree canopy size through a season. This survey presents a comprehensive survey of environmental monitoring, covering data-driven algorithms geared towards deployment on cyber-physical systems, such as wireless sensor networks and networked robotic vehicles. This serves as a tutorial for engineers and scientists who are interested in applying information theoretic algorithms to maximize the yield of scientific studies. This objective is particularly necessary in the context of field data collection that can be dramatically improved by the choice of efficient robotic sampling strategies.

1.1 Related Surveys

We compile related survey papers that discuss autonomous monitoring applications. Corke *et al.* (2010) review environmental and agricultural applications utilizing wireless sensor networks. Camilli *et al.* (2010) conduct an overview of advanced platforms, power generation, communications, and sensing technologies for marine environmental monitoring. An environmental monitoring survey paper by Dunbabin and Marques (2012) introduces various sensor types, sensor network platforms, and commonly used technologies for measuring environmental variables. Lattanzi and Miller (2017) present a recent survey on robotic infrastructure inspection. Challenges in the infrastructure inspection include the design of inspection robots, trajectory planning, and handling GPS-denied environments. Precision agriculture (R Shamshiri *et al.*, 2018; Vougioukas, 2019; Sparrow and Howard, 2021; Oliveira *et al.*, 2021a; Basiri *et al.*, 2022) has recently gained significant attention in robotics, with an objective to monitor and enhance crop health by utilizing multiple sources in a more efficient manner. Murphy *et al.* (2016) summarize robot designs, concepts, and open issues in search and rescue for disaster scenarios. Liu and Nejat (2013) introduce control methods in robotic urban search and rescue, while a survey paper by Queralta *et al.* (2020) focuses on multi-robot systems for search and rescue.

In contrast to the aforementioned survey papers that focus on specific applications, our goal is to offer a comprehensive algorithmic framework for a broad spectrum of environmental monitoring tasks. Our survey will serve as a guideline for identifying appropriate decision-making challenges, assumptions, and algorithmic considerations for various applications.

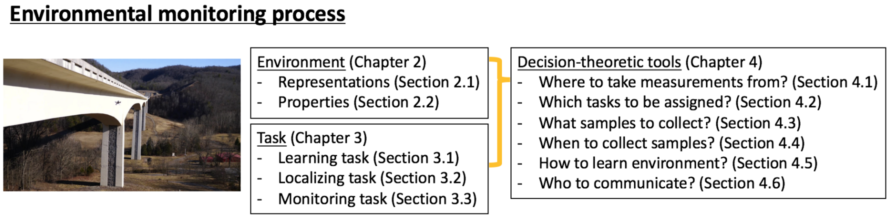

Figure 1.1: Organization of this survey. Environmental monitoring processes involve three key aspects that must be clearly defined. First, it is essential to determine the ideal environmental representations and their properties. Second, understanding the type of task the monitoring process is involved in is crucial to define task objectives effectively. Third, leveraging decision-theoretic tools from the literature is critical for making informed decisions during environmental monitoring. This survey provides detailed guidelines for each of these aspects to assist practical users in their monitoring endeavors.

The remainder of this survey is organized as follows (Figure 1.1). In Section 2, we introduce various methods of representing the environment, which are broadly grouped into discrete and continuous approaches. In Section 3, we present three primary tasks in environmental monitoring: the learning, localizing, and monitoring tasks. Section 4 is the core of this survey, where we delve into the details of various decision-theoretic approaches based on 5W1H-driven categories. We conclude the survey in Section 5 with a discussion on promising future directions and final remarks.

References

Abraham, I. and T. D. Murphey. (2018). "Decentralized ergodic control: distribution-driven sensing and exploration for multiagent systems". *IEEE Robotics and Automation Letters*. 3(4): 2987–2994.

Al-Abri, S., W. Wu, and F. Zhang. (2018). "A Gradient-Free 3-dimensional Source Seeking Strategy with Robustness Analysis". *IEEE Transactions on Automatic Control*.

Acar, E. U. and H. Choset. (2002). "Sensor-based coverage of unknown environments: Incremental construction of morse decompositions". *The International Journal of Robotics Research*. 21(4): 345–366.

Agarwal, S. and S. Akella. (2020). "Line Coverage with Multiple Robots". In: *IEEE International Conference on Robotics and Automation*.

Applegate, D. L., R. E. Bixby, V. Chvatal, and W. J. Cook. (2006). *The traveling salesman problem: a computational study*. Princeton university press.

Aragues, R., J. Cortes, and C. Sagues. (2012). "Distributed consensus on robot networks for dynamically merging feature-based maps". *IEEE Transactions on Robotics*. 28(4): 840–854.

Arain, M. A., M. Cirillo, V. H. Bennetts, E. Schaffernicht, M. Trincavelli, and A. J. Lilienthal. (2015). "Efficient measurement planning for remote gas sensing with mobile robots". In: *Robotics and Automation (ICRA), 2015 IEEE International Conference on*. IEEE. 3428–3434.

Arbuckle, D., A. Howard, and M. Mataric. (2002). "Temporal occupancy grids: a method for classifying the spatio-temporal properties of the environment". In: *IEEE/RSJ International Conference on Intelligent Robots and Systems*. Vol. 1. IEEE. 409–414.

Arkin, E. M., S. P. Fekete, and J. S. Mitchell. (2000). "Approximation algorithms for lawn mowing and milling". *Computational Geometry*. 17(1-2): 25–50.

Arya, S., S.-W. Cheng, and D. M. Mount. (2001). "Approximation algorithm for multiple-tool milling". *International Journal of Computational Geometry & Applications*. 11(03): 339–372.

Atanasov, N., J. Le Ny, K. Daniilidis, and G. J. Pappas. (2014). "Information acquisition with sensing robots: Algorithms and error bounds". In: *2014 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE. 6447–6454.

Atanasov, N. A., J. Le Ny, and G. J. Pappas. (2015). "Distributed algorithms for stochastic source seeking with mobile robot networks". *Journal of Dynamic Systems, Measurement, and Control*. 137(3): 031004.

Bai, S., J. Wang, F. Chen, and B. Englot. (2016). "Information-theoretic exploration with Bayesian optimization". In: *2016 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 1816–1822.

Balas, E. (1989). "The prize collecting traveling salesman problem". *Networks*. 19(6): 621–636.

Banfi, J., N. Basilico, and F. Amigoni. (2018). "Multirobot reconnection on graphs: Problem, complexity, and algorithms". *IEEE Transactions on Robotics*. (99): 1–16.

Barbosa, F. S., D. Duberg, P. Jensfelt, and J. Tumova. (2019). "Guiding autonomous exploration with signal temporal logic". *IEEE Robotics and Automation Letters*. 4(4): 3332–3339.

Basiri, A., V. Mariani, G. Silano, M. Aatif, L. Iannelli, and L. Glielmo. (2022). "A survey on the application of path-planning algorithms for multi-rotor UAVs in precision agriculture". *The Journal of Navigation*. 75(2): 364–383.

Bender, M. A., A. Fernández, D. Ron, A. Sahai, and S. Vadhan. (2002). "The power of a pebble: Exploring and mapping directed graphs". *Information and computation*. 176(1): 1–21.

Benevento, A., M. Santos, G. Notarstefano, K. Paynabar, M. Bloch, and M. Egerstedt. (2020). "Multi-robot coordination for estimation and coverage of unknown spatial fields". In: *2020 ieee international conference on robotics and automation (icra)*. IEEE. 7740–7746.

Bennetts, V. M. H., A. J. Lilienthal, A. A. Khaliq, V. P. Sese, and M. Trincavelli. (2013). "Towards real-world gas distribution mapping and leak localization using a mobile robot with 3d and remote gas sensing capabilities". In: *Robotics and Automation (ICRA), 2013 IEEE International Conference on*. IEEE. 2335–2340.

Bergen, K. J., P. A. Johnson, V. Maarten, and G. C. Beroza. (2019). "Machine learning for data-driven discovery in solid Earth geoscience". *Science*. 363(6433).

Bertsekas, D. P. (1988). "The auction algorithm: A distributed relaxation method for the assignment problem". *Annals of operations research*. 14(1): 105–123.

Best, G., J. Faigl, and R. Fitch. (2018). "Online planning for multi-robot active perception with self-organising maps". *Autonomous Robots*. 42(4): 715–738.

Best, G. and G. A. Hollinger. (2020). "Decentralised self-organising maps for multi-robot information gathering". In: *2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 4790–4797.

Bhattacharya, S., R. Ghrist, and V. Kumar. (2014). "Multi-robot coverage and exploration on Riemannian manifolds with boundaries". *The International Journal of Robotics Research*. 33(1): 113–137.

Binney, J., A. Krause, and G. S. Sukhatme. (2013). "Optimizing waypoints for monitoring spatiotemporal phenomena". *The International Journal of Robotics Research*. 32(8): 873–888.

Bircher, A., M. Kamel, K. Alexis, H. Oleynikova, and R. Siegwart. (2018). "Receding horizon path planning for 3D exploration and surface inspection". *Autonomous Robots*. 42(2): 291–306.

Bormann, R., F. Jordan, J. Hampp, and M. Hägele. (2018). "Indoor coverage path planning: Survey, implementation, analysis". In: *2018 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE. 1718–1725.

Bourne, J. R., M. N. Goodell, X. He, J. A. Steiner, and K. K. Leang. (2020). "Decentralized Multi-agent information-theoretic control for target estimation and localization: finding gas leaks". *The International Journal of Robotics Research*: 0278364920957090.

Brass, P., F. Cabrera-Mora, A. Gasparri, and J. Xiao. (2011). "Multi-robot tree and graph exploration". *IEEE Transactions on Robotics*. 27(4): 707–717.

Calinescu, G., C. Chekuri, M. Pál, and J. Vondrák. (2011). "Maximizing a monotone submodular function subject to a matroid constraint". *SIAM Journal on Computing*. 40(6): 1740–1766.

Camilli, R., A. Bowen, and N. Farr. (2010). "Bright Blue: Advanced technologies for marine environmental monitoring and offshore energy". In: *OCEANS 2010 IEEE-Sydney*. IEEE. 1–7.

Cao, N., K. H. Low, and J. M. Dolan. (2013). "Multi-robot informative path planning for active sensing of environmental phenomena: A tale of two algorithms". In: *Proceedings of the 2013 international conference on Autonomous agents and multi-agent systems*. International Foundation for Autonomous Agents and Multiagent Systems. 7–14.

Carpin, S., D. Burch, N. Basilico, T. H. Chung, and M. Kölsch. (2013). "Variable resolution search with quadrotors: Theory and practice". *Journal of Field Robotics*. 30(5): 685–701.

Carron, A., M. Todescato, R. Carli, L. Schenato, and G. Pillonetto. (2015). "Multi-agents adaptive estimation and coverage control using Gaussian regression". In: *2015 European Control Conference (ECC)*. IEEE. 2490–2495.

Cesare, K., R. Skeele, S.-H. Yoo, Y. Zhang, and G. Hollinger. (2015). "Multi-UAV exploration with limited communication and battery". In: *2015 IEEE international conference on robotics and automation (ICRA)*. IEEE. 2230–2235.

Chang, D., W. Wu, C. R. Edwards, and F. Zhang. (2017). "Motion tomography: Mapping flow fields using autonomous underwater vehicles". *The International Journal of Robotics Research*. 36(3): 320–336.

Chekuri, C. and M. Pal. (2005). "A recursive greedy algorithm for walks in directed graphs". In: *Foundations of Computer Science, 2005. FOCS 2005. 46th Annual IEEE Symposium on*. IEEE. 245–253.

Chen, J., T. Shu, T. Li, and C. W. de Silva. (2019a). "Deep reinforced learning tree for spatiotemporal monitoring with mobile robotic wireless sensor networks". *IEEE Transactions on Systems, Man, and Cybernetics: Systems*. 50(11): 4197–4211.

Chen, J., K. H. Low, Y. Yao, and P. Jaillet. (2015). "Gaussian process decentralized data fusion and active sensing for spatiotemporal traffic modeling and prediction in mobility-on-demand systems". *IEEE Transactions on Automation Science and Engineering*. 12(3): 901–921.

Chen, S. W., G. V. Nardari, E. S. Lee, C. Qu, X. Liu, R. A. F. Romero, and V. Kumar. (2020a). "SLOAM: Semantic Lidar Odometry and Mapping for Forest Inventory". *IEEE Robotics and Automation Letters*. 5(2): 612–619.

Chen, W., R. Khardon, and L. Liu. (2022). "AK: Attentive Kernel for Information Gathering". In: *Robotics: Science and Systems*.

Chen, X., T. M. Tucker, T. R. Kurfess, and R. Vuduc. (2019b). "Adaptive deep path: efficient coverage of a known environment under various configurations". In: *2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 3549–3556.

Chen, Z., T. R. Scott, S. Bearman, H. Anand, D. Keating, C. Scott, J. R. Arrowsmith, and J. Das. (2020b). "Geomorphological Analysis Using Unpiloted Aircraft Systems, Structure from Motion, and Deep Learning". In: *2020 IEEE/RSJ International Conference on Intelligent Robots and Systems*. IEEE.

Chin, W.-p. and S. Ntafos. (1986). "Optimum watchman routes". In: *Proceedings of the second annual symposium on Computational geometry*. 24–33.

Choi, H.-L., L. Brunet, and J. P. How. (2009). "Consensus-based decentralized auctions for robust task allocation". *IEEE transactions on robotics*. 25(4): 912–926.

Choset, H. (2000). "Coverage of known spaces: The boustrophedon cellular decomposition". *Autonomous Robots*. 9(3): 247–253.

Chung, J. J., N. R. Lawrance, and S. Sukkarieh. (2015). "Learning to soar: Resource-constrained exploration in reinforcement learning". *The International Journal of Robotics Research*. 34(2): 158–172.

Citovsky, G., T. Mayer, and J. S. Mitchell. (2017). "TSP with locational uncertainty: the adversarial model". *arXiv preprint arXiv:1705.06180*.

Corah, M. and N. Michael. (2018). "Distributed matroid-constrained submodular maximization for multi-robot exploration: Theory and practice". *Autonomous Robots*: 1–17.

Corke, P., T. Wark, R. Jurdak, W. Hu, P. Valencia, and D. Moore. (2010). "Environmental wireless sensor networks". *Proceedings of the IEEE*. 98(11): 1903–1917.

Cortes, J., S. Martinez, T. Karatas, and F. Bullo. (2004). "Coverage control for mobile sensing networks". *IEEE Transactions on robotics and Automation*. 20(2): 243–255.

Curless, B. and M. Levoy. (1996). "A volumetric method for building complex models from range images". In: *Proceedings of the 23rd annual conference on Computer graphics and interactive techniques*. 303–312.

Dames, P., P. Tokekar, and V. Kumar. (2017). "Detecting, localizing, and tracking an unknown number of moving targets using a team of mobile robots". *The International Journal of Robotics Research*. 36(13-14): 1540–1553.

Das, J., F. Py, J. B. Harvey, J. P. Ryan, A. Gellene, R. Graham, D. A. Caron, K. Rajan, and G. S. Sukhatme. (2015a). "Data-driven robotic sampling for marine ecosystem monitoring". *The International Journal of Robotics Research*. 34(12): 1435–1452.

Das, J., K. Rajany, S. Frolovy, F. Pyy, J. Ryany, D. A. Caronz, and G. S. Sukhatme. (2010). "Towards marine bloom trajectory prediction for AUV mission planning". In: *2010 IEEE International Conference on Robotics and Automation*. IEEE. 4784–4790.

Das, S., D. Dereniowski, and C. Karousatou. (2015b). "Collaborative exploration by energy-constrained mobile robots". In: *International Colloquium on Structural Information and Communication Complexity*. Springer. 357–369.

Das, S., P. Flocchini, S. Kutten, A. Nayak, and N. Santoro. (2007). "Map construction of unknown graphs by multiple agents". *Theoretical Computer Science*. 385(1-3): 34–48.

Deisenroth, M. and J. W. Ng. (2015). "Distributed gaussian processes". In: *International Conference on Machine Learning*. 1481–1490.

Dharmadhikari, M., H. Deshpande, T. Dang, and K. Alexis. (2021). "Hypergame-based adaptive behavior path planning for combined exploration and visual search". In: *2021 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE. 269–275.

Ding, Y., W. Luo, and K. Sycara. (2019). "Heuristic-based Multiple Mobile Depots Route Planning for Recharging Persistent Surveillance Robots". In: *2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 3308–3313.

Doherty, K., G. Flaspohler, N. Roy, and Y. Girdhar. (2018). "Approximate Distributed Spatiotemporal Topic Models for Multi-Robot Terrain Characterization". In: *2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 3730–3737.

Doherty, K., T. Shan, J. Wang, and B. Englot. (2019). "Learning-aided 3-D occupancy mapping with Bayesian generalized kernel inference". *IEEE Transactions on Robotics*. 35(4): 953–966.

Doroodgar, B., Y. Liu, and G. Nejat. (2014). "A learning-based semi-autonomous controller for robotic exploration of unknown disaster scenes while searching for victims". *IEEE Transactions on Cybernetics*. 44(12): 2719–2732.

Duecker, D. A., B. Mersch, R. C. Hochdahl, and E. Kreuzer. (2021). "Embedded Stochastic Field Exploration with Micro Diving Agents using Bayesian Optimization-Guided Tree-Search and GMRFs". In: *2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 8649–8656.

Dumitrescu, A. and J. S. Mitchell. (2003). "Approximation algorithms for TSP with neighborhoods in the plane". *Journal of Algorithms*. 48(1): 135–159.

Dunbabin, M. and L. Marques. (2012). "Robots for environmental monitoring: Significant advancements and applications". *IEEE Robotics & Automation Magazine*. 19(1): 24–39.

Dutta, A., O. Patrick Kreidl, and J. M. O'Kane. (2021). "Opportunistic multi-robot environmental sampling via decentralized markov decision processes". In: *International Symposium Distributed Autonomous Robotic Systems*. Springer. 163–175.

Dynia, M., J. ŁopuszaŃski, and C. Schindelhauer. (2007). "Why robots need maps". In: *International Colloquium on Structural Information and Communication Complexity*. Springer. 41–50.

Elwin, M. L., R. A. Freeman, and K. M. Lynch. (2019). "Distributed Environmental Monitoring With Finite Element Robots". *IEEE Transactions on Robotics*.

Fahad, M., N. Saul, Y. Guo, and B. Bingham. (2015). "Robotic simulation of dynamic plume tracking by unmanned surface vessels". In: *Robotics and Automation (ICRA), 2015 IEEE International Conference on*. IEEE. 2654–2659.

Faigl, J. (2010). "Approximate solution of the multiple watchman routes problem with restricted visibility range". *IEEE transactions on neural networks*. 21(10): 1668–1679.

Faigl, J. and G. A. Hollinger. (2017). "Autonomous data collection using a self-organizing map". *IEEE transactions on neural networks and learning systems*. 29(5): 1703–1715.

Faigl, J., R. Pěnička, and G. Best. (2016). "Self-organizing map-based solution for the orienteering problem with neighborhoods". In: *2016 IEEE International Conference on Systems, Man, and Cybernetics (SMC)*. IEEE. 001315–001321.

Faigl, J., P. Váňa, and J. Deckerová. (2019). "Fast Heuristics for the 3-D Multi-Goal Path Planning Based on the Generalized Traveling Salesman Problem With Neighborhoods". *IEEE Robotics and Automation Letters*. 4(3): 2439–2446.

Farias, R. and M. Kallmann. (2020). "Planar max flow maps and determination of lanes with clearance". *Autonomous Robots*: 1–17.

Ferguson, T. S. *et al.* (1989). "Who solved the secretary problem?" *Statistical science*. 4(3): 282–289.

Fink, J. and V. Kumar. (2010). "Online methods for radio signal mapping with mobile robots". In: *Robotics and Automation (ICRA), 2010 IEEE International Conference on*. IEEE. 1940–1945.

Flaspohler, G., V. Preston, A. P. Michel, Y. Girdhar, and N. Roy. (2019). "Information-guided robotic maximum seek-and-sample in partially observable continuous environments". *IEEE Robotics and Automation Letters*. 4(4): 3782–3789.

Flaspohler, G., N. Roy, and Y. Girdhar. (2018). "Near-optimal irrevocable sample selection for periodic data streams with applications to marine robotics". In: *2018 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE. 1–8.

Fraigniaud, P., L. Gasieniec, D. R. Kowalski, and A. Pelc. (2006). "Collective tree exploration". *Networks: An International Journal*. 48(3): 166–177.

Freeman, P. (1983). "The secretary problem and its extensions: A review". *International Statistical Review/Revue Internationale de Statistique*: 189–206.

Galceran, E. and M. Carreras. (2013). "A survey on coverage path planning for robotics". *Robotics and Autonomous systems*. 61(12): 1258–1276.

García-Olaya, A., F. Py, J. Das, and K. Rajan. (2012). "An online utility-based approach for sampling dynamic ocean fields". *IEEE Journal of Oceanic Engineering*. 37(2): 185–203.

Gautam, S., B. S. Roy, A. Candela, and D. Wettergreen. (2017). "Science-aware exploration using entropy-based planning". In: *2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 3819–3825.

Gerkey, B. P. and M. J. Matarić. (2004). "A formal analysis and taxonomy of task allocation in multi-robot systems". *The International Journal of Robotics Research*. 23(9): 939–954.

Gielis, J., A. Shankar, and A. Prorok. (2022). "A Critical Review of Communications in Multi-robot Systems". *Current Robotics Reports*: 1–13.

Girdhar, Y., L. Cai, S. Jamieson, N. McGuire, G. Flaspohler, S. Suman, and B. Claus. (2019). "Streaming Scene Maps for Co-Robotic Exploration in Bandwidth Limited Environments". *arXiv preprint arXiv:1903.03214*.

Girdhar, Y. and G. Dudek. (2016). "Modeling curiosity in a mobile robot for long-term autonomous exploration and monitoring". *Autonomous Robots*. 40(7): 1267–1278.

Girdhar, Y., P. Giguere, and G. Dudek. (2014). "Autonomous adaptive exploration using realtime online spatiotemporal topic modeling". *The International Journal of Robotics Research*. 33(4): 645–657.

Golovin, D. and A. Krause. (2011). "Adaptive submodularity: Theory and applications in active learning and stochastic optimization". *Journal of Artificial Intelligence Research*. 42: 427–486.

Gosrich, W., S. Mayya, R. Li, J. Paulos, M. Yim, A. Ribeiro, and V. Kumar. (2022). "Coverage Control in Multi-Robot Systems via Graph Neural Networks". In: *2022 International Conference on Robotics and Automation (ICRA)*. IEEE. 8787–8793.

Gotovos, A., N. Casati, G. Hitz, and A. Krause. (2013). "Active learning for level set estimation". In: *Twenty-Third International Joint Conference on Artificial Intelligence*.

Guizilini, V., R. Senanayake, and F. Ramos. (2019). "Dynamic Hilbert Maps: Real-Time Occupancy Predictions in Changing Environments". In: *2019 International Conference on Robotics and Automation (ICRA)*. IEEE. 4091–4097.

Gul, S., E. Tiktinsky, S. Shamshanov, and R. Cohen. (2022). "Online exploration outside a convex obstacle". *Theoretical Computer Science*.

Hajieghrary, H., D. Mox, and M. A. Hsieh. (2017). "Information theoretic source seeking strategies for multiagent plume tracking in turbulent fields". *Journal of Marine Science and Engineering*. 5(1): 3.

Hameed, I. A. (2014). "Intelligent coverage path planning for agricultural robots and autonomous machines on three-dimensional terrain". *Journal of Intelligent & Robotic Systems*. 74(3-4): 965–983.

Hammar, M. and B. J. Nilsson. (1999). "Approximation results for kinetic variants of TSP". In: *International colloquium on automata, languages, and programming*. Springer. 392–401.

Häni, N., P. Roy, and V. Isler. (2020). "A comparative study of fruit detection and counting methods for yield mapping in apple orchards". *Journal of Field Robotics*. 37(2): 263–282.

Hassan, M. and D. Liu. (2019). "PPCPP: A predator–prey-based approach to adaptive coverage path planning". *IEEE Transactions on Robotics*. 36(1): 284–301.

Heintzman, L. and R. K. Williams. (2020). "Multi-agent intermittent interaction planning via sequential greedy selections over position samples". *IEEE Robotics and Automation Letters*. 6(2): 534–541.

Helvig, C. S., G. Robins, and A. Zelikovsky. (2003). "The moving-target traveling salesman problem". *Journal of Algorithms*. 49(1): 153–174.

Heng, L., A. Gotovos, A. Krause, and M. Pollefeys. (2015). "Efficient visual exploration and coverage with a micro aerial vehicle in unknown environments". In: *2015 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE. 1071–1078.

Hernández, J. D., E. Vidal, M. Moll, N. Palomeras, M. Carreras, and L. E. Kavraki. (2019). "Online motion planning for unexplored underwater environments using autonomous underwater vehicles". *Journal of Field Robotics*. 36(2): 370–396.

Higashikawa, Y., N. Katoh, S. Langerman, and S.-i. Tanigawa. (2014). "Online graph exploration algorithms for cycles and trees by multiple searchers". *Journal of Combinatorial Optimization*. 28(2): 480–495.

Hitz, G., A. Gotovos, M.-É. Garneau, C. Pradalier, A. Krause, R. Y. Siegwart, *et al.* (2014). "Fully autonomous focused exploration for robotic environmental monitoring". In: *Robotics and Automation (ICRA), 2014 IEEE International Conference on*. IEEE. 2658–2664.

Hitz, G., F. Pomerleau, F. Colas, and R. Siegwart. (2015). "Relaxing the planar assumption: 3D state estimation for an autonomous surface vessel". *The International Journal of Robotics Research*. 34(13): 1604–1621.

Hollinger, G. A., B. Englot, F. S. Hover, U. Mitra, and G. S. Sukhatme. (2013). "Active planning for underwater inspection and the benefit of adaptivity". *The International Journal of Robotics Research*. 32(1): 3–18.

Hollinger, G. A., A. A. Pereira, J. Binney, T. Somers, and G. S. Sukhatme. (2016). "Learning uncertainty in ocean current predictions for safe and reliable navigation of underwater vehicles". *Journal of Field Robotics*. 33(1): 47–66.

Hollinger, G. A. and S. Singh. (2012). "Multirobot coordination with periodic connectivity: Theory and experiments". *IEEE Transactions on Robotics*. 28(4): 967–973.

Hong, A., O. Igharoro, Y. Liu, F. Niroui, G. Nejat, and B. Benhabib. (2018). "Investigating Human-Robot Teams for Learning-Based Semi-autonomous Control in Urban Search and Rescue Environments". *Journal of Intelligent & Robotic Systems*: 1–18.

Hornung, A., K. M. Wurm, M. Bennewitz, C. Stachniss, and W. Burgard. (2013). "OctoMap: An efficient probabilistic 3D mapping framework based on octrees". *Autonomous robots*. 34(3): 189–206.

Icking, C., T. Kamphans, R. Klein, and E. Langetepe. (2000). "Exploring an Unknown Cellular Environment." In: *EuroCG*. 140–143.

Icking, C., T. Kamphans, R. Klein, and E. Langetepe. (2005). "Exploring simple grid polygons". In: *International Computing and Combinatorics Conference*. Springer. 524–533.

Iocchi, L., L. Marchetti, and D. Nardi. (2011). "Multi-robot patrolling with coordinated behaviours in realistic environments". In: *Intelligent Robots and Systems (IROS), 2011 IEEE/RSJ International Conference on*. IEEE. 2796–2801.

Jadaliha, M. and J. Choi. (2013). "Environmental monitoring using autonomous aquatic robots: Sampling algorithms and experiments". *IEEE Transactions on Control Systems Technology*. 21(3): 899–905.

Jadaliha, M., Y. Xu, J. Choi, N. S. Johnson, and W. Li. (2013). "Gaussian process regression for sensor networks under localization uncertainty". *IEEE Transactions on Signal Processing*. 61(2): 223–237.

Jang, D., J. Yoo, C. Y. Son, D. Kim, and H. J. Kim. (2020). "Multi-robot active sensing and environmental model learning with distributed Gaussian process". *IEEE Robotics and Automation Letters*. 5(4): 5905–5912.

Jang, I., H.-S. Shin, and A. Tsourdos. (2018). "Anonymous hedonic game for task allocation in a large-scale multiple agent system". *IEEE Transactions on Robotics*. (99): 1–15.

Jayaratne, M., D. De Silva, and D. Alahakoon. (2019). "Unsupervised machine learning based scalable fusion for active perception". *IEEE Transactions on Automation Science and Engineering*. 16(4): 1653–1663.

Jensen, E. A. and M. Gini. (2019). "Effects of communication restriction on online multi-robot exploration in bounded environments". In: *Distributed Autonomous Robotic Systems*. Springer. 469–483.

Jensen-Nau, K. R., T. Hermans, and K. K. Leang. (2020). "Near-optimal area-coverage path planning of energy-constrained aerial robots with application in autonomous environmental monitoring". *IEEE Transactions on Automation Science and Engineering*. 18(3): 1453–1468.

Jorion, P. (2007). *Value at risk: the new benchmark for managing financial risk*. The McGraw-Hill Companies, Inc.

Kalyanam, K., D. Casbeer, and M. Pachter. (2020). "Graph search of a moving ground target by a UAV aided by ground sensors with local information". *Autonomous Robots*: 1–13.

Kamousi, P. and S. Suri. (2013). "Euclidean traveling salesman tours through stochastic neighborhoods". In: *International Symposium on Algorithms and Computation*. Springer. 644–654.

Kandasamy, K., G. Dasarathy, J. Oliva, J. Schneider, and B. Poczos. (2019). "Multi-fidelity gaussian process bandit optimisation". *Journal of Artificial Intelligence Research*. 66: 151–196.

Kantaros, Y., M. Guo, and M. M. Zavlanos. (2019). "Temporal Logic Task Planning and Intermittent Connectivity Control of Mobile Robot Networks". *IEEE Transactions on Automatic Control*.

Kantaros, Y., B. Schlotfeldt, N. Atanasov, and G. J. Pappas. (2021). "Sampling-based planning for non-myopic multi-robot information gathering". *Autonomous Robots*. 45(7): 1029–1046.

Karapetyan, N., J. Moulton, J. S. Lewis, A. Q. Li, J. M. O'Kane, and I. Rekleitis. (2018). "Multi-robot Dubins coverage with autonomous surface vehicles". In: *2018 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE. 2373–2379.

Kavraki, L. E., P. Svestka, J.-C. Latombe, and M. H. Overmars. (1996). "Probabilistic roadmaps for path planning in high-dimensional configuration spaces". *IEEE transactions on Robotics and Automation*. 12(4): 566–580.

Kayacan, E., Z.-Z. Zhang, and G. Chowdhary. (2018). "Embedded High Precision Control and Corn Stand Counting Algorithms for an Ultra-Compact 3D Printed Field Robot." In: *Robotics: Science and Systems*.

Khamis, A., A. Hussein, and A. Elmogy. (2015). "Multi-robot task allocation: A review of the state-of-the-art". In: *Cooperative Robots and Sensor Networks 2015*. Springer. 31–51.

Kim, C.-Y., D. Song, Y. Xu, J. Yi, and X. Wu. (2014). "Cooperative search of multiple unknown transient radio sources using multiple paired mobile robots". *IEEE Transactions on Robotics*. 30(5): 1161–1173.

Knizhnik, G., P. Li, X. Yu, and M. A. Hsieh. (2022). "Flow-Based Control of Marine Robots in Gyre-Like Environments": 3047–3053.

Kolenderska, A., A. Kosowski, M. Małafiejski, and P. Żyliński. (2009). "An improved strategy for exploring a grid polygon". In: *International Colloquium on Structural Information and Communication Complexity*. Springer. 222–236.

Koreitem, K., F. Shkurti, T. Manderson, W.-D. Chang, J. C. G. Higuera, and G. Dudek. (2020). "One-shot informed robotic visual search in the wild". In: *2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 5800–5807.

Körner, F., R. Speck, A. H. Göktogan, and S. Sukkarieh. (2010). "Autonomous airborne wildlife tracking using radio signal strength". In: *2010 IEEE/RSJ International Conference on Intelligent Robots and Systems*. IEEE. 107–112.

Korsah, G. A., A. Stentz, and M. B. Dias. (2013). "A comprehensive taxonomy for multi-robot task allocation". *The International Journal of Robotics Research*. 32(12): 1495–1512.

Krajník, T., M. Kulich, L. Mudrová, R. Ambrus, and T. Duckett. (2015). "Where's waldo at time t? using spatio-temporal models for mobile robot search". In: *2015 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE. 2140–2146.

Krause, A. and C. Guestrin. (2007). "Nonmyopic active learning of gaussian processes: an exploration-exploitation approach". In: *Proceedings of the 24th international conference on Machine learning.* ACM. 449–456.

Krause, A., H. B. McMahan, C. Guestrin, and A. Gupta. (2008a). "Robust submodular observation selection". *Journal of Machine Learning Research.* 9(Dec): 2761–2801.

Krause, A., A. Singh, and C. Guestrin. (2008b). "Near-optimal sensor placements in Gaussian processes: Theory, efficient algorithms and empirical studies". *Journal of Machine Learning Research.* 9(Feb): 235–284.

Kress-Gazit, H., M. Lahijanian, and V. Raman. (2018). "Synthesis for robots: Guarantees and feedback for robot behavior". *Annual Review of Control, Robotics, and Autonomous Systems.* 1: 211–236.

Kreuzer, E. and E. Solowjow. (2018). "Learning environmental fields with micro underwater vehicles: a path integral—Gaussian Markov random field approach". *Autonomous Robots.* 42(4): 761–780.

Kurihara, K., M. Welling, and N. Vlassis. (2006). "Accelerated variational Dirichlet process mixtures". *Advances in neural information processing systems.* 19.

Landgren, P., V. Srivastava, and N. E. Leonard. (2016). "On distributed cooperative decision-making in multiarmed bandits". In: *Control Conference (ECC), 2016 European.* IEEE. 243–248.

Lattanzi, D. and G. Miller. (2017). "Review of robotic infrastructure inspection systems". *Journal of Infrastructure Systems.* 23(3): 04017004.

Lauri, M., J. Pajarinen, and J. Peters. (2020a). "Multi-agent active information gathering in discrete and continuous-state decentralized POMDPs by policy graph improvement". *Autonomous Agents and Multi-Agent Systems.* 34(2): 1–44.

Lauri, M., J. Pajarinen, J. Peters, and S. Frintrop. (2020b). "Multi-Sensor Next-Best-View Planning as Matroid-Constrained Submodular Maximization". *IEEE Robotics and Automation Letters.* 5(4): 5323–5330.

Le Ny, J. and G. J. Pappas. (2012). “Adaptive deployment of mobile robotic networks”. *IEEE Transactions on automatic control*. 58(3): 654–666.

Leahy, K., E. Cristofalo, C.-I. Vasile, A. Jones, E. Montijano, M. Schwager, and C. Belta. (2019). “Control in belief space with temporal logic specifications using vision-based localization”. *The International Journal of Robotics Research*. 38(6): 702–722.

Lee, B., C. Zhang, Z. Huang, and D. D. Lee. (2019a). “Online continuous mapping using gaussian process implicit surfaces”. In: *2019 International Conference on Robotics and Automation (ICRA)*. IEEE. 6884–6890.

Lee, K. M. B., C. Yoo, B. Hollings, S. Anstee, S. Huang, and R. Fitch. (2019b). “Online Estimation of Ocean Current from Sparse GPS Data for Underwater Vehicles”. *arXiv preprint arXiv:1901.09513*.

Lee, S. K., S. P. Fekete, and J. McLurkin. (2016). “Structured triangulation in multi-robot systems: Coverage, patrolling, voronoi partitions, and geodesic centers”. *The International Journal of Robotics Research*. 35(10): 1234–1260.

Leonard, N. E., D. A. Paley, F. Lekien, R. Sepulchre, D. M. Fratantoni, and R. E. Davis. (2007). “Collective motion, sensor networks, and ocean sampling”. *Proceedings of the IEEE*. 95(1): 48–74.

Li, A. Q., P. K. Penumarthi, J. Banfi, N. Basilico, J. M. O’Kane, I. Rekleitis, S. Nelakuditi, and F. Amigoni. (2019). “Multi-robot online sensing strategies for the construction of communication maps”. *Autonomous Robots*: 1–21.

Li, T., C. Wang, M. Q.-H. Meng, and C. W. de Silva. (2021). “Attention-Driven Active Sensing With Hybrid Neural Network for Environmental Field Mapping”. *IEEE Transactions on Automation Science and Engineering*.

Lindgren, F., H. Rue, and J. Lindström. (2011). “An explicit link between Gaussian fields and Gaussian Markov random fields: the stochastic partial differential equation approach”. *Journal of the Royal Statistical Society Series B: Statistical Methodology*. 73(4): 423–498.

Liu, B., X. Xiao, and P. Stone. (2021). "Team orienteering coverage planning with uncertain reward". In: *2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 9728–9733.

Liu, J. and R. K. Williams. (2019). "Submodular optimization for coupled task allocation and intermittent deployment problems". *IEEE Robotics and Automation Letters*. 4(4): 3169–3176.

Liu, L. and D. A. Shell. (2012). "Large-scale multi-robot task allocation via dynamic partitioning and distribution". *Autonomous Robots*. 33(3): 291–307.

Liu, L. and D. A. Shell. (2013). "Optimal Market-based Multi-Robot Task Allocation via Strategic Pricing." In: *Robotics: Science and Systems*. Vol. 9. No. 1. 33–40.

Liu, Y. and G. Nejat. (2013). "Robotic urban search and rescue: A survey from the control perspective". *Journal of Intelligent & Robotic Systems*. 72(2): 147–165.

Low, K. H., J. M. Dolan, and P. Khosla. (2008). "Adaptive multi-robot wide-area exploration and mapping". In: *Proceedings of the 7th International Joint Conference on Autonomous agents and Multiagent systems-Volume 1*. International Foundation for Autonomous Agents and Multiagent Systems. 23–30.

Lu, Q. and Q.-L. Han. (2018). "Mobile robot networks for environmental monitoring: A cooperative receding horizon temporal logic control approach". *IEEE transactions on cybernetics*. 49(2): 698–711.

Luckcuck, M., M. Farrell, L. A. Dennis, C. Dixon, and M. Fisher. (2019). "Formal specification and verification of autonomous robotic systems: A survey". *ACM Computing Surveys (CSUR)*. 52(5): 1–41.

Luo, L., N. Chakraborty, and K. Sycara. (2014). "Provably-good distributed algorithm for constrained multi-robot task assignment for grouped tasks". *IEEE Transactions on Robotics*. 31(1): 19–30.

Luo, W., C. Nam, G. Kantor, and K. Sycara. (2019). "Distributed Environmental Modeling and Adaptive Sampling for Multi-Robot Sensor Coverage". In: *Proceedings of the 18th International Conference on Autonomous Agents and MultiAgent Systems*. 1488–1496.

Luo, W. and K. Sycara. (2019). "Voronoi-based coverage control with connectivity maintenance for robotic sensor networks". In: *2019 International Symposium on Multi-Robot and Multi-Agent Systems (MRS)*. IEEE. 148–154.

Lynch, K. M., I. B. Schwartz, P. Yang, and R. A. Freeman. (2008). "Decentralized environmental modeling by mobile sensor networks". *IEEE Transactions on Robotics*. 24(3): 710–724.

Lynch, N. A. (1996). *Distributed algorithms*. Elsevier.

Ma, K.-C., L. Liu, H. K. Heidarsson, and G. S. Sukhatme. (2018). "Data-driven learning and planning for environmental sampling". *Journal of Field Robotics*. 35(5): 643–661.

Macwan, A., G. Nejat, and B. Benhabib. (2011). "Optimal deployment of robotic teams for autonomous wilderness search and rescue". In: *2011 IEEE/RSJ International Conference on Intelligent Robots and Systems*. IEEE. 4544–4549.

Mahadev, A., D. Krupke, S. P. Fekete, and A. T. Becker. (2017). "Mapping and coverage with a particle swarm controlled by uniform inputs". In: *2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 1097–1104.

Mahler, R. P. (2003). "Multitarget Bayes filtering via first-order multitarget moments". *IEEE Transactions on Aerospace and Electronic systems*. 39(4): 1152–1178.

Malencia, M., S. Manjanna, M. A. Hsieh, G. Pappas, and V. Kumar. (2022). "Adaptive Sampling of Latent Phenomena using Heterogeneous Robot Teams (ASLaP-HR)". In: *2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE.

Manjanna, S., A. Q. Li, R. N. Smith, I. Rekleitis, and G. Dudek. (2018). "Heterogeneous Multi-Robot System for Exploration and Strategic Water Sampling". In: *2018 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE. 1–8.

Mansfield, A., S. Manjanna, D. G. Macharet, and M. A. Hsieh. (2021). "Multi-robot Scheduling for Environmental Monitoring as a Team Orienteering Problem". In: *2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 6398–6404.

Marchant, R. and F. Ramos. (2012). “Bayesian optimisation for intelligent environmental monitoring”. In: *Intelligent Robots and Systems (IROS), 2012 IEEE/RSJ International Conference on*. IEEE. 2242–2249.

Marchant, R., F. Ramos, S. Sanner, *et al.* (2014). “Sequential Bayesian optimisation for spatial-temporal monitoring.” In: *UAI*. 553–562.

Martin, J. and B. Englot. (2017). “Extending Model-based Policy Gradients for Robots in Heteroscedastic Environments”. In: *Proceedings of the 1st Annual Conference on Robot Learning*.

Martin, J., J. Wang, and B. Englot. (2018). “Sparse gaussian process temporal difference learning for marine robot navigation”.

Matveev, A. S., M. C. Hoy, K. Ovchinnikov, A. Anisimov, and A. V. Savkin. (2015). “Robot navigation for monitoring unsteady environmental boundaries without field gradient estimation”. *Automatica*. 62: 227–235.

Mavrommati, A., E. Tzorakoleftherakis, I. Abraham, and T. D. Murphey. (2017). “Real-time area coverage and target localization using receding-horizon ergodic exploration”. *IEEE Transactions on Robotics*. 34(1): 62–80.

Meera, A. A., M. Popović, A. Millane, and R. Siegwart. (2019). “Obstacle-aware Adaptive Informative Path Planning for UAV-based Target Search”. In: *International Conference on Robotics and Automation (ICRA 2019)*.

Meghjani, M., S. Manjanna, and G. Dudek. (2016). “Multi-target rendezvous search”. In: *2016 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 2596–2603.

Megow, N., K. Mehlhorn, and P. Schweitzer. (2012). “Online graph exploration: New results on old and new algorithms”. *Theoretical Computer Science*. 463: 62–72.

Meng, Z., H. Qin, Z. Chen, X. Chen, H. Sun, F. Lin, and M. H. Ang Jr. (2017). “A two-stage optimized next-view planning framework for 3-D unknown environment exploration, and structural reconstruction”. *IEEE Robotics and Automation Letters*. 2(3): 1680–1687.

Miller, L. M., Y. Silverman, M. A. MacIver, and T. D. Murphey. (2015). “Ergodic exploration of distributed information”. *IEEE Transactions on Robotics*. 32(1): 36–52.

Mishra, S., S. Rodriguez, M. Morales, and N. M. Amato. (2016). "Battery-constrained coverage". In: *2016 IEEE International Conference on Automation Science and Engineering (CASE)*. IEEE. 695–700.

Morere, P., R. Marchant, and F. Ramos. (2017). "Sequential Bayesian optimization as a POMDP for environment monitoring with UAVs". In: *2017 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE. 6381–6388.

Morere, P., R. Marchant, and F. Ramos. (2018). "Continuous State-Action-Observation POMDPs for Trajectory Planning with Bayesian Optimisation". In: *2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 8779–8786.

Mukherjee, P., M. Santilli, A. Gasparri, and R. K. Williams. (2020). "Optimal topology selection for stable coordination of asymmetrically interacting multi-robot systems". In: *2020 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE. 6668–6674.

Murphy, R. R., S. Tadokoro, and A. Kleiner. (2016). "Disaster robotics". In: *Springer handbook of robotics*. Springer. 1577–1604.

Nam, C. and D. A. Shell. (2015). "Assignment algorithms for modeling resource contention in multirobot task allocation". *IEEE Transactions on Automation Science and Engineering*. 12(3): 889–900.

Nemhauser, G. L., L. A. Wolsey, and M. L. Fisher. (1978). "An analysis of approximations for maximizing submodular set functions—I". *Mathematical programming*. 14(1): 265–294.

Neumann, P. P., V. Hernandez Bennetts, A. J. Lilienthal, M. Bartholmai, and J. H. Schiller. (2013). "Gas source localization with a micro-drone using bio-inspired and particle filter-based algorithms". *Advanced Robotics*. 27(9): 725–738.

Nguyen, L. V., S. Kodagoda, R. Ranasinghe, and G. Dissanayake. (2016). "Information-driven adaptive sampling strategy for mobile robotic wireless sensor network". *IEEE Transactions on Control Systems Technology*. 24(1): 372–379.

Nilsson, P., S. Haesaert, R. Thakker, K. Otsu, C.-I. Vasile, A.-A. Agha-Mohammadi, R. M. Murray, and A. D. Ames. (2018). "Toward specification-guided active mars exploration for cooperative robot teams".

Niroui, F., K. Zhang, Z. Kashino, and G. Nejat. (2019). "Deep Reinforcement Learning Robot for Search and Rescue Applications: Exploration in Unknown Cluttered Environments". *IEEE Robotics and Automation Letters*. 4(2): 610–617.

Noon, C. E. and J. C. Bean. (1993). "An efficient transformation of the generalized traveling salesman problem". *INFOR: Information Systems and Operational Research*. 31(1): 39–44.

Notomista, G., S. Mayya, S. Hutchinson, and M. Egerstedt. (2019). "An optimal task allocation strategy for heterogeneous multi-robot systems". In: *2019 18th European Control Conference (ECC)*. IEEE. 2071–2076.

Notomista, G., C. Pacchierotti, and P. R. Giordano. (2022). "Multi-robot persistent environmental monitoring based on constraint-driven execution of learned robot tasks". In: *ICRA 2022-IEEE International Conference on Robotics and Automation*.

Ntafos, S. (1992). "Watchman routes under limited visibility". *Computational Geometry*. 1(3): 149–170.

Nunes, E. and M. Gini. (2015). "Multi-robot auctions for allocation of tasks with temporal constraints". In: *Proceedings of the AAAI Conference on Artificial Intelligence*. Vol. 29. No. 1.

Nuske, S., S. Achar, T. Bates, S. Narasimhan, and S. Singh. (2011). "Yield estimation in vineyards by visual grape detection". In: *2011 IEEE/RSJ International Conference on Intelligent Robots and Systems*. IEEE. 2352–2358.

O'rourke, J. (1987). *Art gallery theorems and algorithms*. Vol. 57. Oxford University Press Oxford.

O'Callaghan, S. T. and F. T. Ramos. (2012). "Gaussian process occupancy maps". *The International Journal of Robotics Research*. 31(1): 42–62.

Oliveira, L. F., A. P. Moreira, and M. F. Silva. (2021a). "Advances in agriculture robotics: A state-of-the-art review and challenges ahead". *Robotics*. 10(2): 52.

Oliveira, L. F., A. P. Moreira, and M. F. Silva. (2021b). "Advances in forest robotics: A state-of-the-art survey". *Robotics*. 10(2): 53.

Ono, M., M. Pavone, Y. Kuwata, and J. Balaram. (2015). "Chance-constrained dynamic programming with application to risk-aware robotic space exploration". *Autonomous Robots*. 39(4): 555–571.

Ono, M., M. Quadrelli, and T. L. Huntsberger. (2014). "Safe maritime autonomous path planning in a high sea state". In: *2014 American Control Conference*. IEEE. 4727–4734.

Oßwald, S., M. Bennewitz, W. Burgard, and C. Stachniss. (2016). "Speeding-up robot exploration by exploiting background information". *IEEE Robotics and Automation Letters*. 1(2): 716–723.

Ouyang, R. and B. K. H. Low. (2020). "Gaussian process decentralized data fusion meets transfer learning in large-scale distributed cooperative perception". *Autonomous Robots*. 44(3): 359–376.

Ouyang, R., K. H. Low, J. Chen, and P. Jaillet. (2014). "Multi-robot active sensing of non-stationary Gaussian process-based environmental phenomena". In: *Proceedings of the 2014 international conference on Autonomous agents and multi-agent systems*. International Foundation for Autonomous Agents and Multiagent Systems. 573–580.

Paciorek, C. J. and M. J. Schervish. (2004). "Nonstationary covariance functions for Gaussian process regression". In: *Advances in neural information processing systems*. 273–280.

Palacios-Gasós, J. M., E. Montijano, C. Sagüés, and S. Llorente. (2016). "Distributed Coverage Estimation and Control for Multirobot Persistent Tasks." *IEEE Trans. Robotics*. 32(6): 1444–1460.

Paley, D. A. and A. Wolek. (2020). "Mobile sensor networks and control: Adaptive sampling of spatiotemporal processes". *Annual Review of Control, Robotics, and Autonomous Systems*. 3: 91–114.

Palomeras, N., N. Hurtós, E. Vidal, and M. Carreras. (2019). "Autonomous Exploration of Complex Underwater Environments Using a Probabilistic Next-Best-View Planner". *IEEE Robotics and Automation Letters*. 4(2): 1619–1625.

Papachristos, C., F. Mascarich, S. Khattak, T. Dang, and K. Alexis. (2019). "Localization uncertainty-aware autonomous exploration and mapping with aerial robots using receding horizon path-planning". *Autonomous Robots*. 43(8): 2131–2161.

Park, J. and J. Choi. (2020). "Gaussian Process Online Learning With a Sparse Data Stream". *IEEE Robotics and Automation Letters*. 5(4): 5977–5984.

Parker, L. T., R. A. Coogle, and A. M. Howard. (2013). "Estimation-informed, resource-aware robot navigation for environmental monitoring applications". In: *Robotics and Automation (ICRA), 2013 IEEE International Conference on*. IEEE. 1041–1046.

Pavone, M., N. Bisnik, E. Frazzoli, and V. Isler. (2009). "A stochastic and dynamic vehicle routing problem with time windows and customer impatience". *Mobile Networks and Applications*. 14(3): 350.

Peltzer, O., A. Bouman, S.-K. Kim, R. Senanayake, J. Ott, H. Delecki, M. Sobue, M. Kochenderfer, M. Schwager, J. Burdick, *et al.* (2022). "FIG-OP: Exploring Large-Scale Unknown Environments on a Fixed Time Budget". In: *2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE.

Pillonetto, G., L. Schenato, and D. Varagnolo. (2018). "Distributed multi-agent Gaussian regression via finite-dimensional approximations". *IEEE Transactions on Pattern Analysis and Machine Intelligence*. 41(9): 2098–2111.

Plonski, P. A., J. Vander Hook, C. Peng, N. Noori, and V. Isler. (2017). "Environment Exploration in Sensing Automation for Habitat Monitoring". *IEEE Transactions on Automation Science and Engineering*. 14(1): 25–38.

Popović, M., T. Vidal-Calleja, G. Hitz, J. J. Chung, I. Sa, R. Siegwart, and J. Nieto. (2020). "An informative path planning framework for UAV-based terrain monitoring". *Autonomous Robots*: 1–23.

Preshant, A., K. Yu, and P. Tokekar. (2016). "A Geometric Approach for Multi-Robot Exploration in Orthogonal Polygons". In: *Workshop on Algorithmic Foundations of Robotics (WAFR)*. URL: http://www.wafr.org/papers/WAFR_2016_paper_25.pdf.

Queralta, J. P., J. Taipalmaa, B. C. Pullinen, V. K. Sarker, T. N. Gia, H. Tenhunen, M. Gabbouj, J. Raitoharju, and T. Westerlund. (2020). "Collaborative multi-robot search and rescue: Planning, coordination, perception, and active vision". *Ieee Access*. 8: 191617–191643.

R Shamshiri, R., C. Weltzien, I. A. Hameed, I. J Yule, T. E Grift, S. K. Balasundram, L. Pitonakova, D. Ahmad, and G. Chowdhary. (2018). "Research and development in agricultural robotics: A perspective of digital farming".

Ramos, F. and L. Ott. (2016). "Hilbert maps: scalable continuous occupancy mapping with stochastic gradient descent". *The International Journal of Robotics Research*. 35(14): 1717–1730.

Reggente, M. and A. J. Lilienthal. (2010). "The 3d-kernel dm+ v/w algorithm: Using wind information in three dimensional gas distribution modelling with a mobile robot". In: *Sensors, 2010 IEEE*. IEEE. 999–1004.

Reverdy, P. B., V. Srivastava, and N. E. Leonard. (2014). "Modeling human decision making in generalized Gaussian multiarmed bandits". *Proceedings of the IEEE*. 102(4): 544–571.

Rizk, Y., M. Awad, and E. W. Tunstel. (2019). "Cooperative heterogeneous multi-robot systems: A survey". *ACM Computing Surveys (CSUR)*. 52(2): 1–31.

Rockafellar, R. T., S. Uryasev, *et al.* (2000). "Optimization of conditional value-at-risk". *Journal of risk*. 2: 21–42.

Rückin, J., L. Jin, and M. Popović. (2022). "Adaptive Informative Path Planning Using Deep Reinforcement Learning for UAV-based Active Sensing". In: *2022 International Conference on Robotics and Automation (ICRA)*. IEEE. 4473–4479.

Sa, I., Z. Chen, M. Popović, R. Khanna, F. Liebisch, J. Nieto, and R. Siegwart. (2017). "weednet: Dense semantic weed classification using multispectral images and mav for smart farming". *IEEE robotics and automation letters*. 3(1): 588–595.

Salam, T., V. Edwards, and M. A. Hsieh. (2022). "Learning and Leveraging Features in Flow-Like Environments to Improve Situational Awareness". *IEEE Robotics and Automation Letters*. 7(2): 2071–2078.

Santos, M., U. Madhushani, A. Benevento, and N. E. Leonard. (2021). "Multi-robot Learning and Coverage of Unknown Spatial Fields". In: *2021 International Symposium on Multi-Robot and Multi-Agent Systems (MRS)*. IEEE. 137–145.

Saroya, M., G. Best, and G. A. Hollinger. (2020). "Online exploration of tunnel networks leveraging topological CNN-based world predictions". In: *Proc. of IEEE/RSJ IROS*.

Saulnier, K., N. Atanasov, G. J. Pappas, and V. Kumar. (2020). "Information Theoretic Active Exploration in Signed Distance Fields".

Schlotfeldt, B., V. Tzoumas, and G. J. Pappas. (2021). "Resilient active information acquisition with teams of robots". *IEEE Transactions on Robotics*. 38(1): 244–261.

Schmid, L., M. Pantic, R. Khanna, L. Ott, R. Siegwart, and J. Nieto. (2020). "An efficient sampling-based method for online informative path planning in unknown environments". *IEEE Robotics and Automation Letters*. 5(2): 1500–1507.

Schwager, M., D. Rus, and J.-J. Slotine. (2009). "Decentralized, adaptive coverage control for networked robots". *The International Journal of Robotics Research*. 28(3): 357–375.

Schwarzrock, J., I. Zacarias, A. L. Bazzan, R. Q. de Araujo Fernandes, L. H. Moreira, and E. P. de Freitas. (2018). "Solving task allocation problem in multi unmanned aerial vehicles systems using swarm intelligence". *Engineering Applications of Artificial Intelligence*. 72: 10–20.

Senanayake, R., S. O'Callaghan, and F. Ramos. (2017). "Learning highly dynamic environments with stochastic variational inference". In: *2017 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE. 2532–2539.

Senanayake, R. and F. Ramos. (2017). "Bayesian hilbert maps for dynamic continuous occupancy mapping". In: *Conference on Robot Learning*. 458–471.

Senanayake, R., A. Tompkins, and F. Ramos. (2018). "Automorphing Kernels for Nonstationarity in Mapping Unstructured Environments." In: *CoRL*. 443–455.

Shiryaev, A. N. (2007). *Optimal stopping rules*. Vol. 8. Springer Science & Business Media.

Shnaps, I. and E. Rimon. (2014). "Online coverage by a tethered autonomous mobile robot in planar unknown environments". *IEEE Transactions on Robotics*. 30(4): 966–974.

Shnaps, I. and E. Rimon. (2016). "Online coverage of planar environments by a battery powered autonomous mobile robot". *IEEE Transactions on Automation Science and Engineering*. 13(2): 425–436.

Sim, R. and J. J. Little. (2009). "Autonomous vision-based robotic exploration and mapping using hybrid maps and particle filters". *Image and Vision Computing*. 27(1-2): 167–177.

Singh, A., A. Krause, C. Guestrin, and W. J. Kaiser. (2009). "Efficient informative sensing using multiple robots". *Journal of Artificial Intelligence Research*. 34: 707–755.

Singh, A., F. Ramos, H. D. Whyte, and W. J. Kaiser. (2010). "Modeling and decision making in spatio-temporal processes for environmental surveillance". In: *2010 IEEE International Conference on Robotics and Automation*. IEEE. 5490–5497.

Smith, R. N., M. Schwager, S. L. Smith, B. H. Jones, D. Rus, and G. S. Sukhatme. (2011). "Persistent ocean monitoring with underwater gliders: Adapting sampling resolution". *Journal of Field Robotics*. 28(5): 714–741.

Smith, S. L., S. D. Bopardikar, and F. Bullo. (2009). "A dynamic boundary guarding problem with translating targets". In: *Proceedings of the 48h IEEE Conference on Decision and Control (CDC) held jointly with 2009 28th Chinese Control Conference*. IEEE. 8543–8548.

Smith, S. L., M. Schwager, and D. Rus. (2012). "Persistent robotic tasks: Monitoring and sweeping in changing environments". *IEEE Transactions on Robotics*. 28(2): 410–426.

Snelson, E. and Z. Ghahramani. (2006). "Sparse Gaussian processes using pseudo-inputs". In: *Advances in neural information processing systems*. 1257–1264.

Solin, A., J. Hensman, and R. E. Turner. (2018). "Infinite-horizon Gaussian processes". In: *Advances in Neural Information Processing Systems*. 3486–3495.

Somers, T. and G. A. Hollinger. (2016). "Human–robot planning and learning for marine data collection". *Autonomous Robots*. 40(7): 1123–1137.

Song, D., C.-Y. Kim, and J. Yi. (2011). “On the time to search for an intermittent signal source under a limited sensing range”. *IEEE Transactions on Robotics*. 27(2): 313–323.

Song, D., C.-Y. Kim, and J. Yi. (2012). “Simultaneous localization of multiple unknown and transient radio sources using a mobile robot”. *IEEE Transactions on Robotics*. 28(3): 668–680.

Soucie, J. E. S., H. M. Sosik, and Y. Girdhar. (2020). “Gaussian-Dirichlet Random Fields for Inference over High Dimensional Categorical Observations”.

Sparrow, R. and M. Howard. (2021). “Robots in agriculture: prospects, impacts, ethics, and policy”. *precision agriculture*. 22(3): 818–833.

Srinivas, N., A. Krause, S. Kakade, and M. Seeger. (2010). “Gaussian Process Optimization in the Bandit Setting: No Regret and Experimental Design”. In: *Proceedings of the 27th International Conference on International Conference on Machine Learning*. *ICML’10*. Haifa, Israel: Omnipress. 1015–1022. URL: http://dl.acm.org/citation.cfm?id=3104322.3104451.

Steinberg, D., A. Friedman, O. Pizarro, and S. B. Williams. (2011). “A Bayesian nonparametric approach to clustering data from underwater robotic surveys”. In: *International Symposium on Robotics Research*. Vol. 28. 1–16.

Strimel, G. P. and M. M. Veloso. (2014). “Coverage planning with finite resources”. In: *2014 IEEE/RSJ International Conference on Intelligent Robots and Systems*. IEEE. 2950–2956.

Sujit, P. and D. Ghose. (2004). “Search using multiple UAVs with flight time constraints”. *IEEE Transactions on Aerospace and Electronic Systems*. 40(2): 491–509.

Sung, Y. (2019). “Multi-robot coordination for hazardous environmental monitoring”. *PhD thesis*. Virginia Tech.

Sung, Y., D. Dixit, and P. Tokekar. (2021). “Environmental hotspot identification in limited time with a uav equipped with a downward-facing camera”. In: *2021 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE. 13264–13270.

Sung, Y. and P. Tokekar. (2019). “A competitive algorithm for online multi-robot exploration of a translating plume”. In: *2019 International Conference on Robotics and Automation (ICRA)*. IEEE. 3391–3397.

Sung, Y. and P. Tokekar. (2021). “Gm-phd filter for searching and tracking an unknown number of targets with a mobile sensor with limited fov”. *IEEE Transactions on Automation Science and Engineering*.

Suryan, V. and P. Tokekar. (2020). “Learning a spatial field in minimum time with a team of robots”. *IEEE Transactions on Robotics*. 36(5): 1562–1576.

Suslova, E. and P. Fazli. (2020). “Multi-Robot Task Allocation with Time Window and Ordering Constraints”. In: *2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 6909–6916.

Tamjidi, A., R. Oftadeh, S. Chakravorty, and D. Shell. (2019). “Efficient recursive distributed state estimation of hidden Markov models over unreliable networks”. *Autonomous Robots*: 1–18.

Tan, X. and T. Hirata. (2003). “Finding shortest safari routes in simple polygons”. *Information processing letters*. 87(4): 179–186.

Tan, Y. T., A. Kunapareddy, and M. Kobilarov. (2018). “Gaussian Process Adaptive Sampling Using the Cross-Entropy Method for Environmental Sensing and Monitoring”. In: *2018 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE. 6220–6227.

Teh, Y. W. *et al.* (2010). “Dirichlet Process.” *Encyclopedia of machine learning*. 1063: 280–287.

Thrun, S. (2003). “Learning occupancy grid maps with forward sensor models”. *Autonomous robots*. 15(2): 111–127.

Tokekar, P., D. Bhadauria, A. Studenski, and V. Isler. (2010). “A robotic system for monitoring carp in Minnesota lakes”. *Journal of Field Robotics*. 27(6): 779–789.

Tokekar, P. and V. Kumar. (2015). “Visibility-based persistent monitoring with robot teams”. In: *2015 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 3387–3394.

Tokekar, P., J. Vander Hook, D. Mulla, and V. Isler. (2016). “Sensor planning for a symbiotic UAV and UGV system for precision agriculture”. *IEEE Transactions on Robotics*. 32(6): 1498–1511.

Tolstaya, E., J. Paulos, V. Kumar, and A. Ribeiro. (2020). "Multi-Robot Coverage and Exploration using Spatial Graph Neural Networks". *arXiv preprint arXiv:2011.01119*.

Tompkins, A., R. Senanayake, and F. Ramos. (2020). "Online Domain Adaptation for Occupancy Mapping". In: *Robotics: Science and Systems*.

Umari, H. and S. Mukhopadhyay. (2017). "Autonomous robotic exploration based on multiple rapidly-exploring randomized trees". In: *2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 1396–1402.

Van Nguyen, H., H. Rezatofighi, B.-N. Vo, and D. C. Ranasinghe. (2019). "Online UAV path planning for joint detection and tracking of multiple radio-tagged objects". *IEEE Transactions on Signal Processing*. 67(20): 5365–5379.

Vasquez-Gomez, J. I., L. E. Sucar, and R. Murrieta-Cid. (2017). "View/state planning for three-dimensional object reconstruction under uncertainty". *Autonomous Robots*. 41(1): 89–109.

Vazirani, V. V. (2013). *Approximation algorithms*. Springer Science & Business Media.

Vidal, E., J. D. Hernández, K. Istenic, and M. Carreras. (2018). "Optimized environment exploration for autonomous underwater vehicles". In: *2018 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE. 6409–6416.

Vougioukas, S. G. (2019). "Agricultural robotics". *Annual Review of Control, Robotics, and Autonomous Systems*. 2(1): 365–392.

Wang, J. and B. Englot. (2016). "Fast, accurate gaussian process occupancy maps via test-data octrees and nested bayesian fusion". In: *2016 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE. 1003–1010.

Wang, J.-W., Y. Guo, M. Fahad, and B. Bingham. (2019). "Dynamic plume tracking by cooperative robots". *IEEE/ASME Transactions on Mechatronics*. 24(2): 609–620.

Wei, L., X. Tan, and V. Srivastava. (2020). "Expedited Multi-Target Search with Guaranteed Performance via Multi-fidelity Gaussian Processes".

Wei, M. and V. Isler. (2018). “Coverage path planning under the energy constraint”. In: *2018 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE. 368–373.

Wilde, N., A. Sadeghi, and S. L. Smith. (2021). “Learning Submodular Objectives for Team Environmental Monitoring”. *IEEE Robotics and Automation Letters*. 7(2): 960–967.

Williams, O. and A. Fitzgibbon. (2006). “Gaussian process implicit surfaces”. In: *Gaussian Processes in Practice*.

Williams, R. K. and G. S. Sukhatme. (2013). “Constrained interaction and coordination in proximity-limited multiagent systems”. *IEEE Transactions on Robotics*. 29(4): 930–944.

Woosley, B., P. Dasgupta, J. G. Rogers, and J. Twigg. (2020). “Multi-robot information driven path planning under communication constraints”. *Autonomous Robots*. 44(5): 721–737.

Wu, W. and F. Zhang. (2012). “Robust cooperative exploration with a switching strategy”. *IEEE Transactions on Robotics*. 28(4): 828–839.

Wu, Z., S. Pan, F. Chen, G. Long, C. Zhang, and S. Y. Philip. (2020). “A comprehensive survey on graph neural networks”. *IEEE transactions on neural networks and learning systems*. 32(1): 4–24.

Xu, Y., J. Choi, S. Dass, and T. Maiti. (2016). *Bayesian prediction and adaptive sampling algorithms for mobile sensor networks: Online environmental field reconstruction in space and time*. Springer.

Yan, Z., N. Jouandeau, and A. A. Cherif. (2013). “A survey and analysis of multi-robot coordination”. *International Journal of Advanced Robotic Systems*. 10(12): 399.

Yu, J., J. Aslam, S. Karaman, and D. Rus. (2015). “Anytime planning of optimal schedules for a mobile sensing robot”. In: *2015 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 5279–5286.

Yu, J., M. Schwager, and D. Rus. (2016). “Correlated orienteering problem and its application to persistent monitoring tasks”. *IEEE Transactions on Robotics*. 32(5): 1106–1118.

Yu, K., A. K. Budhiraja, S. Buebel, and P. Tokekar. (2019). “Algorithms and experiments on routing of unmanned aerial vehicles with mobile recharging stations”. *Journal of Field Robotics*. 36(3): 602–616.

Zavlanos, M. M., L. Spesivtsev, and G. J. Pappas. (2008). "A distributed auction algorithm for the assignment problem". In: *2008 47th IEEE Conference on Decision and Control*. IEEE. 1212–1217.

Zhang, Z., J. Lee, J. M. Smereka, Y. Sung, L. Zhou, and P. Tokekar. (2019). "Tree Search Techniques for Minimizing Detectability and Maximizing Visibility". In: *2019 International Conference on Robotics and Automation (ICRA)*. IEEE. 8791–8797.

Zhi, X., X. He, and S. Schwertfeger. (2019). "Learning Autonomous Exploration and Mapping with Semantic Vision". *arXiv preprint arXiv:1901.04782*.

Zhou, L. and P. Tokekar. (2021). "Multi-robot coordination and planning in uncertain and adversarial environments". *Current Robotics Reports*. 2(2): 147–157.

Zlot, R. M. (2006). "An auction-based approach to complex task allocation for multirobot teams". *PhD thesis*. Citeseer.

Zuo, L., W. Yan, and M. Yan. (2017). "Efficient coverage algorithm for mobile sensor network with unknown density function". *IET Control Theory & Applications*. 11(6): 791–798.