Abstract:
In the pursuit of understanding the world around us, significant efforts are dedicated to developing dependable autonomous systems capable of planning out exploration tasks. These tasks encompass a range of applications, such as scientific sampling, environmental monitoring, surveillance, and search and rescue operations. Robotic systems deployed in real-world scenarios must take into account the dynamic changes and uncertainties of their environments, which exponentially increase the decision state space and make these problems intractable. As such, exploiting the inherent geometric properties of the areas allows for redefining planning as a combinatorial optimization task. This helps to reduce the overhead complexity of the problem and break it into manageable subproblems for handling uncertainties.

In this talk, we will explore a hierarchical approach to generating a comprehensive pipeline of robust exploration and coverage plans, including: (i) creating global trajectory plans, and (ii) incorporating dynamic changes to adjust trajectories as needed. We will specifically examine various coverage strategies for both single and multi-robot systems that consider obstacles, the environment’s implicit geological properties, and effective data collection suited to the deployed sensors. Additionally, we will discuss methods for integrating uncertainties within these plans. Furthermore, we will showcase real-world applications of these techniques, automating scientific sampling operations in the marine domain and beyond.

Bio:
Nare Karapetyan is a postdoctoral associate at the Maryland Robotics Center at the University of Maryland (UMD), working with Dr. Dinesh Manocha and Dr. Pratap Tokekar. She received her Ph.D. from the University of South Carolina (UofSC) in Computer Science where she worked in the Autonomous Field Robotics Laboratory (AFRL) under the supervision of Dr. Ioannis Rekleitis. She has worked on the area coverage path planning problems both for two and three-dimensional areas, with particular applications in aquatic domains. She is currently developing exploration/coverage planning methods for a team of heterogeneous multi-robot systems operating under dynamic changes. She was awarded the prestigious Japan Society for the Promotion of Science (JSPS) postdoctoral fellowship and named Breakthrough Graduate Scholar 2022 by the UofSC. Nare is serving as an Associate Editor for the IROS Conference and IEEE Robotics & Automation Letter Editorial Board.