The Field Robotics Center

Seminar Series

Monday, 8th Dec

GHC 2109 10:30- 11:30am
Food will be served

Nate Otten
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Robotics Institute

Nomadic Exploration: Planning Routes of Continuous Illumination and Traversability using Connected Component Analysis

Abstract: Robots exploring polar regions of airless bodies such as the Moon and Mercury must cope with complex, dynamic environments. They will encounter rough terrain, time-varying illumination, temperature variations, and communication dropouts. Solar-powered rovers in these environments are motivated to stay in the light as much as possible to generate electricity and regulate internal temperature. This concept of following sunlight and other resources and constraints to extend operation is termed Nomadic Exploration. This talk presents a method that applies connected component analysis to plan routes that keep robots in continuous illumination and on traversable slopes. Such routes promise to extend the range, lifespan, and scientific return of robots exploring environments like the Moon. Maps of lighting and slope are used to determine all contiguous regions that both are lit and have safe slope. These connected components are pruned to eliminate infeasible routes and dead ends. The longest-enduring component is used as the basis for a graph search that finds the shortest route between two or more waypoints. Two regions near the Moon's South Pole serve as examples throughout the presentation, and example routes and metrics are discussed.

Speaker Bio: Nate Otten is a Ph.D. student in the Robotics Institute advised by William "Red" Whittaker and David Wettergreen. He holds a B.S. in Mechanical Engineering from the University of Nebraska-Lincoln. His work focuses on path planning algorithms that enable rovers to reason about temporal constraints and resources with primary applications in space exploration. Nate has experience working in the aerospace industry at Honeybee Robotics, NASA Jet Propulsion Lab, and Lockheed Martin Space Systems, and he has been a member of CMU's Google Lunar XPrize team since 2012.

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