Carnegie Mellon University
THE ROBOTICS INSTITUTE

# Thesis Proposal

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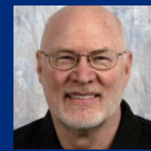
*Thesis Committee*

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# View Trajectory Planning for Modeling Planetary Features under Transient Illumination

Friday, April 25, 2014
GHC 8102
2:00 p.m.


## Abstract

This research addresses the problem of planning views for modeling large, local, substantially 3D terrain features, such as skylights, at long range from surface rovers. Skylights, which are vertical cave entrances, and other pits have been identified in recent high-resolution images of the Moon and Mars. Planetary pits are interesting scientific targets, often exposing layers of bare rock in their walls, hinting at past volcanism and other subsurface processes with their morphology, and sometimes even providing glimpses into caves.

Surface rovers could build models of these features through cross-pit imaging, but only if viewing and illumination angles, both absolute and relative, are carefully chosen. In a planetary environment, the illumination angle is determined by the motion of the sun over time, which is well understood. Viewing angle is determined by rover position. The need is for a class of planner that can autonomously determine what targets to image, from what positions, at what times.

The proposed work formulates the problem as a new vehicle routing problem: the Orienteering Problem with Time Windows and Inter-Node Dependencies (OPTWIND). This extends the established Orienteering Problem with Time Windows in which a traveler gets reward by visiting nodes and wants to maximize reward, but at the same time minimize distance traveled, and visits to a node are limited to a certain time window. The work will compare a newly developed algorithm, a genetic algorithm, and a general-purpose AI planner and identify their comparative merits.