Angle-Specific Goal Assignment for Persistent Coverage

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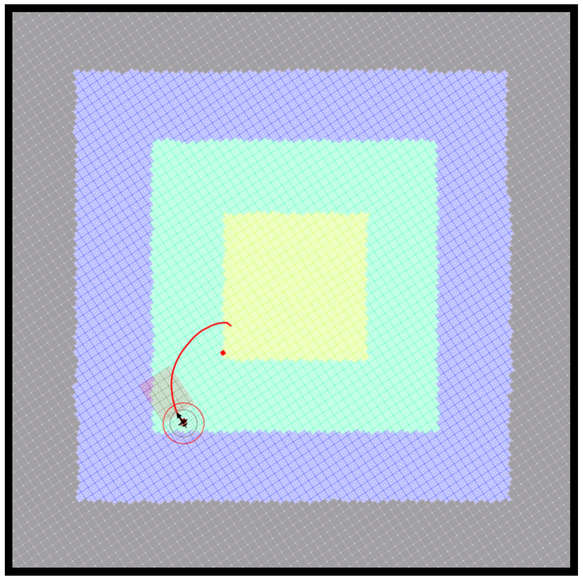
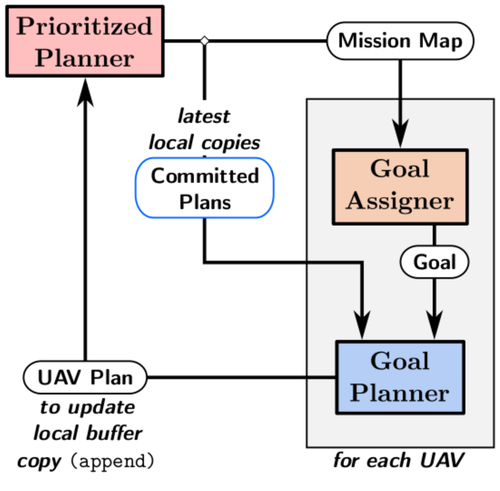
Persistent Coverage



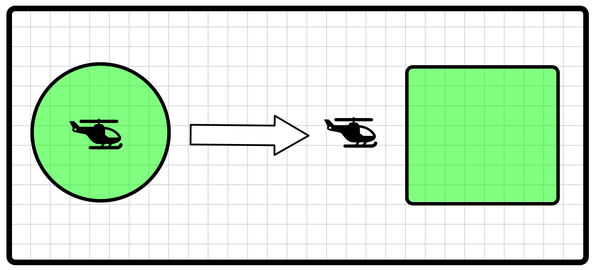
- UAVs covering rectangular sensor footprints in front of their position
- Grid-based environment whose coverage levels degrade over time at varying rates
- Previous work [1]: planning framework for UAVs which cover circles around them
- My work: extend framework to sensor footprints facing in particular directions
- Assign goal poses in (x,y,θ) instead of (x,y) positions

Prioritized Planning Framework

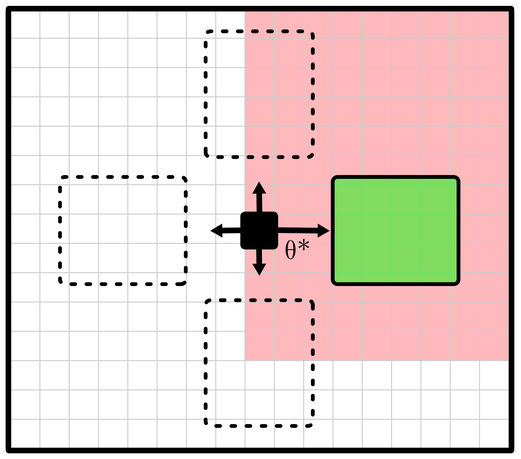


Selecting the Next Goal Pose

Angle-Dependant Sensor Footprints

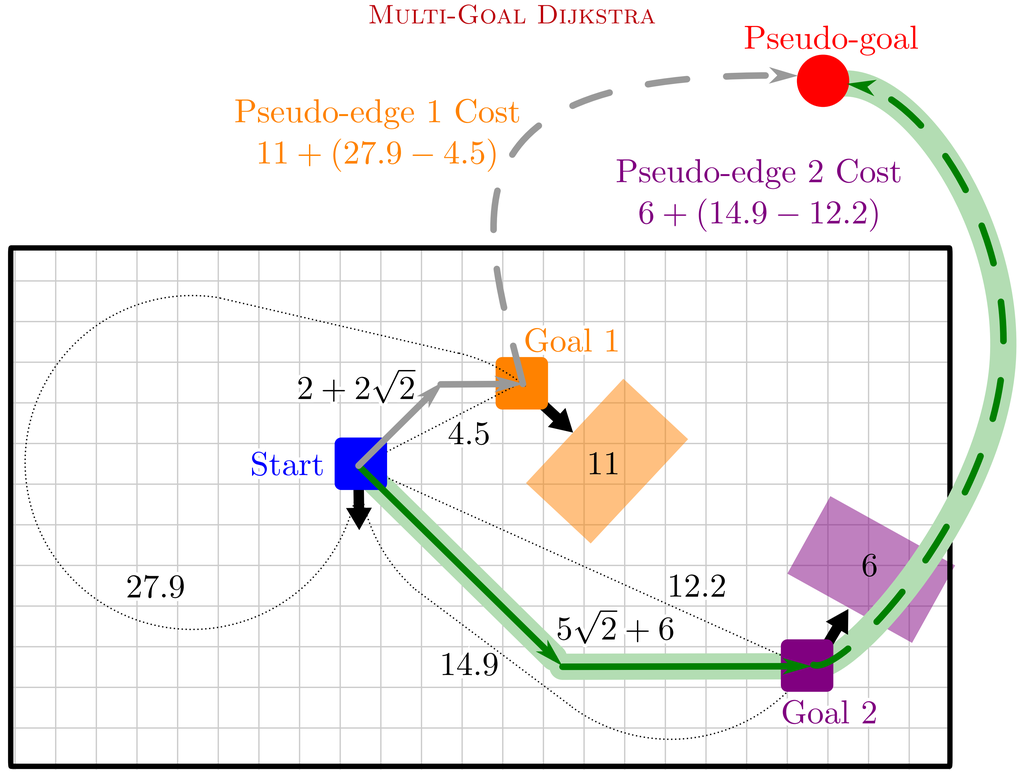


Angle With Most Urgent Coverage



- Selects poses balancing
  - coverage urgency: average time remaining in footprint until cell expiration
  - cost to reach from the current position: approximated with Dubins path length
- From each environment cell (x,y), considers the angle θ* with the most urgent coverage

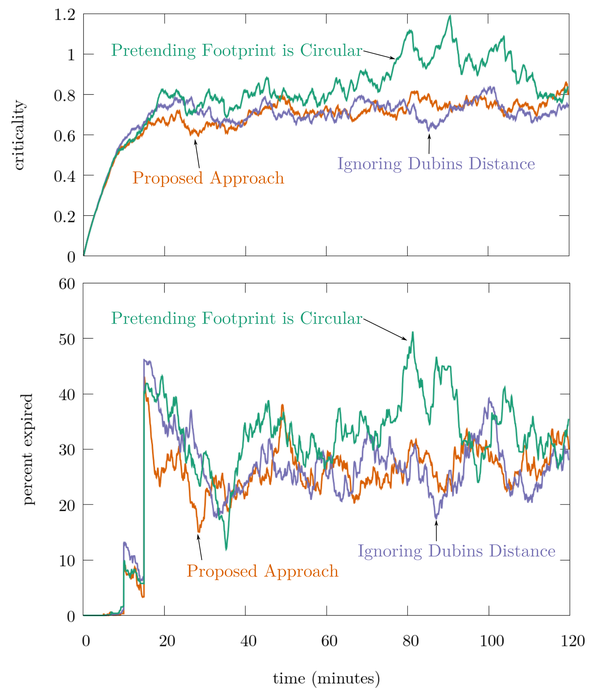
Multi-Goal Dijkstra



$$\text{cost}(R \to G1 \to PG) = 2 + 2\sqrt{2} + 11 + (27.9 - 4.5) \approx 37.8$$

$$\text{cost}(R \to G2 \to PG) = 6 + 5\sqrt{2} + 6 + (14.9 - 12.2) \approx 21.8$$

Results



- Proposed Approach provides better coverage than approximating the footprint as a circle
- Considering the Dubins distance does not significantly improve coverage performance

References

[1] T. Kusnur, S. Mukherjee, D. M. Saxena, T. Fukami, T. Koyama, O. Salzman, and M. Likhachev, "A planning framework for persistent, multi-UAV coverage with global deconfliction," in In Proceedings of Field and Service Robotics 2019 (FSR19), 2019.

Acknowledgements

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