

Robotic Data Collection for Precision Agriculture

Pratap Tokekar, Patrick Plonski,
Joshua Vander Hook, Roman Ripp
David Mulla and Volkan Isler



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ROBOTIC SENSOR NETWORKS
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Precision Agriculture

- Estimate and predict crop status using soil, crop and aerial measurements
- Target *right amounts* of fertilizer at the *right times* at the *right places*
- **Frequent, on-demand sensing**
 - Manual methods can be tedious
 - Remote sensing can be costly
 - Satellite can be infrequent, affected by cloud cover



Ideal Job for Robots!



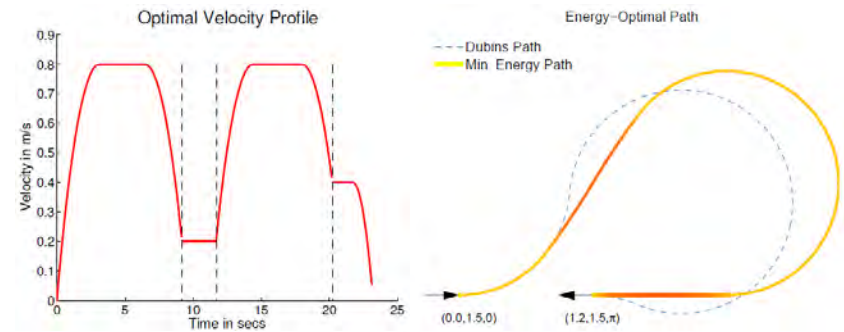
- UAV: multi-spectral images of the crop
- UGV: ground based measurements



Energy-Optimal Trajectory Planning

- Optimize velocity profile, given a path for a car-like robot
- Compute energy-optimal path and velocity profile given start and goal pose

[Tokekar, Karnad & Isler. AURO '14]



Solar Energy Estimation and Planning

- Estimate solar map using only solar panel measurements without knowing the full environmental geometry
- Plan solar-aware paths for the robots to maximize lifetime

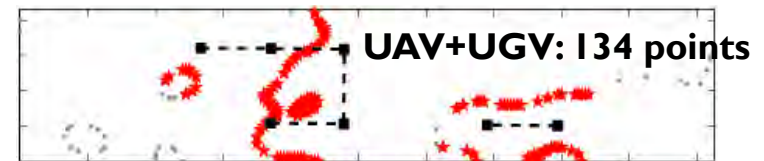
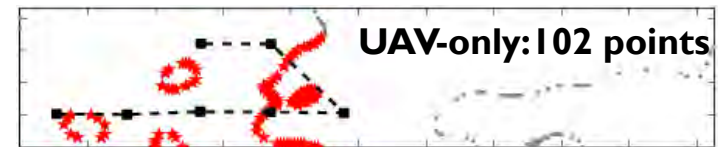
[Plonski & Isler, ICRA '14], [Plonski, Vander Hook & Isler, '14]
[Plonski, Tokekar & Isler, JFR '13]



Symbiotic UAV+UGV System

- UAVs have limited on-board battery
- UGV can mule the UAV between deployment locations, increasing coverage range
- *How to plan such paths?*

[Tokekar, Vander Hook, Mulla & Isler. IROS '13]





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Thank you!
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