CPS: Medium: Leveraging Honey Bees as Bio-Cyber Physical Systems

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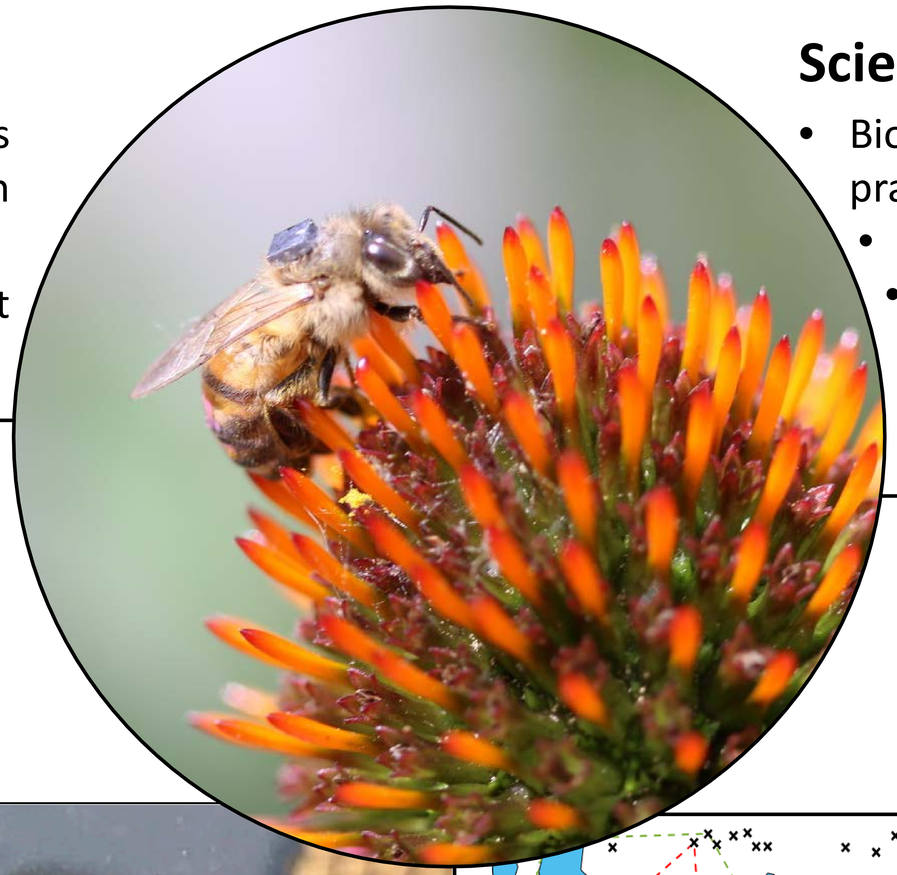
Challenge

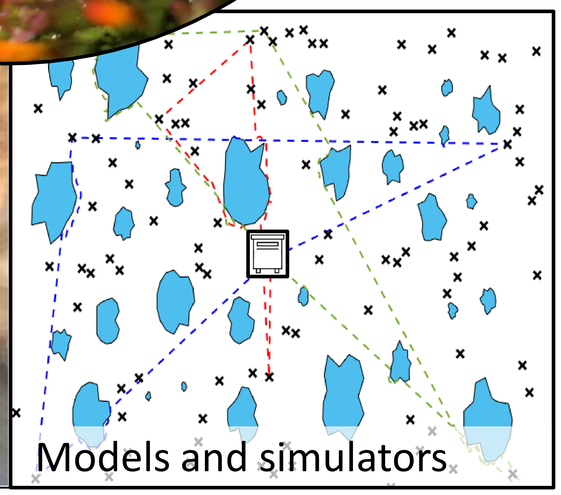
- Can we observe foraging patterns of bees to estimate bloom and pollination in orchards?
- Given knowledge of bloom, can we affect bees to forage more efficiently?



Solution

- Miniature flight recorders based on Angle Sensitive Pixels
- Models and simulation frameworks of honey bee foraging in orchards
- Particle filter-based methods to generate foraging activity maps from noisy, low-resolution outputs
- Mechanical mimicking of honey bee shaking signals
- Best mounting practices


2021 Field trials


Models and simulators

Scientific Impact

- Bio-hybrid technologies and best mounting practices
  - Ultra low-power sensors
  - Probabilistic inference from large-scale noisy data sources
  - Feedback control of bio-hybrid systems

Broader Impact

- Automated and robust tracking of field pollination
- Improved control of pollination
  - Gains to apiculture and entomology
  - Better management practices and design of multi-use landscapes
  - K1-16 outreach events, festival exhibits, academic seminars and a seminar class on Robots, Wine, and Food.

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