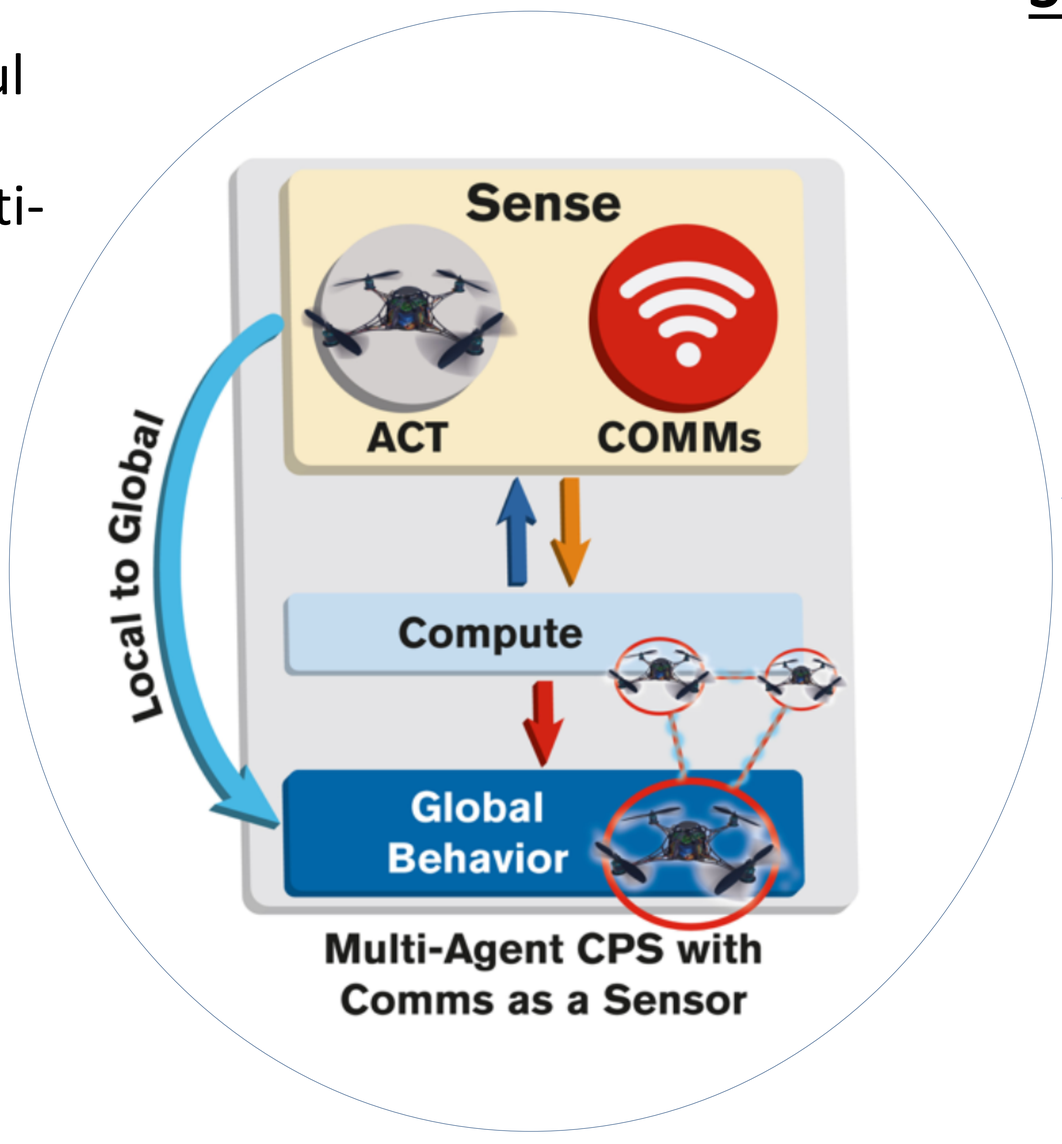
CAREER: Multi-Agent Decision Making and Optimization using Communication as a Sensor

Award# 2114733/June2019/Stephanie Gil (Harvard University)

Challenge:

- Extract and characterize useful information from physical communication to inform multi-agent CPS algorithms
- Characterize the value of this information mathematically

Solution:



Overview of concept with comms/control interplay

Scientific Impact:

Broader Impact:

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Solution:

- Robot empowered with Synthetic Aperture Radar ability over its arbitrary flight path for the first time
- Characterized a lower bound on the variance of the angle-of-arrival estimate using the Cramer Rao Bound

Off-the-shelf drone emulates Synthetic Aperture Radar over its arbitrary flight path

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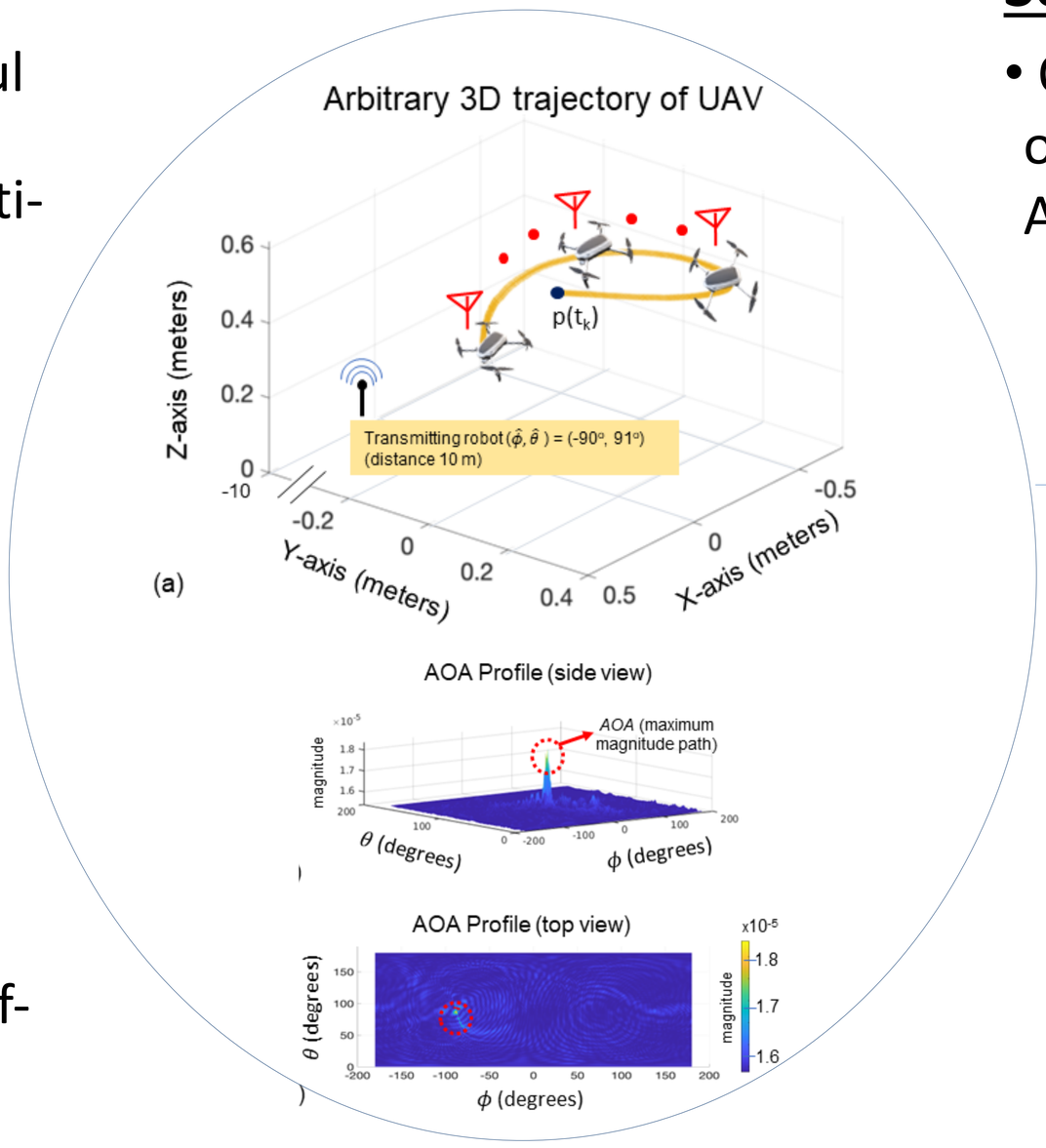

Angle-of-Arrival estimation performed onboard

Scientific Impact:

- Off-the-shelf robots with all on-body sensing can perform AOA estimation

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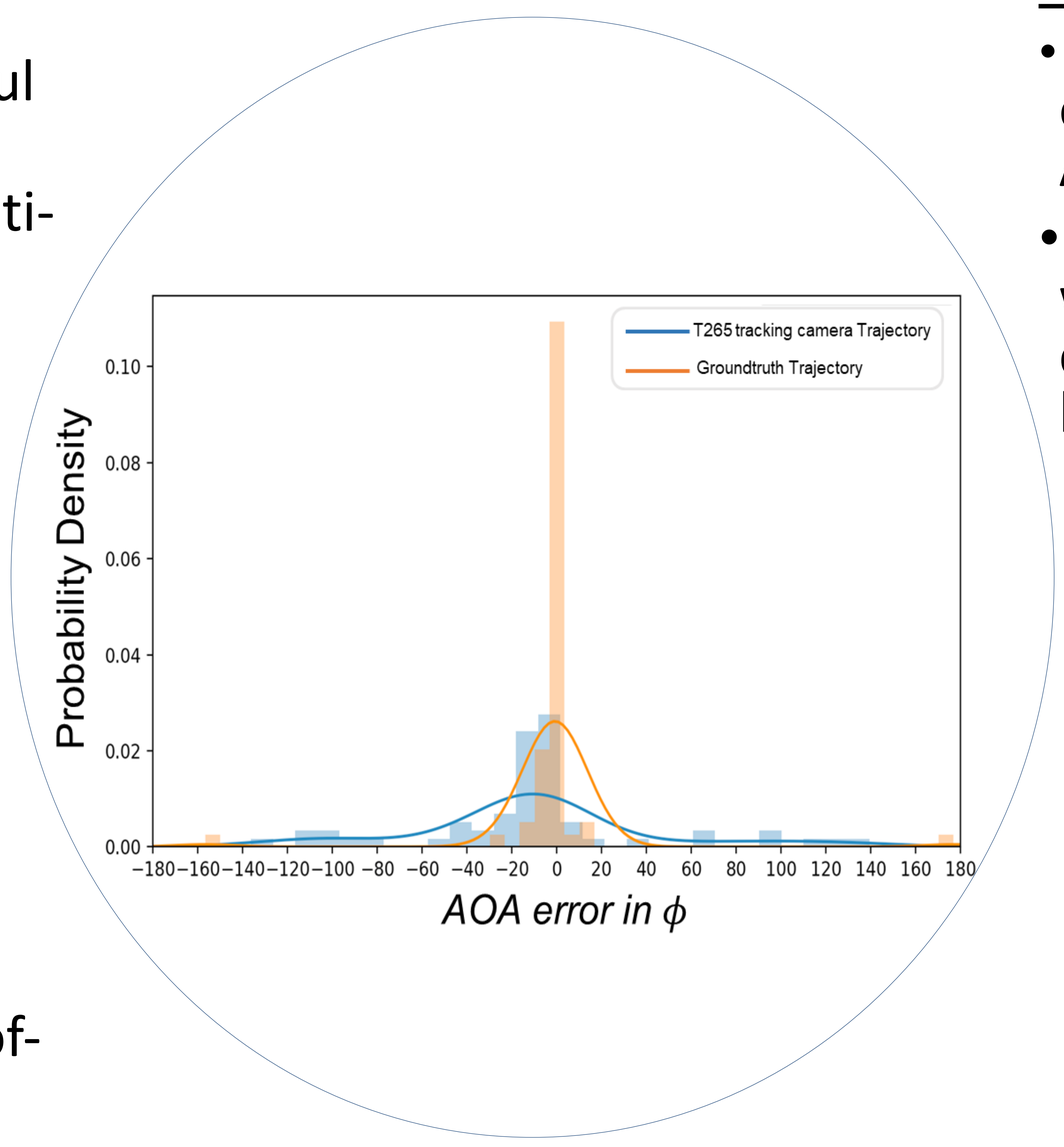

Error characterization and lower bound derived for communication-as-a-sensor

Scientific Impact:

- Off-the-shelf robots with all on-body sensing can perform AOA estimation
- By characterizing the error we are able to achieve communication-as-a-sensor between agents

Broader Impact:

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Search and Rescue workshop conducted with over 55 participants including students and professionals

Scientific Impact:

- Off-the-shelf robots with all on-body sensing can perform AOA estimation
- By characterizing the error we are able to achieve communication-as-a-sensor between agents

Broader Impact:

- Enables robots with important direction-finding capabilities for
  - Coordination algorithms like exploration
  - Search and rescue tasks as members of a hybrid team human/autonomous team