2021 NSF CYBER-PHYSICAL SYSTEMS PRINCIPAL INVESTIGATORS' MEETING

Enabling Multimodal Sensing, Real-time Onboard Detection and Adaptive Control for Fully Autonomous Unmanned Aerial Systems (Award #1739748 8/7/2017 - 9/30/2021)

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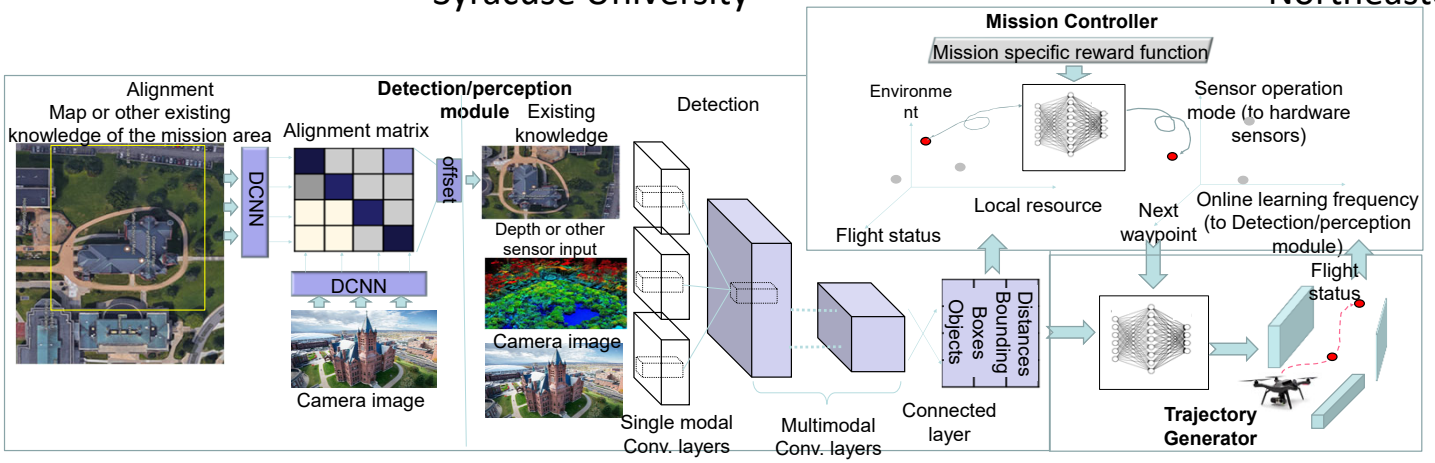

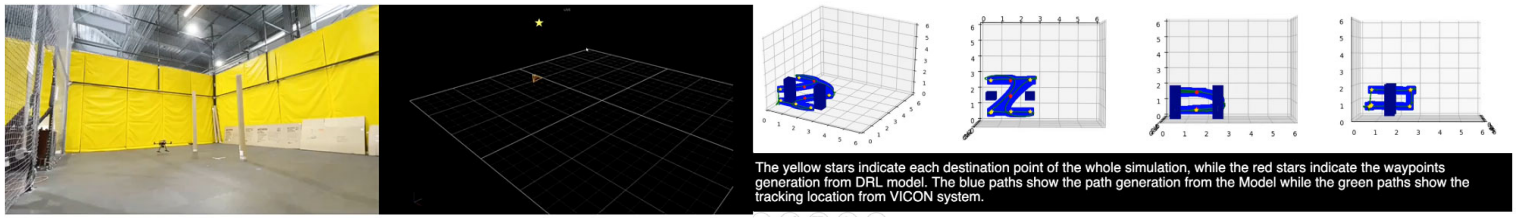

Challenge:

- Autonomous UAV requires on-board context aware trajectory generation & control
- Stability vs. planning complexity
- Limited onboard computing power

Solution:

- Hierarchical planning
  - –Upper level: deep reinforcement learning based way point generation
  - –Lower level: nonlinear optimization
- Weight pruning and neural network compression

Scientific Impact:

- Hybrid control framework learns how to partition large optimization problem into subproblems
- Gives trajectory 13% more energy efficient and 6% less complex
- ADMM based structured pruning removes 60% of the storage and provides 40.8% speedups

Broader Impact:

- Truly autonomous UAVs may enable many novel applications
- Will benefit engineers/researchers working on building inspection, hazard detection, surveillance, environment data collection
- PIs involves actively in teaching and K-12 students mentoring
- Mentor of regional champion team in FLL LEGO Robot competition