

Collaborative Research: CPS: Frontier: CHORUS: Resilient Distributed CPS through Rational and Dynamic Decision-Making Among Multiple Stakeholders

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Overarching Goal: Develop rigorous, scientific mechanisms to enable CPS resilience against a large universe of perturbations, with demonstrations in Connected and Autonomous Transportation Systems (CATS).

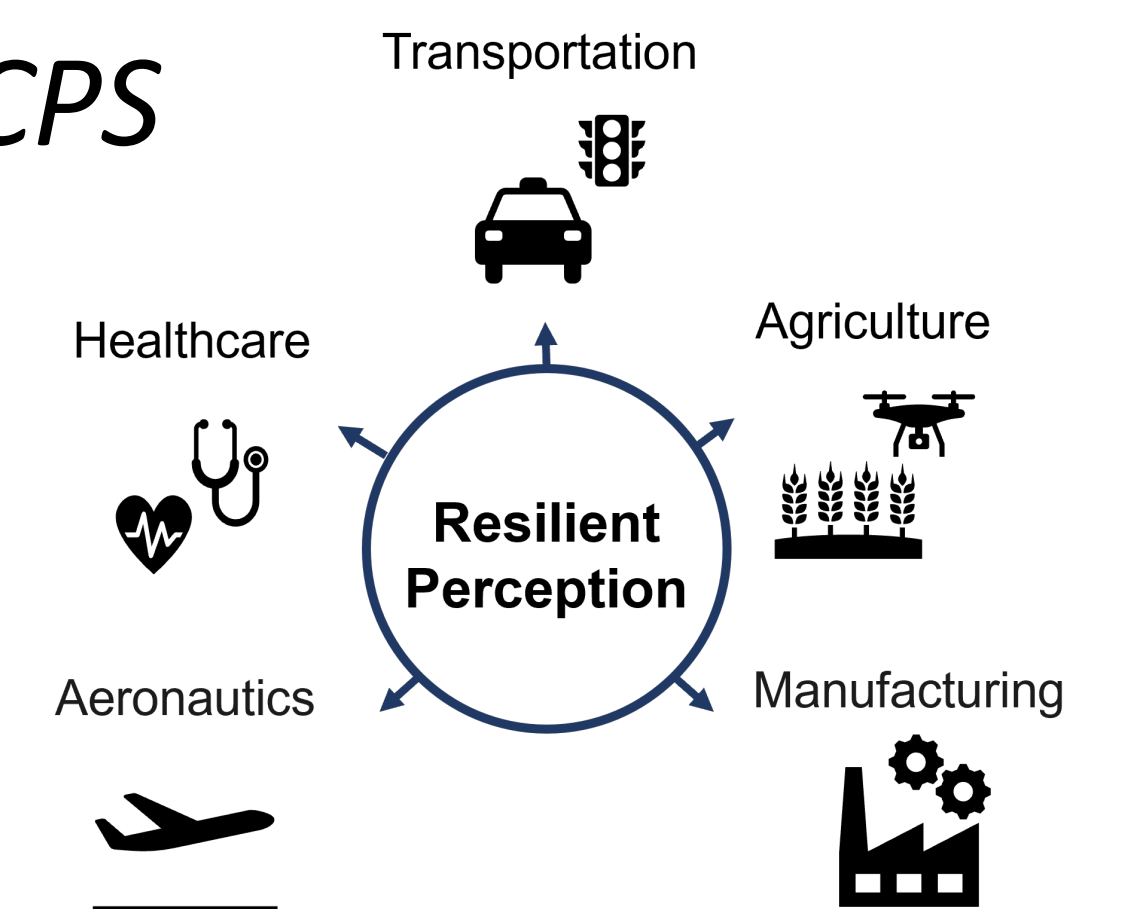
Our focus is developing algorithms and techniques to *respond* to runtime perturbations related to *sensing and perception*

Key Challenges: Runtime perturbations caused by imperfect perception, e.g., partial sensor failures due to severe weather during natural disasters, are inherently *unpredictable*.

- *How can we respond to these perturbations optimally?*
- *How can we ensure a timely response?*

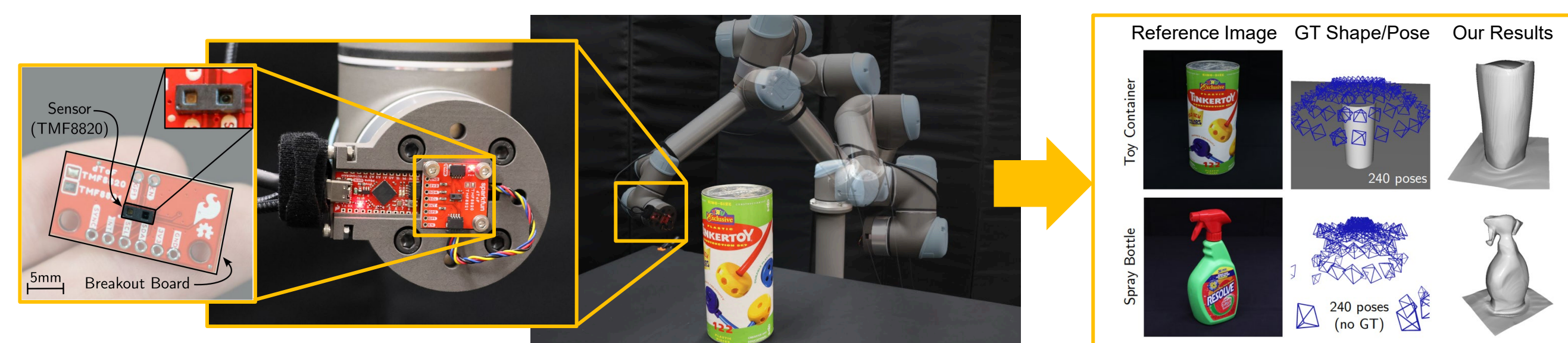
Scientific Impact: *Resilient perception in CPS*

- adapt to dynamically changing environment
- continue to function under various runtime perturbations



Our Solution (resilient and adaptive perception)

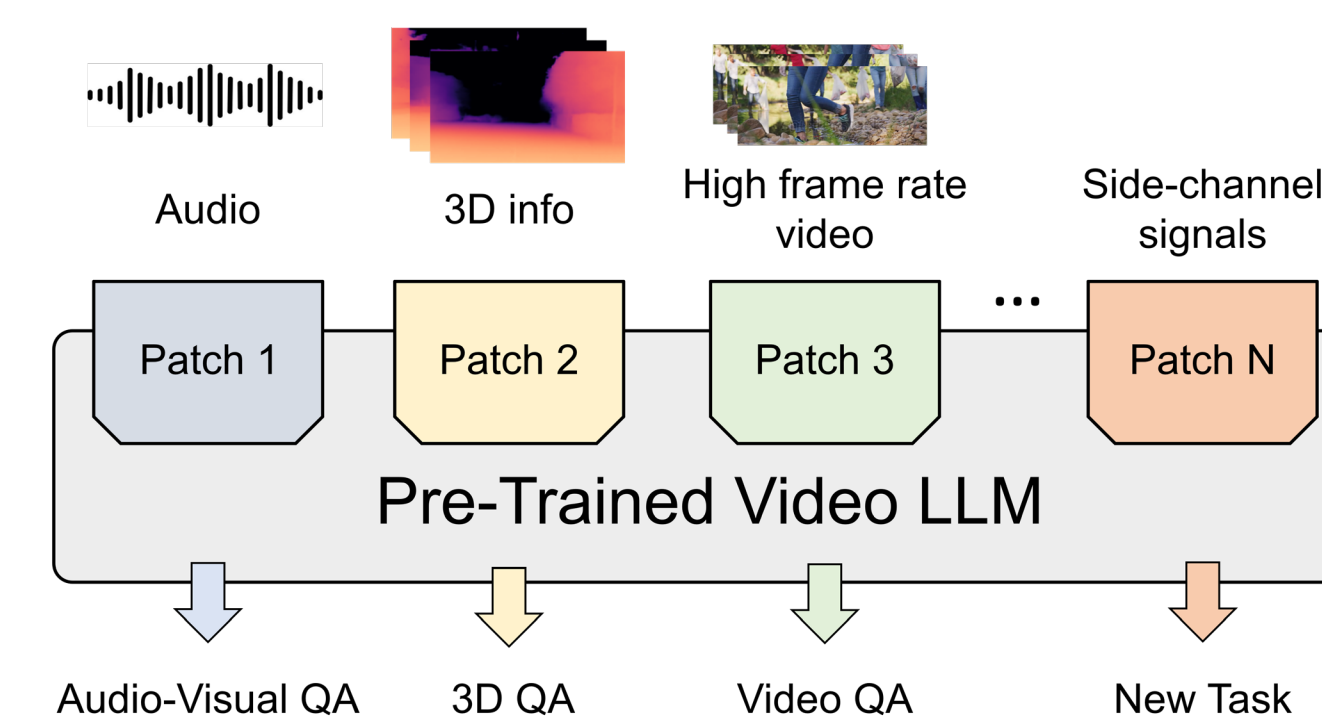
(A) Side-Channel Sensing w. Single Photon Cameras



High speed 3D imaging under low light

CVPR 2024 & under review

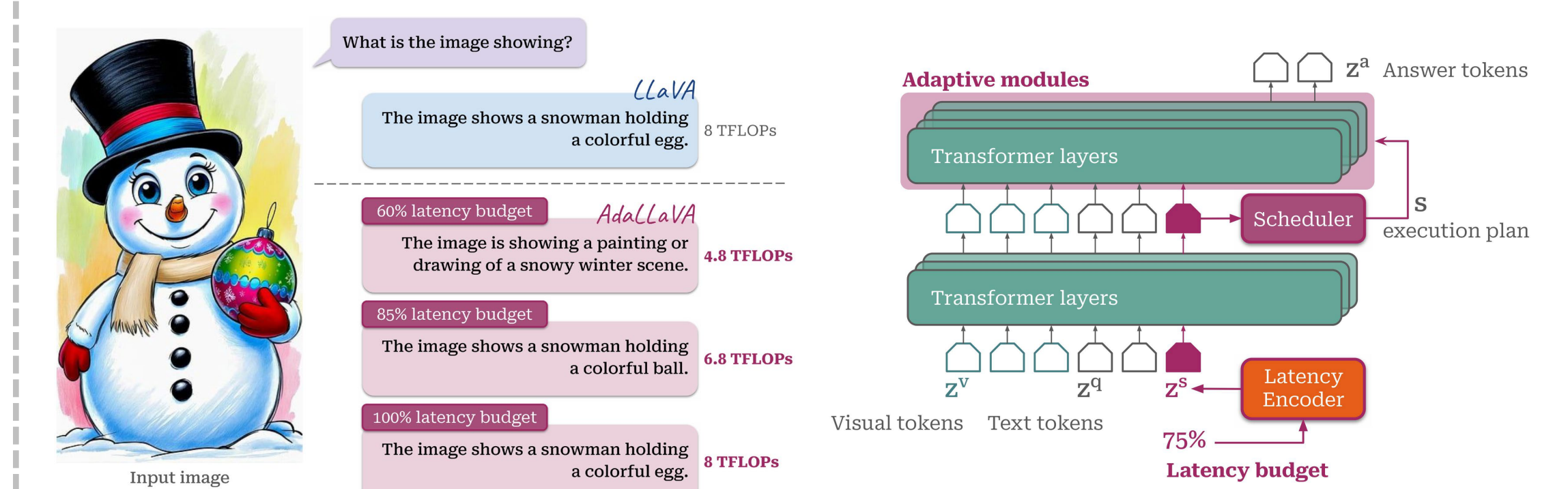
(B) Continuous Adaption in Open World



Efficient online adaption to new tasks

ICLR 2024 & CVPR 2025

(C) Adaptive Perception w. Limited Budget



Accurate inference under varying latency

Under review (in collaboration with Purdue team)

Broader Impacts (collaboration across sites)

- Improve safety and security in CATS and other transportation systems
- Enhance CPS resilience across domains
- CHORUS workshops (hosted on Nov. 24 and annual thereafter)
- Competitions and MOOC
- Create a technically excellent community of CPS researchers and learners