

Frontier: Cognitive Autonomy for Human CPS: From Novices to Experts Meeko Oishi, Sriram Sankaranarayanan, Ufuk Topcu, Inseok Hwang, Neera Jain, Tahira Reid, Brandon Pitts, Tryphenia Peele-Eady

Challenge:

How can we make autonomous cyber-physical systems highly responsive to human cognitive state, yet amenable to formal assurances?

Solution:

- •POMDP models of trust and selfconfidence
- •Conformal prediction for online, customizable constraint satisfaction
- •IRL for customizable blended control with stability guarantees
- •Non-parametric learning for offline verification with a human in the loop
- •Data-driven and model-based characterizations of cognitive state

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Conditional distribution embeddings characterize heterogeneous patterns in human braking under mind-wandering with high fidelity.



POMDP models of the impact of trust and self-confidence on reliance



Scientific Impact:

- •Human-centric algorithms and tools at the intersection of controls and learning
- •Computationally tractable, data-driven models of human state, actions, and priorities
- •Methods for control based on physical *and* cognitive state

Broader Impact:

- •Prevention of "misuse, disuse, and abuse" of automation
- •Methods to accommodate human heterogeneity and variability
- •Culturally aware undergraduate summer research program
- •Characterization of environments for success of underrepresented students

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