

Medium: Resilient-by-Cognition Cyber-Physical Systems

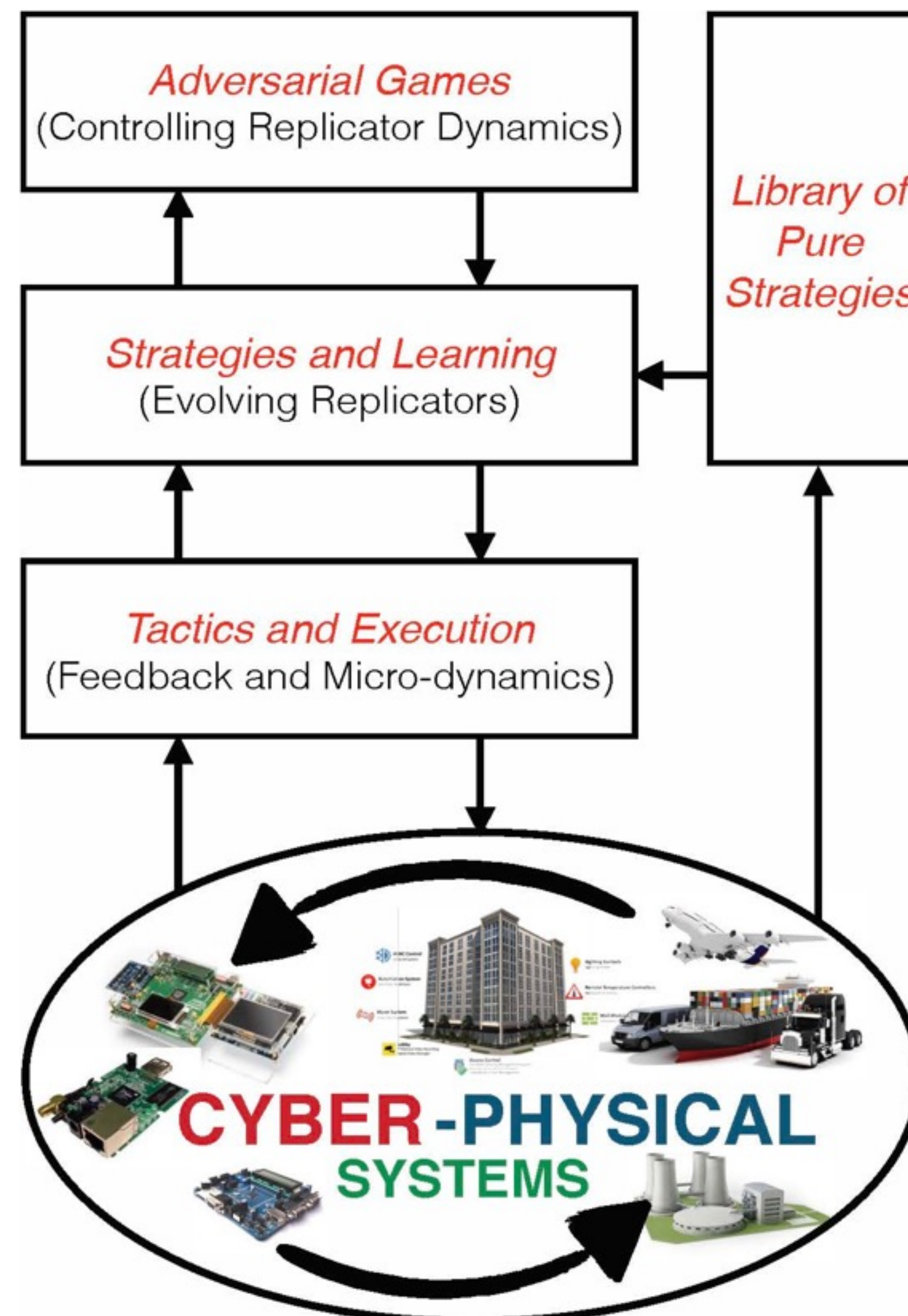
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Challenge:

- Autonomous CPS will always face new situations which the human designer failed to examine during the design phase.
- Equip CPS with a layer of “cognition” that allows them to learn and adapt from adversarial situations.

Solution:

- A bio-inspired, multi-layer, cognitive architecture for resilient CPS.
- Each CPS is equipped with a library of strategies. At real-time, ideas from evolutionary game theory are used to select the “best” strategy. A controller that realizes the strategy is then synthesized and used to control the CPS.
- **Contributions:** Novel theory for evolutionary games – scalable algorithms for controller synthesis



Scientific Impact:

- Acquire a level of resilience against the unforeseen.
- Evolutionary game theory has been enhanced by the uncovering of variational and algebraic structure in fitness maps that govern the theory.
- New tools for the analysis and synthesis of nonlinear controllers.

Broader Impact:

- Autonomous systems operating in close proximity of humans require high-level of assurance in dealing with unexpected situations.
- New undergrad class on “Autonomous systems”, AI-4ALL, Technica: the largest all-women hackathon.