Run-time fault detection and mitigation in information-rich cyber-physical systems

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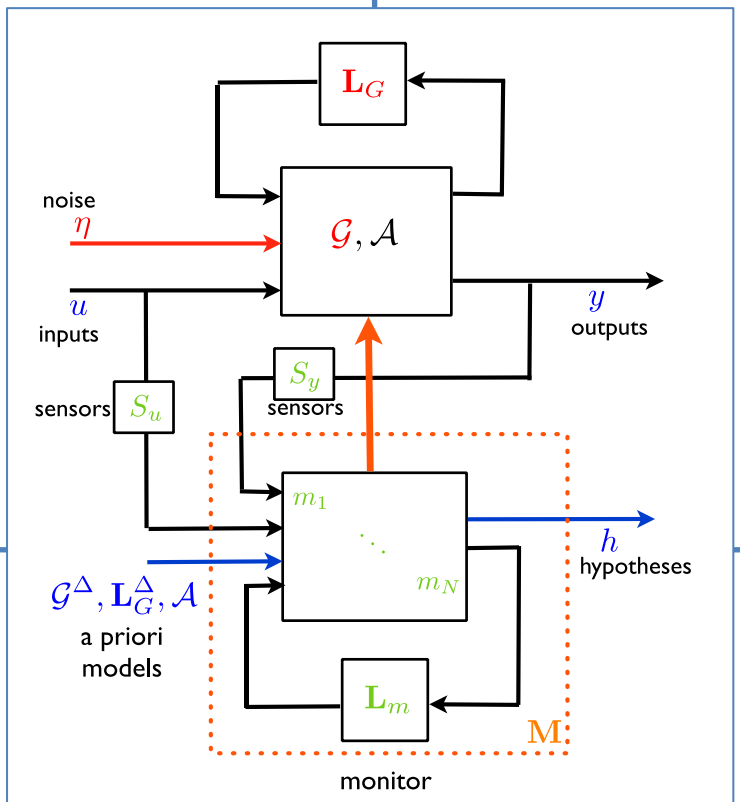
Research Objectives

- Develop a framework for modeling learning algorithms and system dynamics to enable efficient V&V
- **Key insight:** dynamical modeling of adaptive software systems
- Bridge the gap between software verification and model invalidation of dynamical system
- Start TRL: 1
- End TRL: 3 (implementations and demonstrations on university-scale testbeds)



Proposed decentralized monitoring architecture. Both behavioral models (*A*) and dynamical models (*G*) will be used to detect anomalies. The interaction between components are captured by the graph (L).

Approach

- A unified framework for modeling learning algorithms, system dynamics and their interactions based on discrete-time networked hybrid dynamical systems
- Algorithms for run-time fault and anomaly detection using behavioral models (automaton-logics) and dynamical models (hybrid systems) by bringing to bear tools from formal methods and control theory.

Potential Impact

- Cross-cutting technologies for system health management, automated data analysis for decision making and V&V of complex adaptive systems.
- Reductions in system design-time by algorithmic tools for design
- Reductions in system cost
- Substantial improvements in the durations systems operate reliably by enabling timely detection of anomalies and reducing their potentially cascading effects