Event-triggered Learning

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Abstract:

The ability to learn is an essential aspect of autonomous systems facing uncertain and changing environments. However, the process of learning a new model or behavior often does not come for free, but involves a certain cost. For example, gathering informative data can be challenging due to physical limitations, or updating models can require substantial computation. Moreover, learning for autonomous agents often requires exploring new behavior and thus typically means deviating from nominal or desired behavior. Hence, the question of "when to learn?" is essential for the efficient and intelligent operation of autonomous systems. We have recently proposed the concept of event-triggered learning (ETL) for making principled decisions on when to learn new dynamics models. Building on the core idea of learning only when necessary, we have developed concrete triggers and theory for different domains. In the context of networked and interconnected systems, ETL leads to superior communication savings over standard event-triggered control. For linear quadratic control, ETL automatically detects inaccurate models and yields improved control performance under changing dynamics. In this talk, we present the concept, theoretical results, and experimental applications of ETL.