Learning-Enabled Assistive Driving (LEAD): Formal Assurances during Operation and Training

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https://dcsl.gatech.edu/research/lead.html

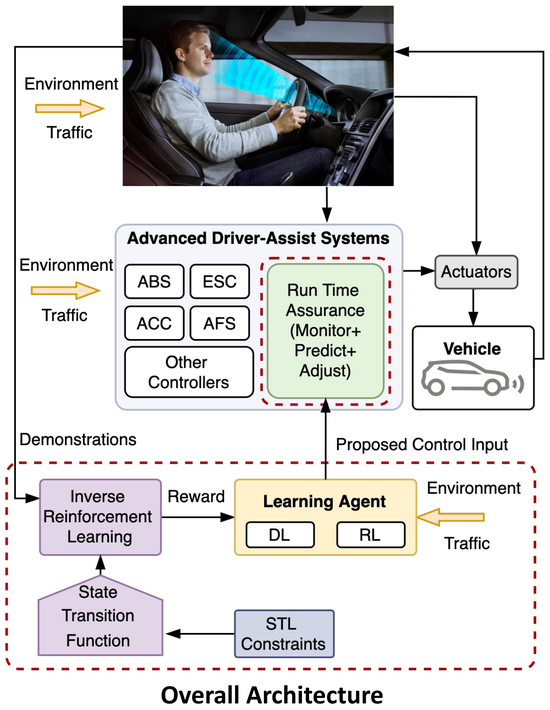
Objective: Make learning-enabled **assistive driving technologies safer** and align their decisions with human-driver; exhibit ”natural” behaviors by autonomous machines that are acceptable, safe, and understandable by humans; quantify impact of human driver within the autonomy loop, both from an individual experiential perspective, as well as in terms of safety.

Motivation/Challenges:

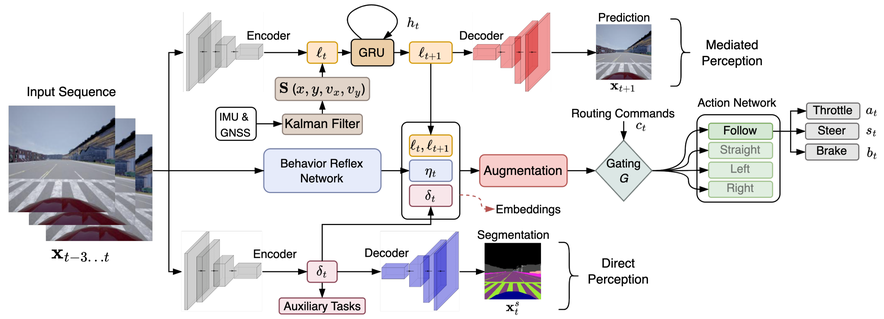
- **Misalignment** of learning agent’s goals with human driver can lead to unsafe interactions
- There is a need to **increase the robustness of learning-based approaches** without sacrificing safety

Scientific Impact:

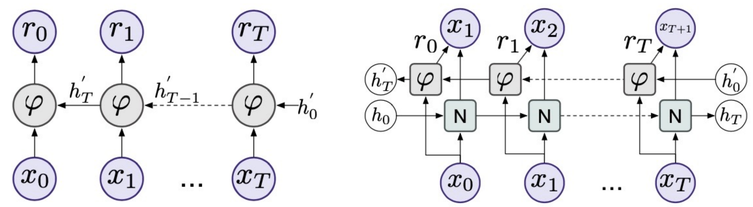
- Develop “**personalized,” safe, and trustworthy autonomous systems**
- Fundamental contributions to **safe operation of deep learning** architectures during training and execution



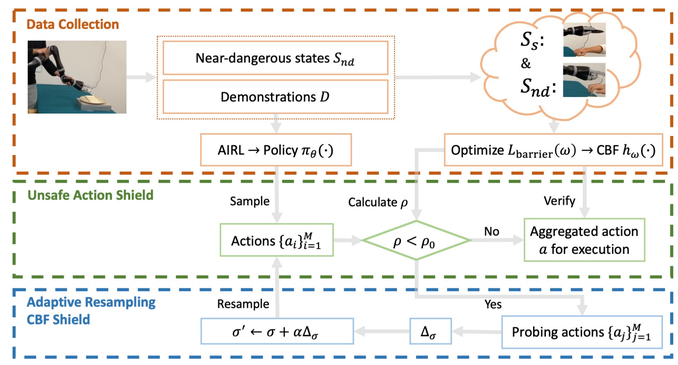
Overall Architecture



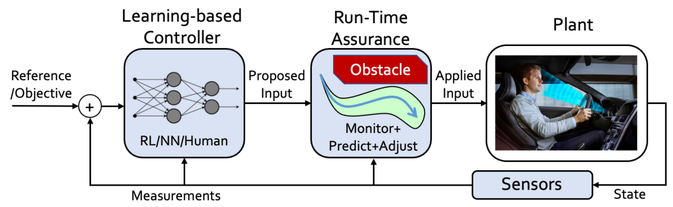
1. Develop redundant neural network architecture to increase robustness and generalizability.



2. Incorporate differentiable Signal Temporal Logic and redundant neural network architectures to increase robustness and generalizability



3. Leverage the advantages of control barrier functions and learning from demonstration to bias a learning agent towards taking safe actions



4. Efficient reachability analysis of neural network for safety during execution

Impact on Society

- Safer ADAS and self-driving vehicles
- Better ADAS will decrease the 40,000 annual casualties from traffic accidents

Education and Outreach

- More than 120 undergraduate students via a Vertically Integrated Project Team (VIP)
- Industry collaboration and technology transfer

Broader Impacts

- Trustworthy, “personalized,” safe autonomous systems in human-machine collaborative settings

Dynamics and Control Systems Laboratory
GEORGIA TECH AEROSPACE ENGINEERING
CORE ROBOTICS LAB
FACTS Lab
Formal Methods & Autonomous Control of Transportation Systems

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