EECE571P: Autonomous Systems

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Reference

CCC whitepaper released in 2015 (link posted on Piazza):



What's the difference between an autonomous system and an automatic system ?

Automation

- Fixed set of rules
- All situations are specified
- Rules determine what system can do
- Rules are fixed in advance
- Testing against inputs to guarantee output

Autonomy

- Goals are fixed, not rules
- Not all situations are specified
- Rules only constraint the behavior
- Behaviour can evolve
- Testing against inputs is harder

Autonomous Systems must be able to operate independently and intelligently in dynamic, uncertain and unanticipated environments (graceful failure when goals conflict with the laws that govern its behavior)

Opportunities for Autonomy

- Automated ground transportation
- Automated flight systems
- Disaster response and recovery
- Automation and space exploration
- Automation and agriculture
- Construction automation
- In-home services
- Law Enforcement
- Planetary Science/weather forecasting

Main Challenges in Building Autonomous systems

1. Creating resilient systems that can deal with unforessen situations and unseen failures and security attacks

2. Interacting with humans in terms of communication, instruction etc.

3. Social, ethical and legal frameworks for reasoning about and controlling these systems

Path forward

Paths to Autonomy

Engineering of Autonomy

Sensing and Autonomy

Autonomy and Human Interaction

Autonomy and Society

Takeaways

Autonomous systems are fundamentally different from automated systems

Autonomous systems face considerable engineering and scientific challenges

- Need to handle unforeseen situations
- Need to be resilient and fail gracefully
- Need to emphasize system safety

Significant opportunities in diverse domains if we're successful

Need a science of autonomous systems