



The City College
of New York

CSC 59867-E: Senior Project II

AI Agents for Decision Making in the Real World

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Welcome Back

We have a very exciting semester
ahead of us!

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Today's Lecture: Introduction

Course Retrospective & Roadmap

From Prototyping
to Implementation

Autonomous Decision-Making

How to use
Common Sense

Class Survey

Backgrounds &
Academic
Milestones

Real-World AI Agent Domains

Scientific /
Engineering
Discovery & more!



Last Semester we...

- Focused on designing and prototyping Multimodal AI Agents capable of autonomous real-world decision-making and environmental interaction.
- Explored fundamental agentic algorithms beyond passive probability generation, including Deep Reinforcement Learning (RL), Multi-Agent RL (MARL), Proximal Policy Optimization (PPO), Imitation Learning, Computational Game Theory, and Model Predictive Control (MPC).
- Trained on rigorous research literature reviews and defining qualitative/quantitative evaluation metrics for agent behavior.

When we left for the summer, each of you had developed an open-source codebase, established preliminary prototype demos, and authored a collaborative research report and final project presentation.



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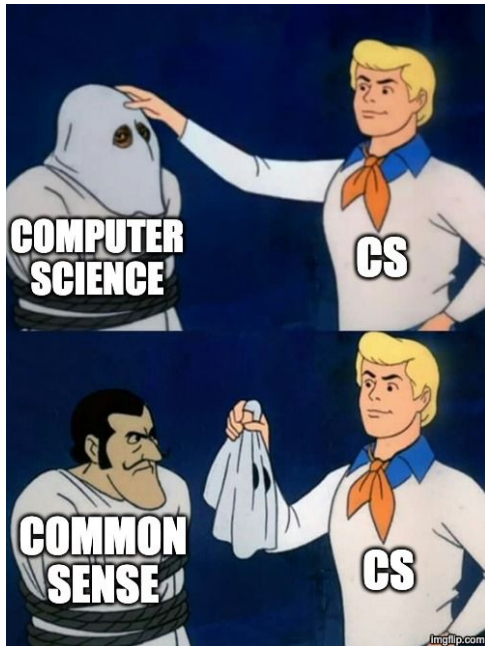
We will be focusing more on Implementation:

- Theoretical Concepts
- Algorithms (for real world and/or virtual environments)
- System level parameters
- Understanding the confluence of science and engineering as the backbone of agents

Remember: Agents take action in the world, whether virtual or physical

Metrics are important, but so is the need to understand open ended problems where new metrics can lead to new open problems

CS: From Computer Science to Common Sense



When we make decisions for ourselves, there is an underlying operating baseline of taking actions that *make sense*.

This might be straightforward for us, but with AI agents autonomously making decisions in the real world, responsibility, accountability, and safety are still open problems.



Class Survey:

**How many of you are in your
final semester?**

Second-to-last Semester?

**How many of you are
Computer Science majors?**

Computer Engineering?

Other?

A Brief Taxonomy of Some Real-World (and Virtual!) AI Agents

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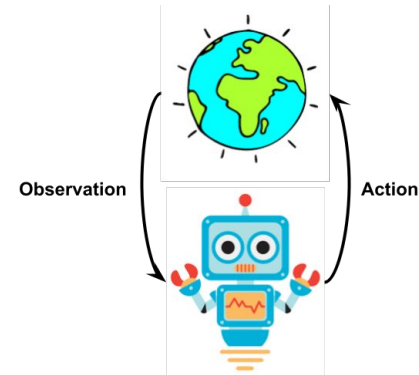
Applications in AI Agent Research

Recall: AI Agents are defined by their ability to *observe* their environment and *interact* with their environment by *intelligently choosing* an action to take.

Any area where decisions are made is an area ripe for AI Agents research:

- Scientific & Medical Discovery
- Engineering & Systems Discovery
- Smart Grids & Energy Orchestration
- Economic Decision-Making

... and many, *many*, more!



Scientific & Medical Discovery

- Protein, biological, biomaterial, and advanced material discovery.
 - Bioplastics
 - Biosynthesis
- Autonomous molecular exploration, drug discovery, and precision drug delivery.
- Deep research modeling for non-viral diseases like Cancer, Parkinson's, and Alzheimer's.
- Autonomous theorem-proving and advanced cellular biology simulations.



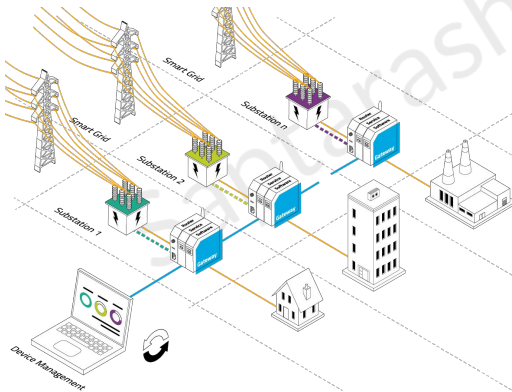
Engineering & Systems Discovery

- Orchestrating autonomous vehicle navigation, such drone swarms , advanced industrial robotics in dynamic environments, and other hardware agents.
- Pioneering the Interstellar Internet, secure sensing networks, and highly advanced Quantum Control mechanisms.
- Optimizing fundamental computing architecture including energy management, memory, high-speed networks, and OS orchestration.

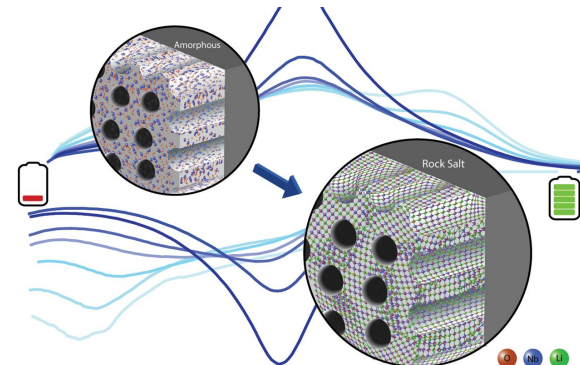


Smart Grids & Energy Orchestration

Agents are critical in maintaining robust control and a consistent supply of electricity across highly volatile, decentralized smart grids.



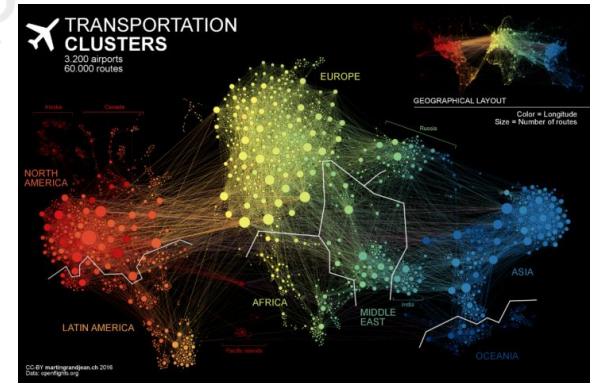
Beyond grid control, AI drives the discovery of next-generation battery materials and novel methods for efficient energy use.



Source: (Barnes et. al.) Electrochemically Induced Amorphous-to-Rock-Salt Phase Transformation in Niobium Oxide Electrode for Li-Ion Batteries,

Economic Decision-Making

- Housing & Transportation driven by real-time multi-agent AI coordination:
 - Zoning Navigation
 - Global logistics
 - Supply chain orchestration
- Financial Strategy:
 - Financial orchestration
 - Structural affordability strategization
- Employability:
 - Strategization of worker skills and autonomously matching job seekers with employers

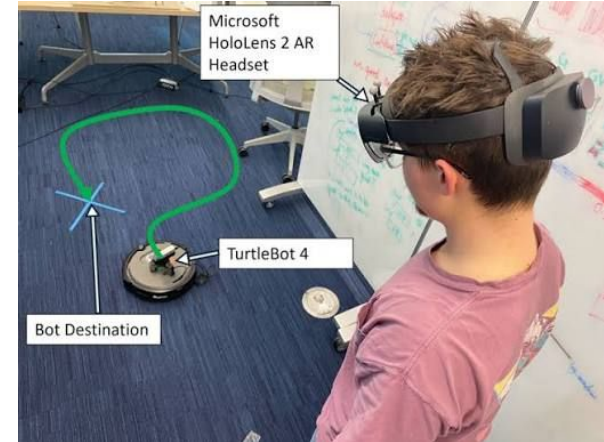


Multimodal Agents and Augmented Reality Software Agents

Advanced Vision-Language Models (VLMs) and Vision-Language-Action models (VLAs) to create highly capable, context-aware Agents that perceive and interact with the real world.

Expanding software interaction:

- Extended Reality (XR)
- Virtual Reality (VR)
- Augmented Reality (AR)



Questions?

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