Self-Driving Cars in Conversation: The AI Systems on Our Roads

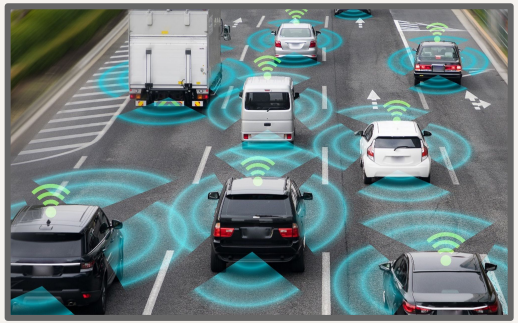
EECS 4461 Team 10

Project Overview

Problem Statement: AI self-driving vehicles are growing in abundance and popularity in the world today. As these vehicles operate more and more on our roads, the impacts of these vehicles are to be studied to uncover emergent effects and behaviours.

Media Ecosystem & Phenomenon: V2V (Vehicle-To-Vehicle) communication enables AI self-driving vehicles to exchange information via omnidirectional radio signals, optimizing driving through AI. This creates an AI-to-AI interaction, forming our media ecosystem where AI vehicles act as biotic elements and roads/human drivers as abiotic ones. Dynamics of energy flow are the primary reason for this distinction; AI self-driving vehicles create the metaphorical nutrients of our media ecosystem.

AI Agent Role: The AI agent here is AI self-driving vehicles that detect nearby cars and use V2V communication to avoid collisions, aiming to reach the grid's end safely. This is in contrast to the non-AI agent which represents human-driven cars, which detect nearby cars but move randomly without communication, mimicking human driving mistakes.



Demonstration

Human Vehicles and AI Vehicles: V2V is enabled for all AI vehicle agents that allow for further decision-making and rulesets. Our human vehicle is based on stochastic methods that are implemented to highlight human error

Environment: Used an OrthogonalMooreGrid model where we replicated a 7 lane highway. Agents spawn dynamically at the "bottom" and work their way "upwards"

Collected numerous pieces of data:

- Agent Counter - Created a new custom component
- Average Count of Middle Spawning Agents (for emergent phenomenon)
- Collisions Over Time (part of our interactions)

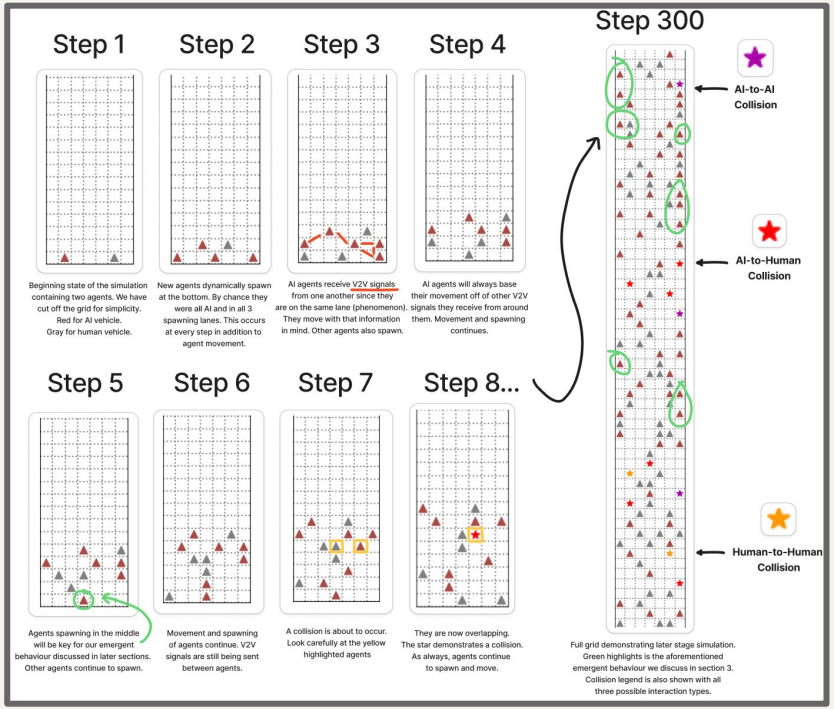


Image is just for slide deck, live demo soon!

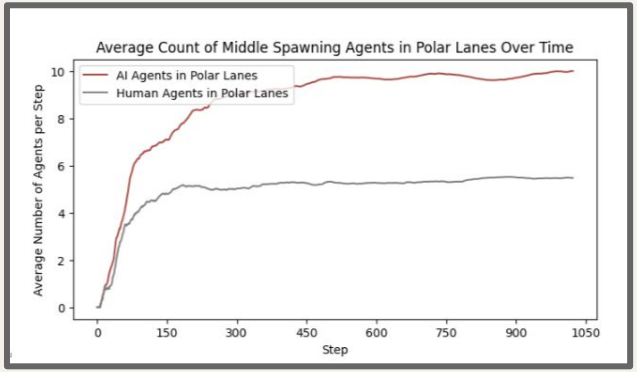
Findings and Insights

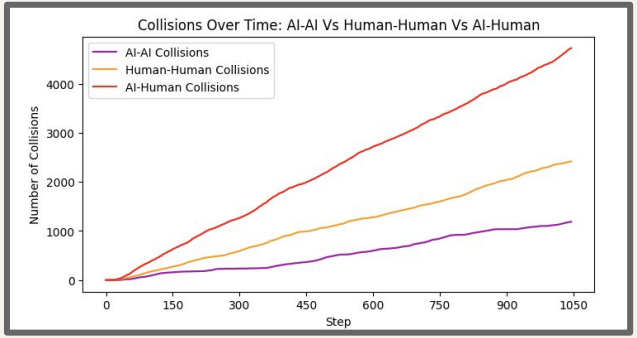
Collisions: Behaving as expected with AI-to-AI collisions. This was our base case to figure out that V2V was working correctly.

Emergent Protective Behaviour: Emergent phenomenon that had middle spawning AI elements moving to polar (left and rightmost) lanes of the highway.

Emergent Ping-Pong Effect: 3 AI agents in a row leads to the middle AI one tweaking between the two others one. It flips between changing lanes and staying straight causing unpredictable behaviour.

Implications and Real World Impact: Road systems are supposed to be safe, collisions being minimized showcases that goal and enables us to keep that in mind for other emergent behaviours. Protective behaviour showcases the potential for AI specific lanes in the future. It also highlights insights that V2V implementors should be mindful of in the future as polar lanes may not be the safest around the world. Ping pong effect showcases what happens at scaled V2V interactions. Developers should be mindful of mass signalling from AI vehicles and incorporate that into their decision-making.





Reflection

Ethical Considerations:

- Ethical frameworks used are critical theory, distributive justice, and techno-ethics with elements of deontological and utilitarian ethics
- Prioritized privacy & avoided real-world data use
- Risks of data misuse, profiling, & surveillance
- AI governance must ensure transparency & driver control
- Bias in AI decision-making, who gets prioritized in accidents?

Societal Implications:

- Micro level: AI improves safety but raises liability questions
- Macro level: Wealthy benefit from AI transport, others left behind
- Centralized AI networks risk surveillance & privacy violations
- Cybersecurity threats, hacked AI could cause accidents & disruptions

Conclusion:

- AI transport offers efficiency but risks bias & monopolization
- Strong AI governance, security, & ethical safeguards are crucial

Q&A

Please ask me questions!

Thank you!