

# **AI Today: Applications**

**Merging vision, language, planning, hardware**

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# Recurring themes

- Do not equate AI with Generative AI
- Surprisingly, AI should be avoided as far as possible
- AI is actually not one single thing – the only unifying theme is a lack of fixed logic
- Most effective applications use multiple methods, both AI and non-AI
- When in doubt, always return to the concept of a single neuron
- Avoid anthropomorphising

# Where are we today?

## THE FOUR INDUSTRIAL REVOLUTIONS



### INDUSTRY 1.0

#### Mechanization

Mechanization and the introduction of steam and water power



### INDUSTRY 2.0

#### Electrification

Mass production assembly lines using electrical power



### INDUSTRY 3.0

#### Automatization

Automated production, computers, IT-systems and robotics



### INDUSTRY 4.0

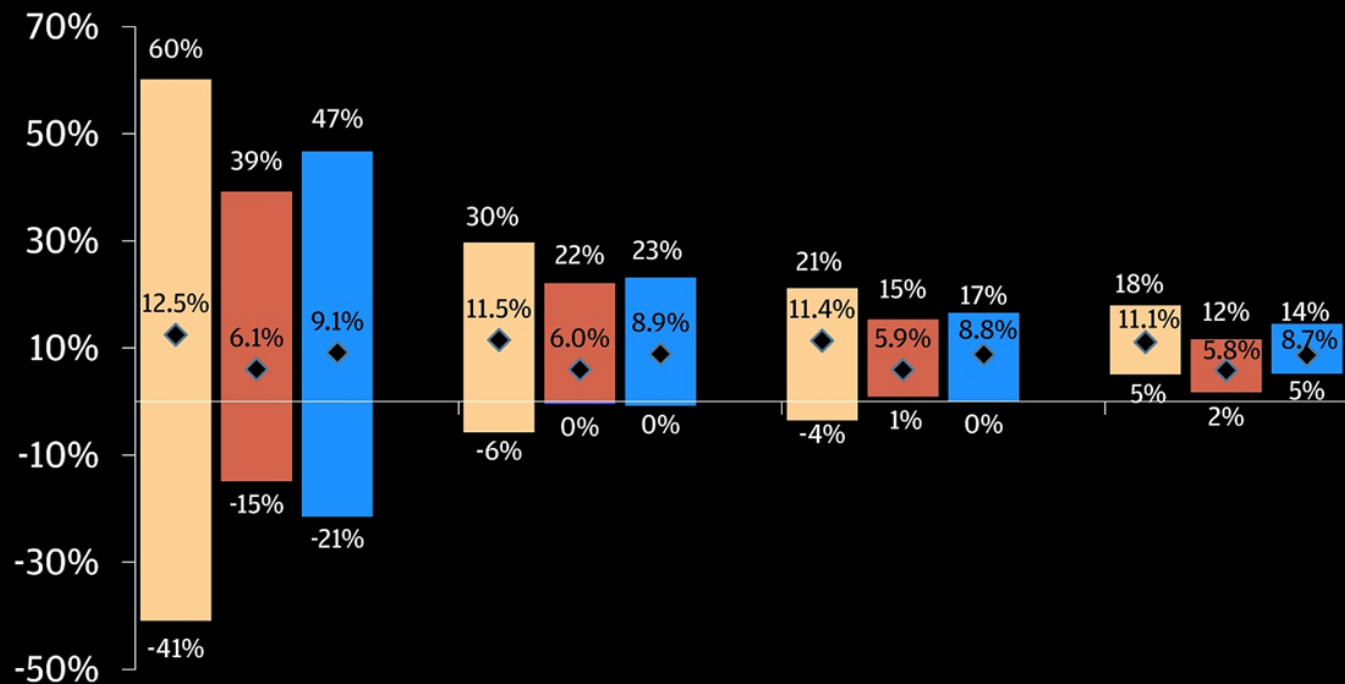
#### Cyber-Physical Systems

The Smart Factory. Autonomous systems, IoT, machine learning

# Some practical AI applications

## Range of stock, bond, and blended allocation total returns

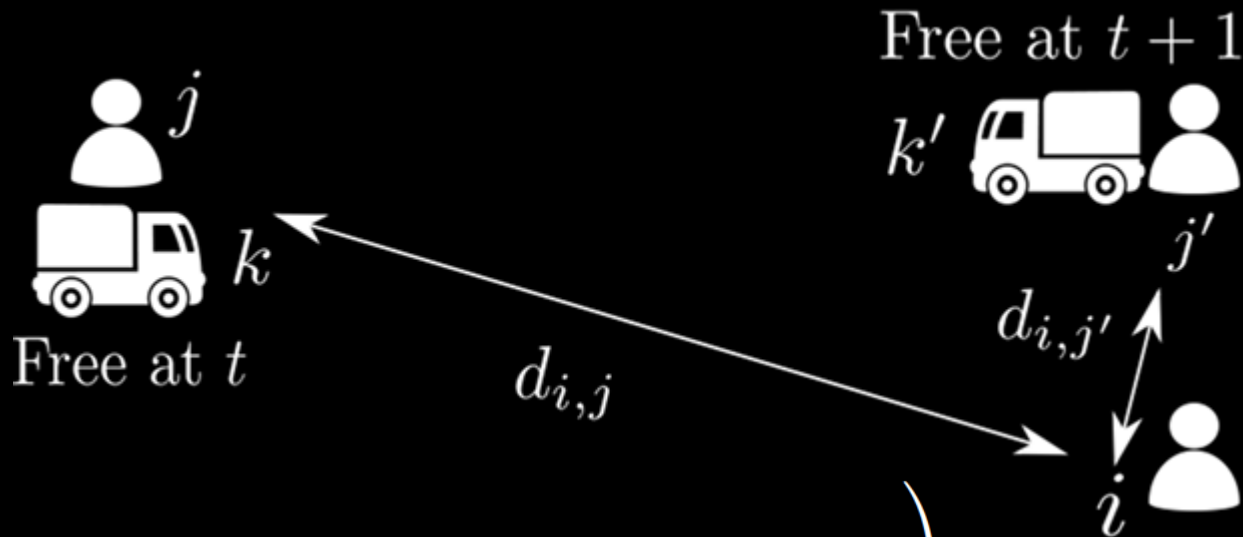
Rolling annualized total returns, 1950 - 2022



Sources: Barclays, FactSet, Federal Reserve, Robert Shiller, Strategas/Ibbotson, J.P. Morgan Asset Management. Returns shown are rolling monthly returns from 1950 to 2022. Stocks represent the S&P 500 Shiller Composite, and Bonds represent Strategas/Ibbotson government bonds and corporate bonds for periods from 1950 to 2017, then the average of Bloomberg U.S. Aggregate Total Return Index and Bloomberg U.S. Treasury Total Return index from 2017 to 2022. 50/50 portfolio is rebalanced monthly and assumes no cost. Analysis is based on the J.P. Morgan Guide to the Markets - Principles for Successful Long-term Investing. \*Actual worst 5-year rolling return of hypothetical 50/50 portfolio: -0.068%. Data as of December 31, 2022.

# Some practical AI applications

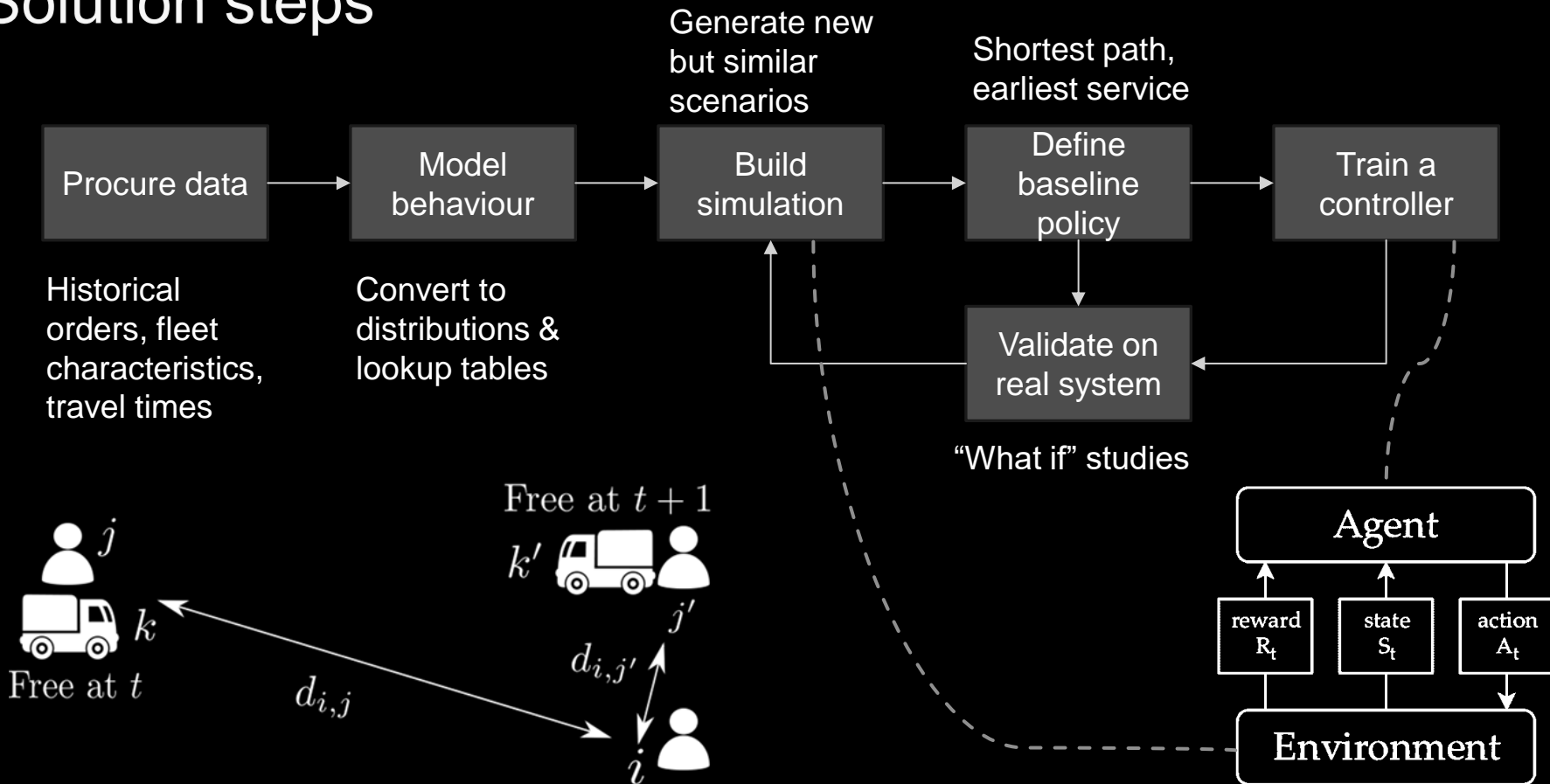
This is about AI-driven solution to the integrated sourcing + routing problem in e-commerce.



$$J = \min_{a_*, f_*, l_*} \left( \sum_{i,j,k} d_{i,j} a_{i,j,k} + \sum_{i,k} d_{o,i} f_{i,k} + \sum_{i,k} d_{o,i} l_{i,k} \right)$$

“A Learning Approach for Discovering Cost-Efficient Integrated Sourcing and Routing Strategies in E-Commerce”  
Omkar Shelke, Pranavi Pathakota, Anandsingh Chauhan, Hardik Meisheri, Harshad Khadilkar, Balaraman Ravindran

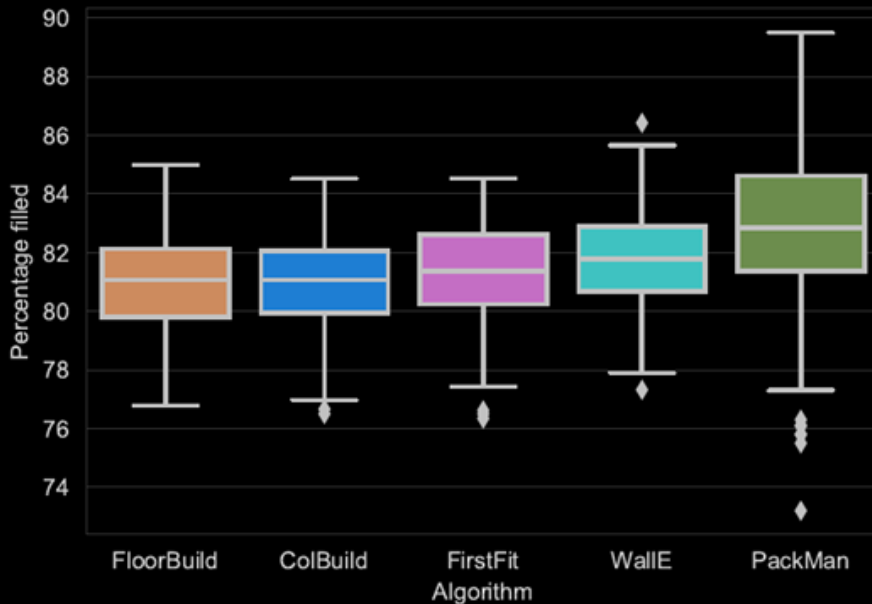
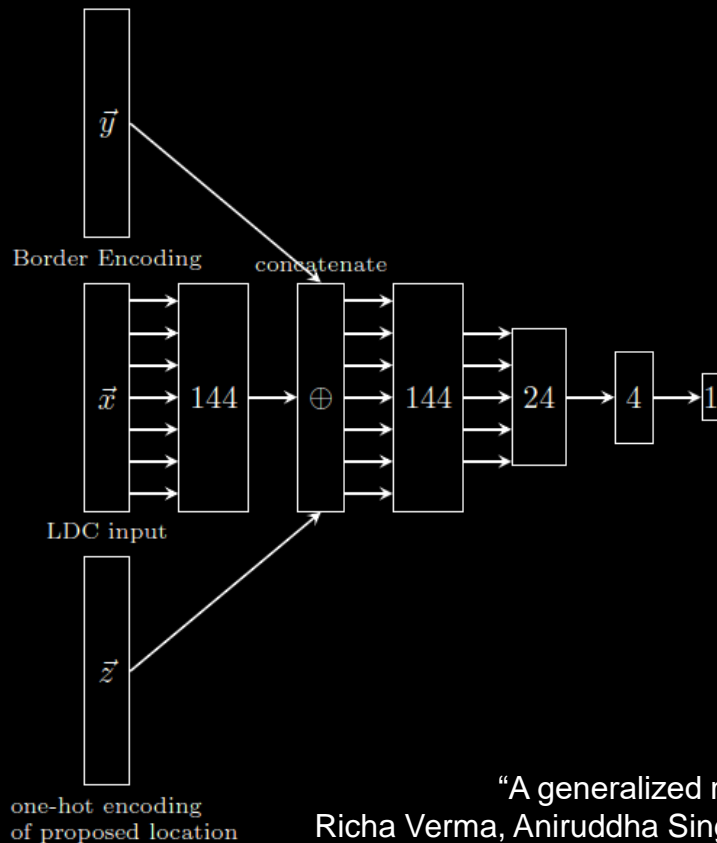
# Solution steps



# Single-agent AI for robotics: Sense-Analyse-Respond



# Single-agent AI for robotics: Sense-Analyse-Respond



“A generalized reinforcement learning algorithm for online 3d bin-packing”

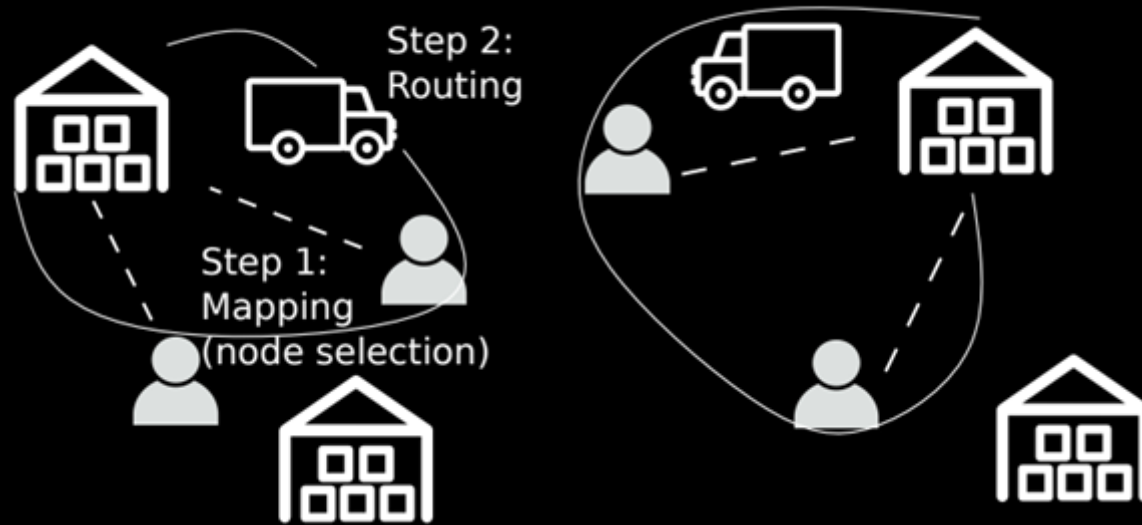
Richa Verma, Aniruddha Singhal, Harshad Khadilkar, Ansuma Basumatary, Siddharth Nayak, Harsh Vardhan Singh, Swagat Kumar, Rajesh Sinha



# Multi-agent AI needs *negotiation*



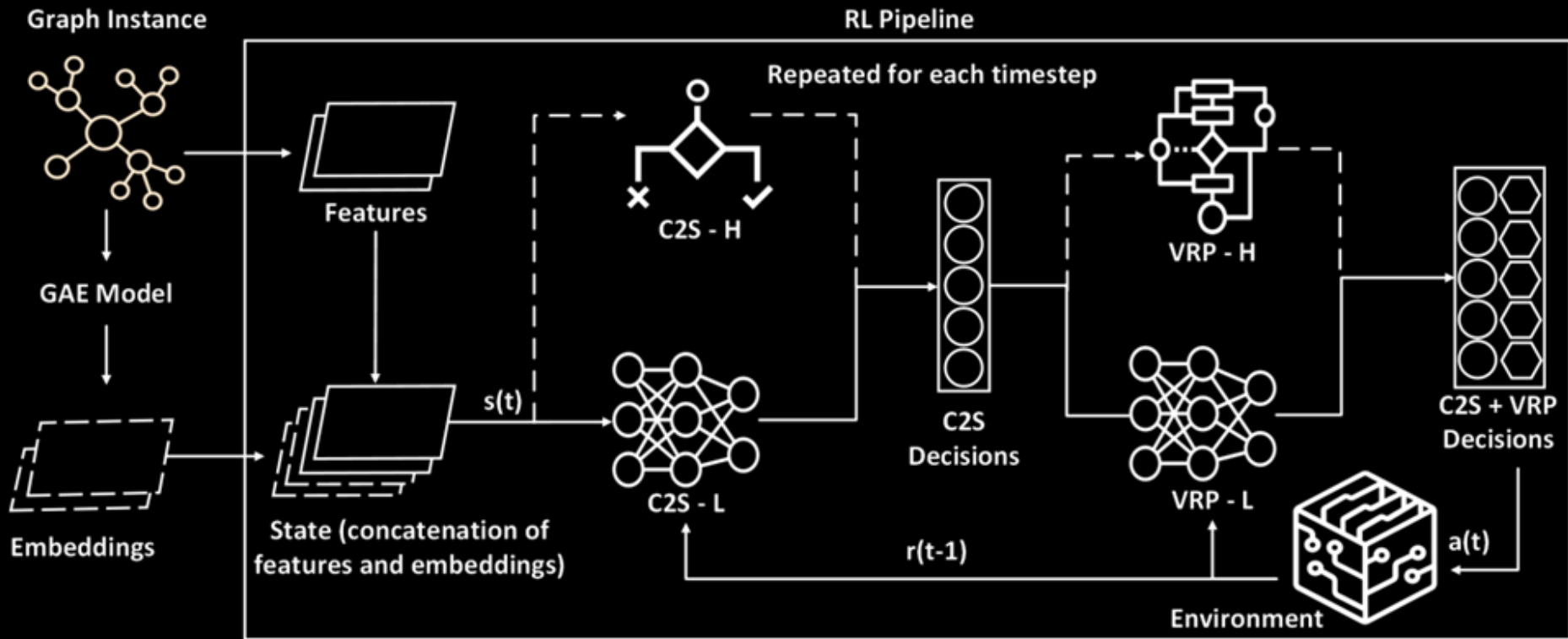
# Multi-agent AI needs *negotiation*



“Multi-agent learning of efficient fulfilment and routing strategies in e-commerce”

Omkar Shelke, Pranavi Pathakota, Anandsingh Chauhan, Harshad Khadilkar, Hardik Meisheri, Balaraman Ravindran

# Multi-agent AI needs *negotiation*



# Other considerations

## Delays: Communication channels, Processing, Action

“Revisiting state augmentation methods for reinforcement learning with stochastic delays”

S Nath, M Baranwal, H Khadilkar

## Errors: Measurement noise, Modelling simplifications

“Follow your Nose: Using General Value Functions for Directed Exploration in Reinforcement Learning”

D Kalwar, O Shelke, S Nath, H Meisheri, H Khadilkar

## Adversaries: Unintentional, Intentional

“Sample Efficient Training in Multi-Agent Adversarial Games with Limited Teammate Communication”

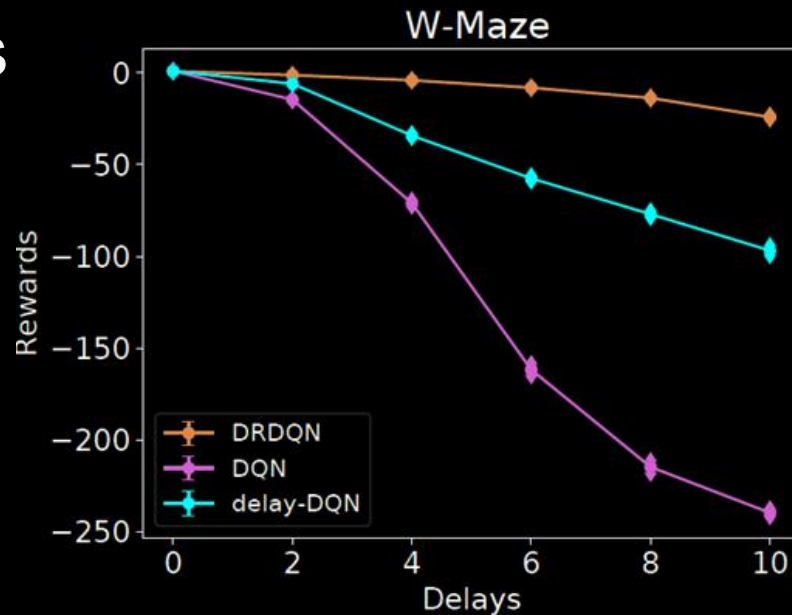
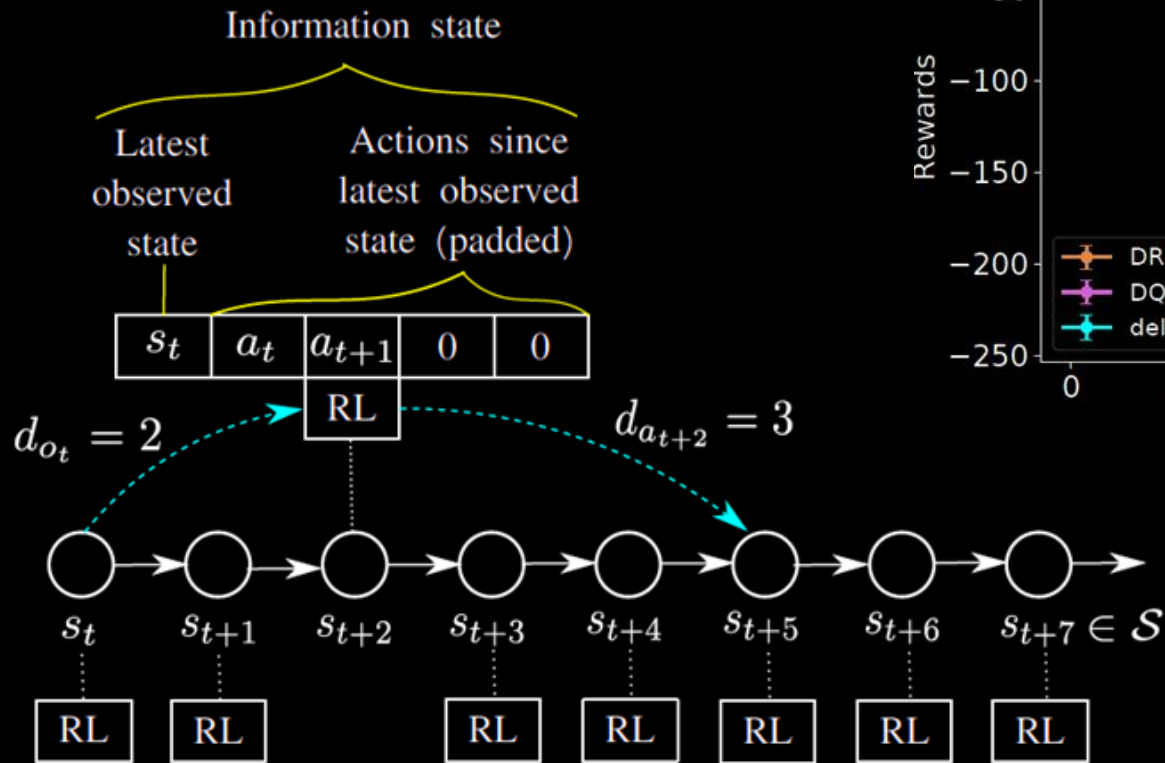
H Meisheri, H Khadilkar

## Ethics: Fairness, Bias, Liability

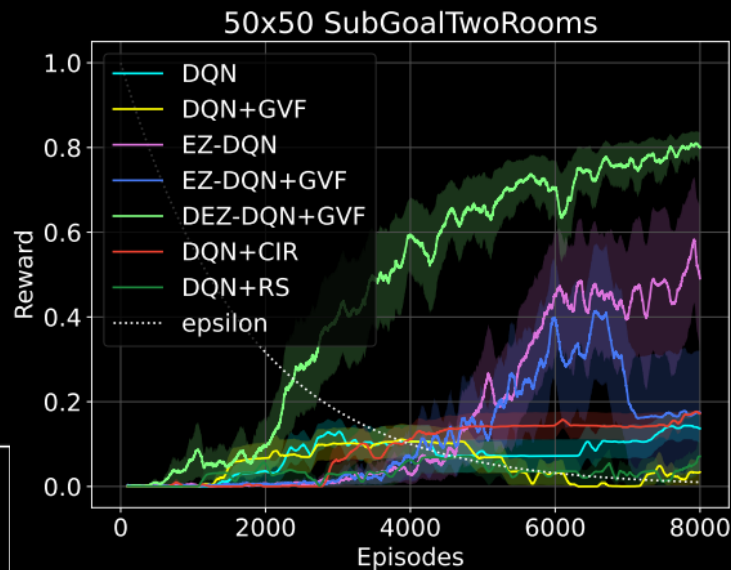
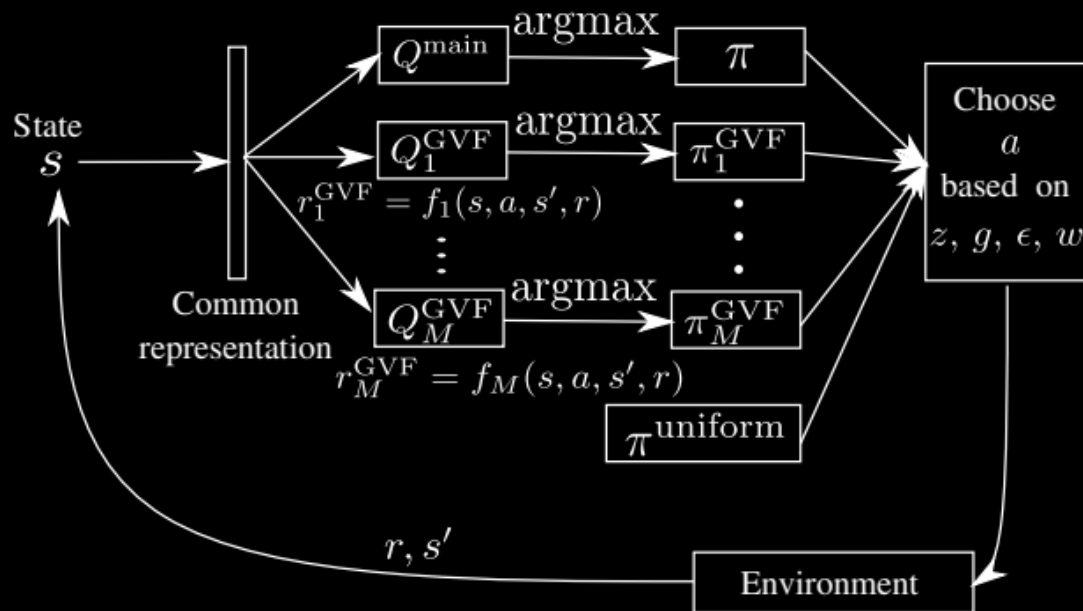
“A novel data augmentation technique for out-of-distribution sample detection using compounded corruptions”

R Hebbalaguppe, SS Ghosal, J Prakash, H Khadilkar, C Arora

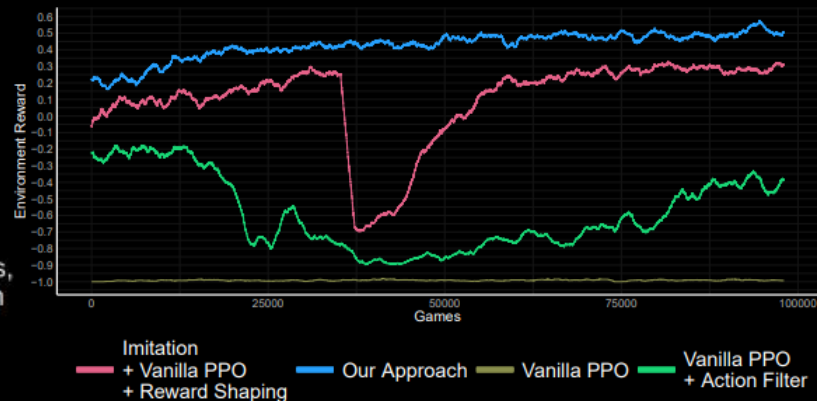
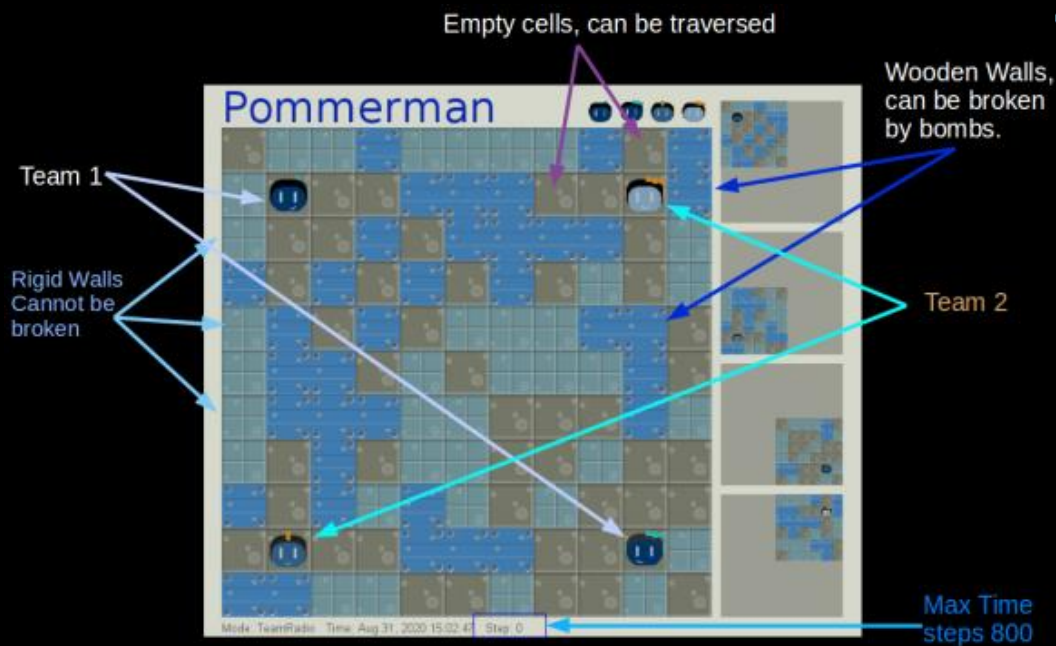
# Other considerations: Delays



# Other considerations: Errors

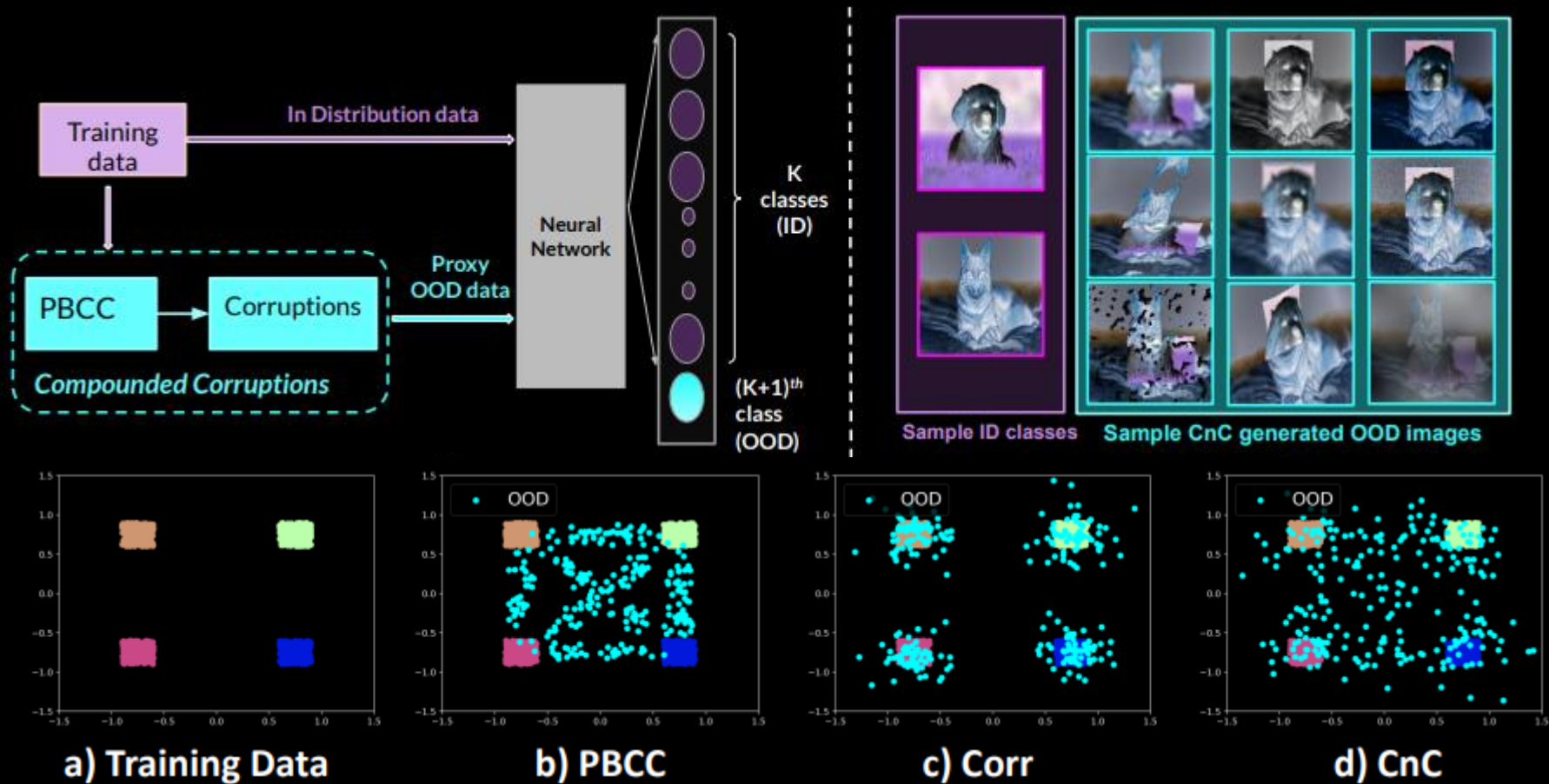


# Other considerations: Adversaries





# Other considerations: Ethics





# Return to recurring themes

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