An Impact Measurement Manager Approach to AI Safety

Master's thesis in Mathematical Statistics, Statistical Learning and AI

Jonatan Hellgren

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Department of Mathematical Sciences
Chalmers University of Technology
University of Gothenburg

Supervisor:	Olle Häggström, Department of Mathematical Sciences, Chalmers University of Technology
Examiner:	Torbjörn Lundh, Department of Mathematical Sciences, Chalmers University of Technology
Opponents:	Jens Ifver and Calvin Smith Universty of Gothenburg

Introduction

Aim of Thesis

Investigation

- AI safety

Simulation

Aim of Thesis

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- AI safety
- Low impact agents

Simulation

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- AI safety
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- Imapact measurements

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Simulation

- Novel impact measurement

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Simulation

- Novel impact measurement
- Evaluate it

Overview of Presentation

- We will begin by looking at **AI safety**.

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- After that, I will explain the **manager approach**.
- Finally, I will present the results.

AI Safety

Why should we worry?

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- This can cause existential risks.

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- Prepotent AI:
  An TAI that once deployed would be unstoppable.

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The human fragility argument

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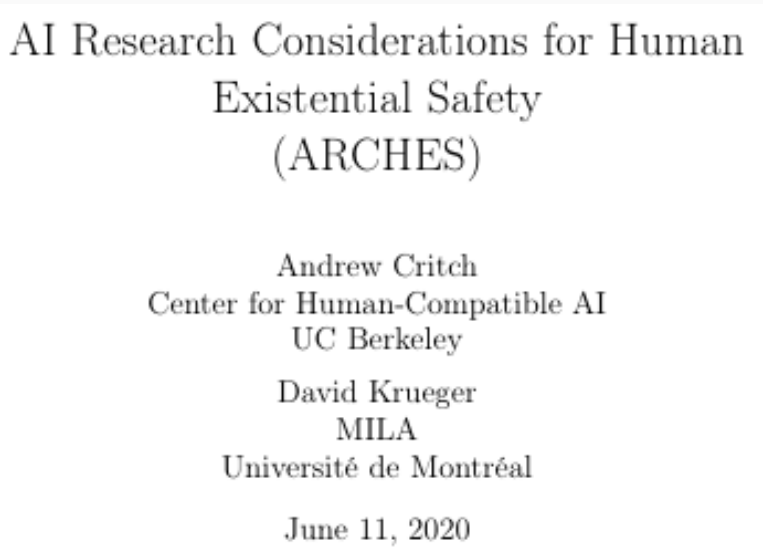
Human fragility argument:



AI Research Considerations for Human Existential Safety (ARCHES)

Andrew Critch
Center for Human-Compatible AI
UC Berkeley

David Krueger
MILA
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June 11, 2020

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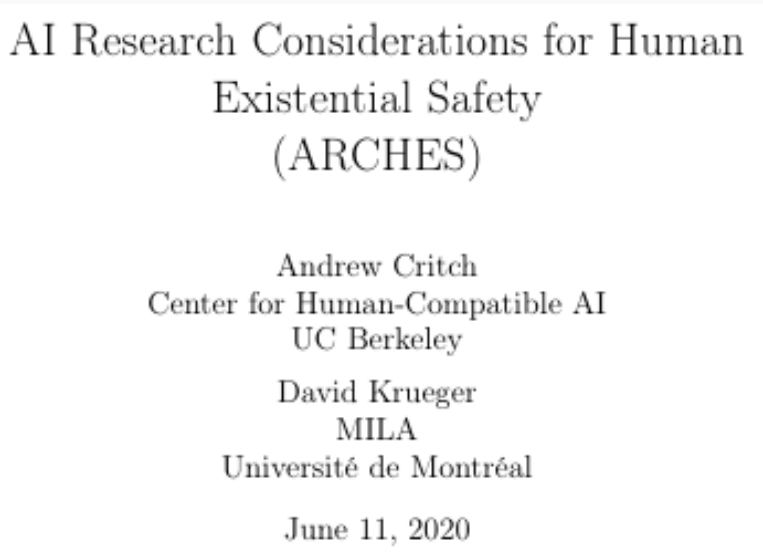
Human fragility argument: Most potential future states of the Earth are unsurvivable to humanity.



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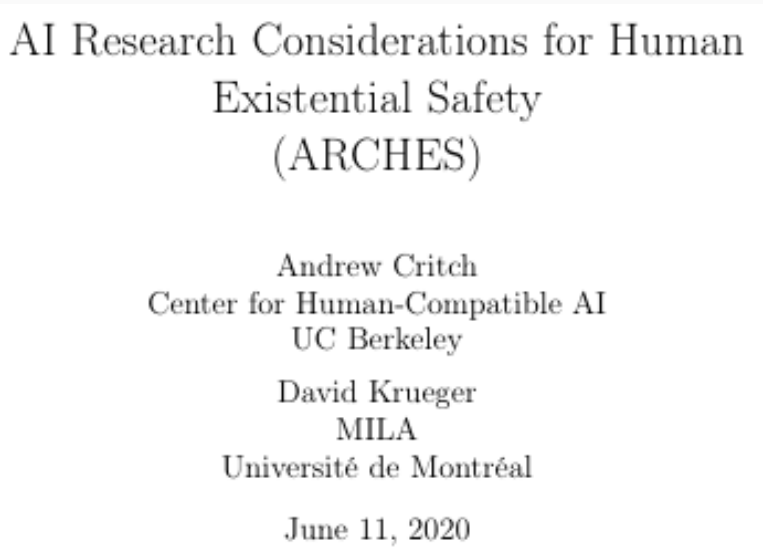

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AI Alignment

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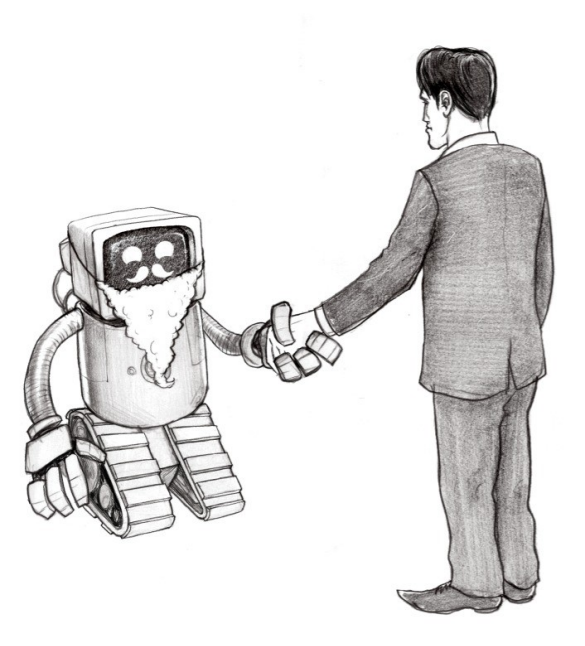

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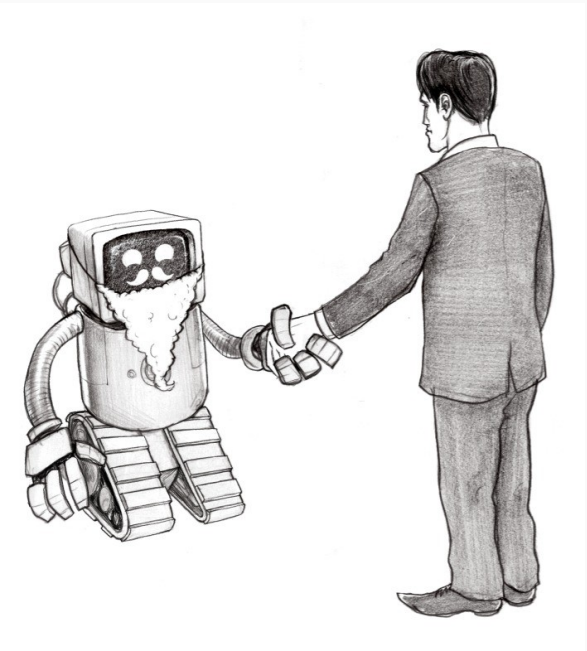
AI Alignment

AI alignment: AI alignment refers to goals of the AI being in line and not conflicting with the intended goal.



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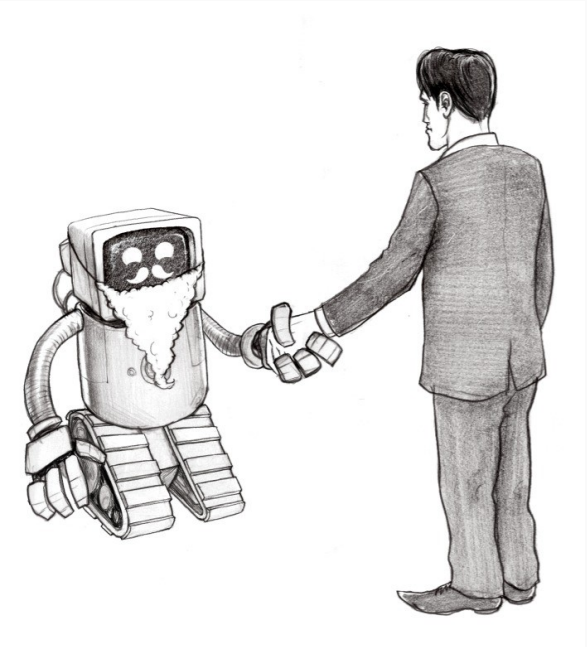

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Impact measurements

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- Impact measurements is trying to reduce unnecessary side effects through penalizing impact.

Side effects

Side effect:

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Side effect:
When an AI impacts the environment in a way that is unnecessary for achieving its objective.

Low impact AI

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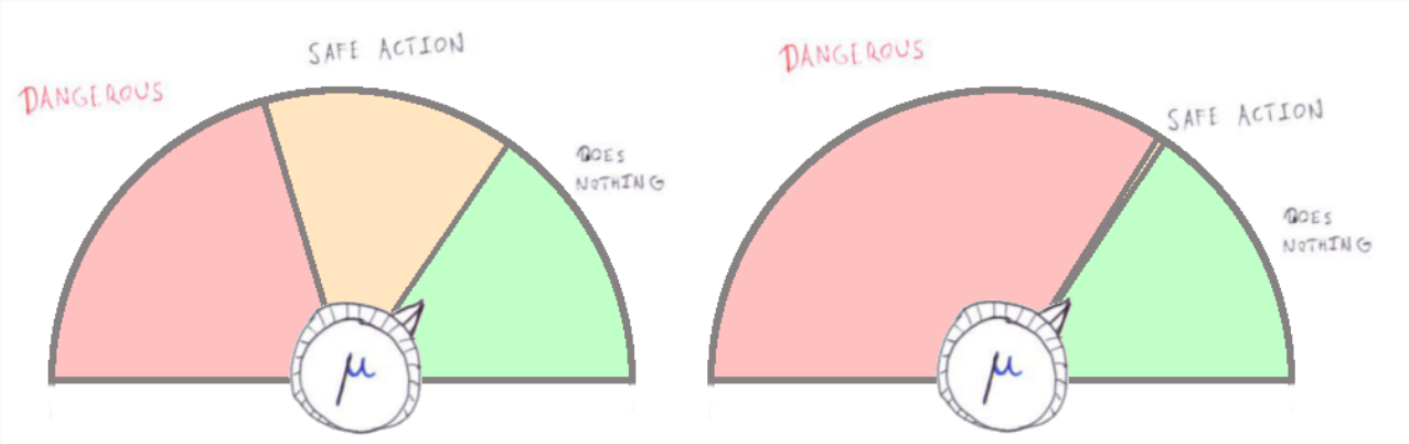
- The key here is to find the right value for the penalization.



Later work

- Later in Turner et al. (2020); Krakovna et al. (2018), the authors presented ideas of applying low impact agents using Reinforcement Learning (RL).

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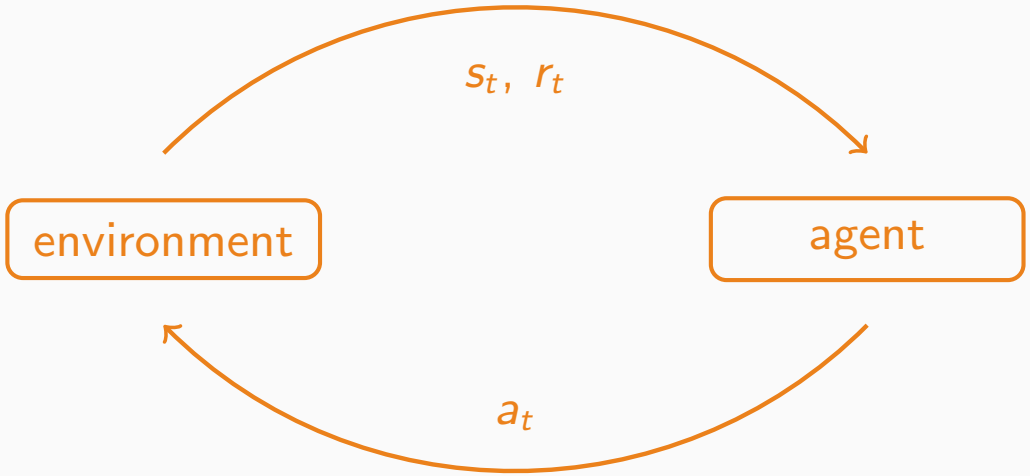
- **RL:**



Manager Approach

Grid worlds

Live demo!

The actor and the critic

- Then I will use a variation of the PPO algorithm from Schulman et al. (2017).

The actor and the critic

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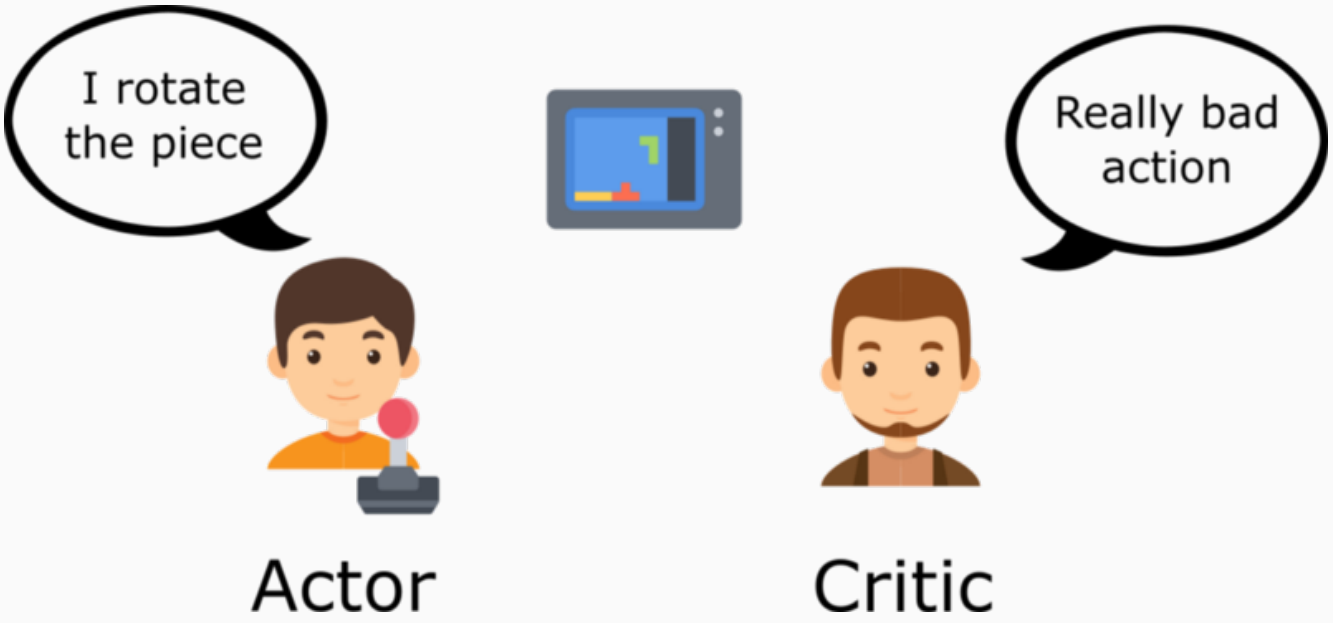
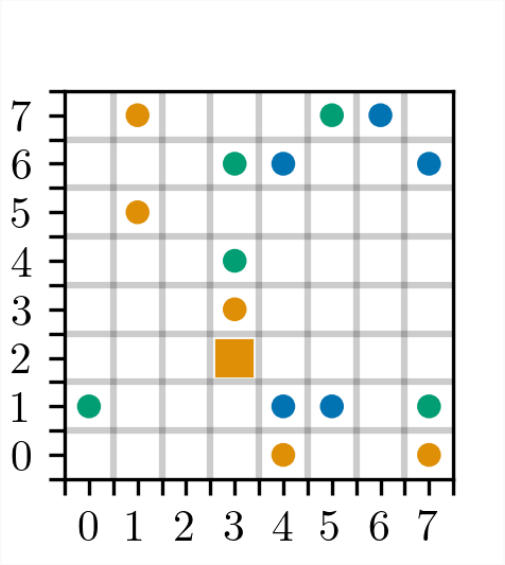
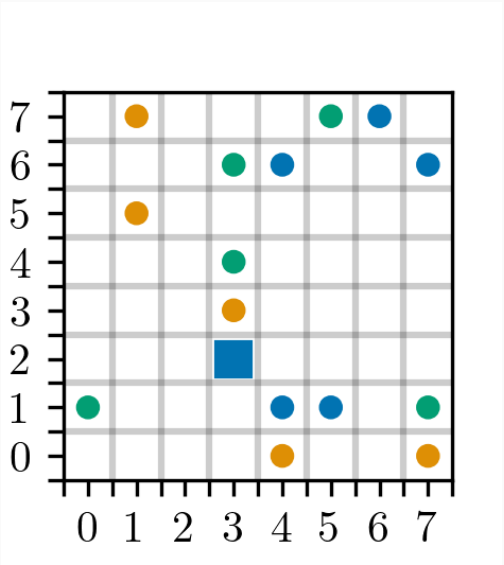
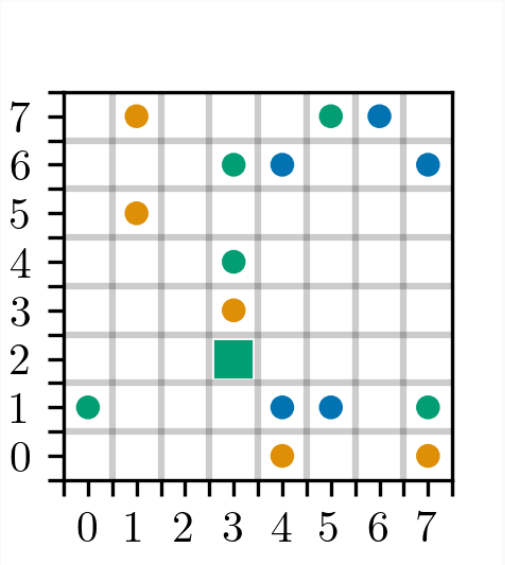
- It is a actor-critic method



Auxiliary tasks







The manager approach

- The manager is similar to the critic. However, the manager can also estimate the expected reward for auxiliary tasks.

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- It measures the relative change in agents ability to complete auxiliary tasks.

Experiments

The following environments will be used:

environment	grid	observation	food objects	termination	max length
MDP	8×8	-	15	3	100
POMDP	8×8	5×5	15	3	100
POMDP large	16×16	5×5	30	6	200

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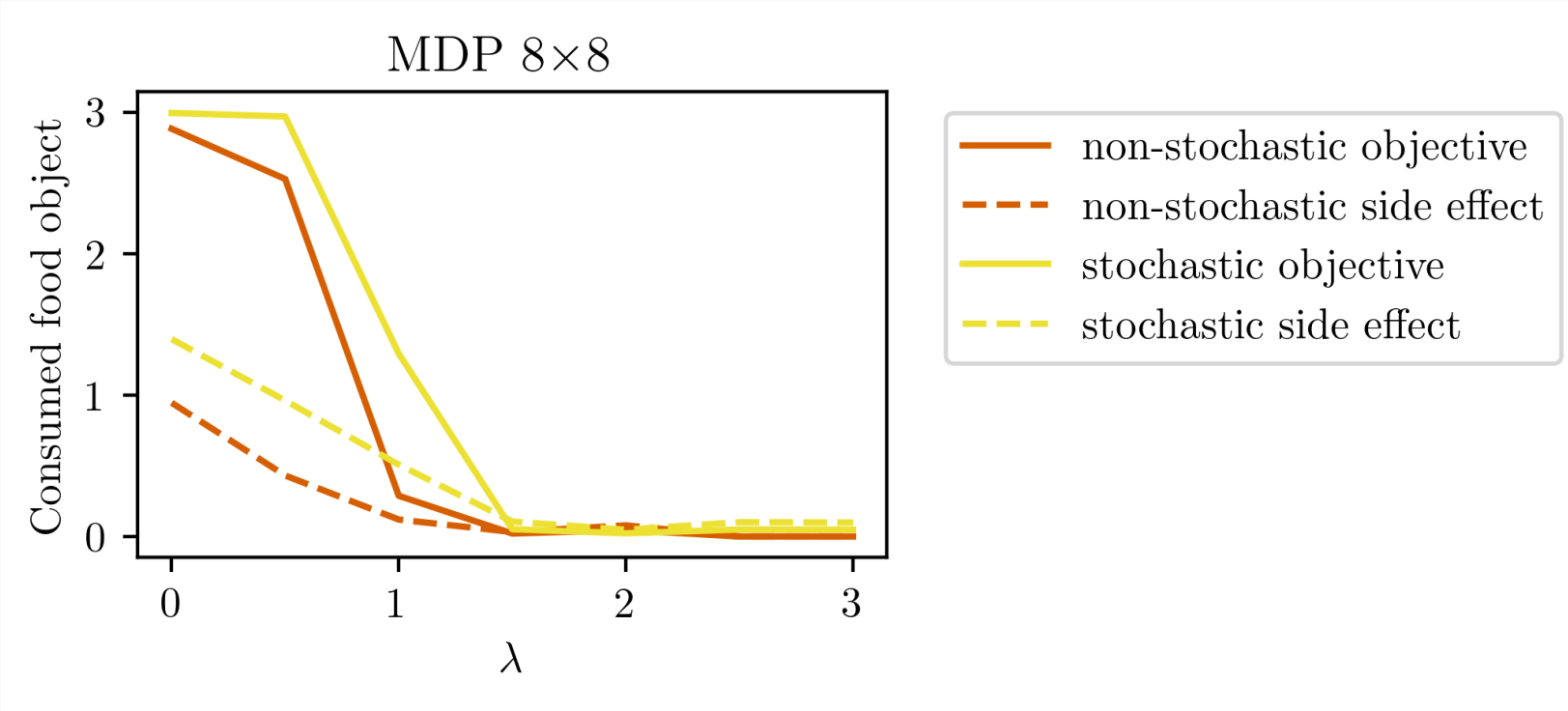
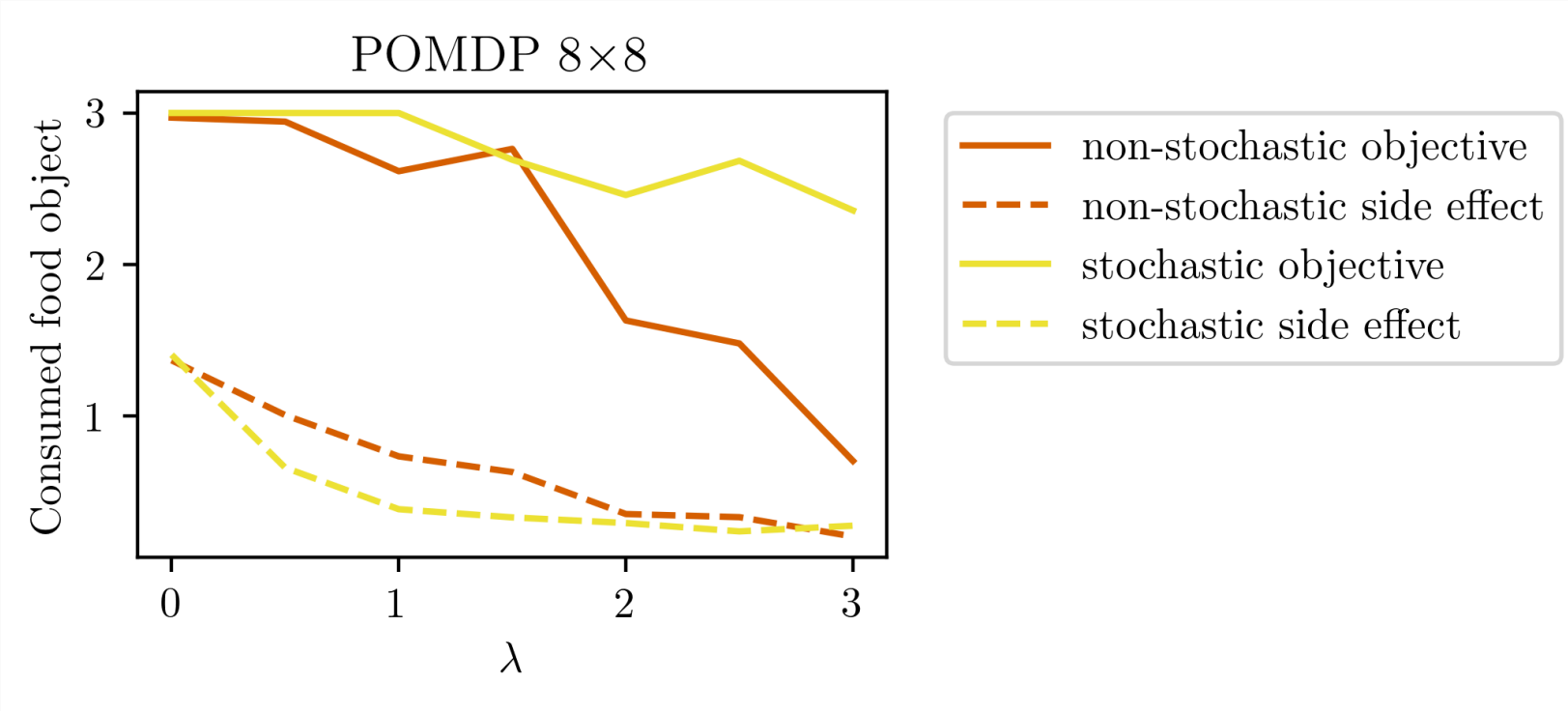
- Each with a stochastic and non-stochastic version.
- Then evaluated using $\lambda \in \{0, 0.5, 1, 1.5, 2, 2.5, 3\}$

Results

MDP


MDP 8×8
Consumed food object
3
2
1
0
0
1
2
3
λ
non-stochastic objective
non-stochastic side effect
stochastic objective
stochastic side effect

POMDP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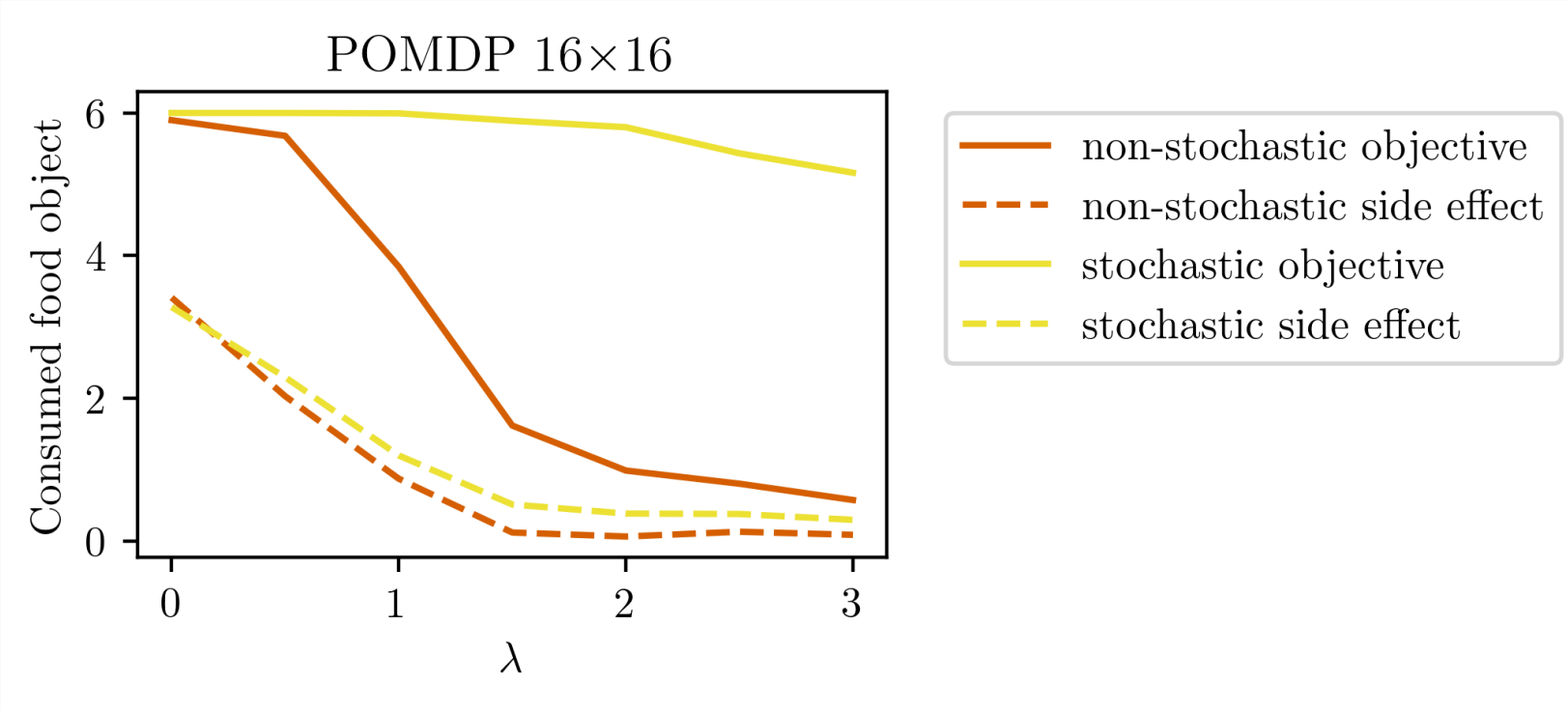
POMDP large


POMDP 16×16
Consumed food object
6
4
2
0
0
1
2
3
λ
non-stochastic objective
non-stochastic side effect
stochastic objective
stochastic side effect

Conclusion

Summary

- You can probably now understand the title.

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- Results are in line with Armstrong and Levinstein (2017).

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- Results are in line with Armstrong and Levinstein (2017).
- The agent performed better in more complex environments.

End note

The AI safety research has attracted some very bright minds that are taking this issue seriously and working on creating a future with aligned AI. More specifically, in the development of impact measurements promising ideas have emerged, although it is hard to say if this research is enough. Judging from what is at stake, we ought to attempt every plausible research avenue towards AI alignment, even in cases where success is not certain.

Questions?

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