Adapting to Unknown Conventions in Cooperative MARL

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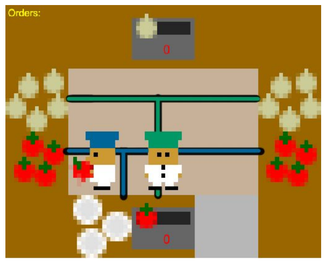
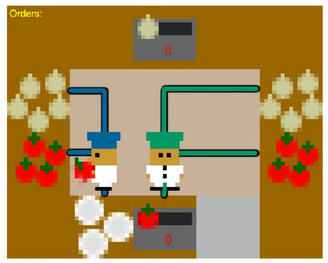
Motivation

MARL agents often converge to arbitrary conventions.



Split by ingredient

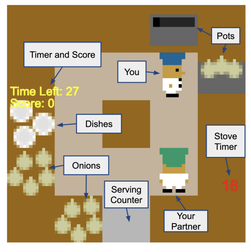


Split by side

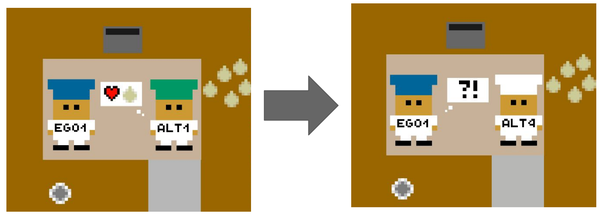
Can we adapt to new partners in real time?

Task Definition

Overcooked Game: Coordination Ring



Partner's convention defines the *Task*



Only the single-agent *transition* changes

Idea: Pre-train on a diverse set of partners to learn how to collaborate with others

Generating Conventions

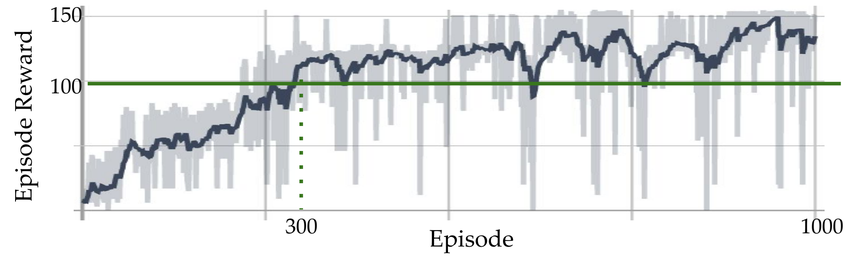
CoMeDi: generates diverse set of conventions

$$\mathcal{L}(\pi^n) = \mathcal{J}(\pi^n, \pi^n) - \beta\mathcal{J}(\pi^n, \pi^*) + \gamma\mathcal{J}_{MP}(\pi^n, \pi^*)$$

High Scoring (SP) — Semantically Different (XP) — Good Faith Actor (MP)

Generated 8 conventions where SP > 120 and XP < 20
(Meta-)Train on first 7 and (Meta-)Test on the last one

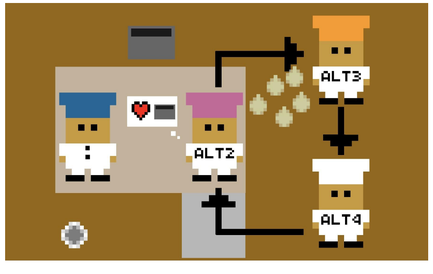
Training from Scratch



Need to play *300 games* for human-like performance (score=100)
- More than 3 hours of user data!

Common Best Response

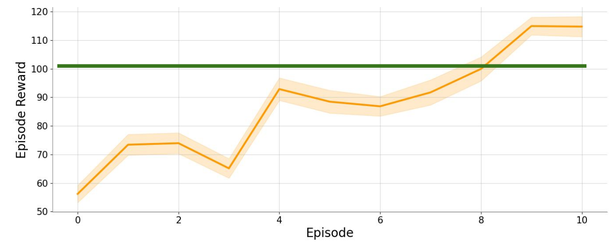
Train a single best response agent to training set.



Common technique for MARL Zero-shot coordination
- Score with test partner is 56

Few-shot Fine Tuning

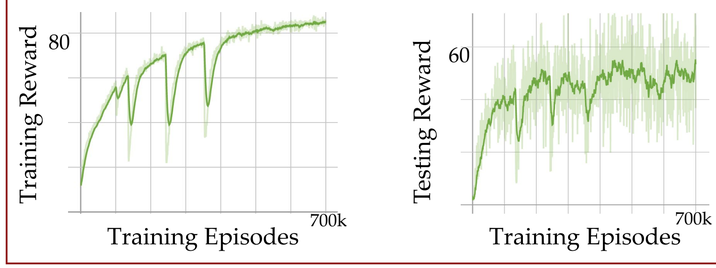
What if we *fine tune* the common best response model?



Human-like score in 10 episodes (7 mins of user data)

MAML

MAML with one episode as support data



Discussion

Using a diverse set of partners, few-shot fine tuning can adapt to *new partners*!

Efficient human-AI adaptation without datasets of human gameplay

Acknowledgements

Special thanks to Andy Shih and Dorsa Sadigh for collaborating on the CoMeDi algorithm.

References

[1] D Strouse, K McKee, M Botvinick, E Hughes, R Everett, Collaborating with humans without human data. *Adv. Neural Inf. Process. Syst.* **34**, 14502–14515 (2021).
[2] B Sarkar, A Talati, A Shih, S Dorsa, Pantheonrl: A marl library for dynamic training interactions in *Proceedings of the 36th AAAI Conference on Artificial Intelligence (Demo Track)*. (2022).
[3] C Yu, et al., The surprising effectiveness of ppo in cooperative, multi-agent games. *arXiv preprint arXiv:2103.01955* (2021).
[4]The garage contributors. Garage: A toolkit for reproducible reinforcement learning research. https://github.com/rlworkgroup/garage, 2019.