

Definition of the subject



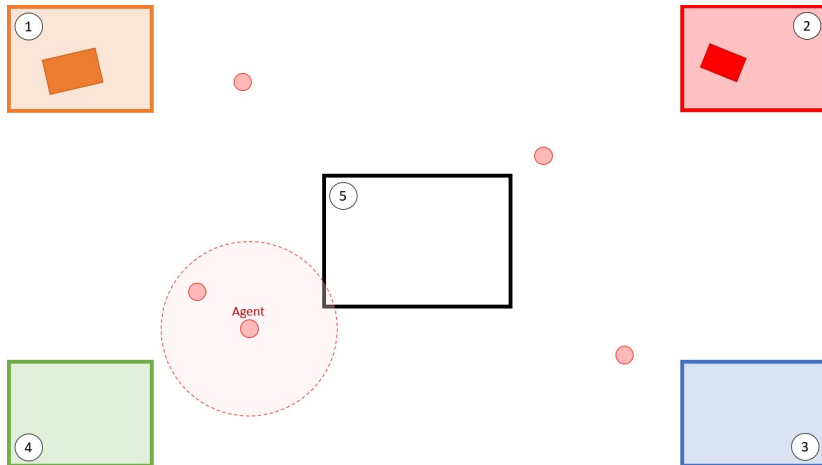
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What characterises future robotic tasks ?

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- Robots will have to comply to pre-defined rules
- Robots will need to interact with heterogeneous agents (e.g. other robots, humans, etc.)
- Robots will have to communicate with each other and with humans
- ↳ using pre-existing languages (e.g. natural language)



Problem

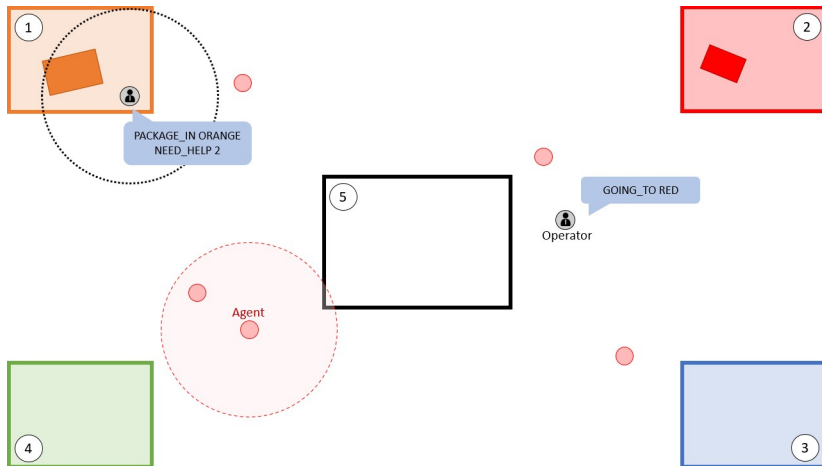
- Communication is not used enough in MADRL research
- How to do credit assignment in this mixed competitive-cooperative environment with sparse rewards ?

Contribution

- Study of emergent communication approaches¹ applied to MADRL sota algorithms²
- Find innovative credit assignment strategies

¹Foerster et al., 2016; Sukhbaatar et al., 2016; Jiang and Lu, 2018; Das et al., 2019

²(Lowe et al., 2017; Rashid et al., 2018; Foerster et al., 2018; Schroeder de Witt et al., 2020)



Problem

- Emergent communication is hard to quantify and interpret³

Contribution

- Learn to understand and use a pre-existing and interpretable language in a robotic task

³Kottur et al., 2017; Lowe et al., 2019; Lazaridou and Baroni, 2020

Contribution 2

Learn a pre-existing language

| Type | Token |
|-----------|---|
| Entities | AGENT OPERATOR PACKAGE |
| Locations | RED_AREA ORANGE_AREA GREEN_AREA BLUE_AREA DELIVERY_AREA |
| Verbs | GOING_TO NEED_HELP PUSH_PACKAGE |

Possible tokens used in our language.

Problem

- We need ways to use DRL approaches in real-world environments

Contribution

- Use macro-actions⁴ to learn policies in simulation that are transferable to the real world

⁴Sutton et al., 1999; Amato et al., 2019; Xiao and Baroni, 2020

Contribution 3

Macro-actions

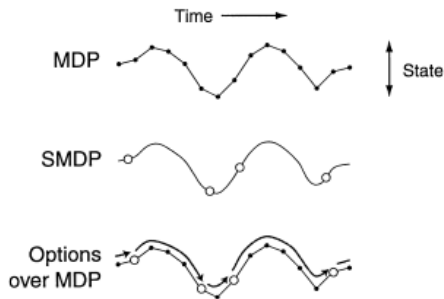


Figure: Options framework and Semi-MDP in Sutton et al. (1999)

| Paper | Macro-actions |
|-------------------|--|
| Amato et al. 2019 | Go to depot 1 Go to depot 2 Go to depot drop-off area Pick up small box Pick up large box Drop off box Go to waiting room Turn on blue light Turn on red light Turn off light |
| Xiao et al. 2020 | Go-to-Workshop Go-to-Tool-room Get-Tool |

Thank you!