

4.2. MAS and Learning

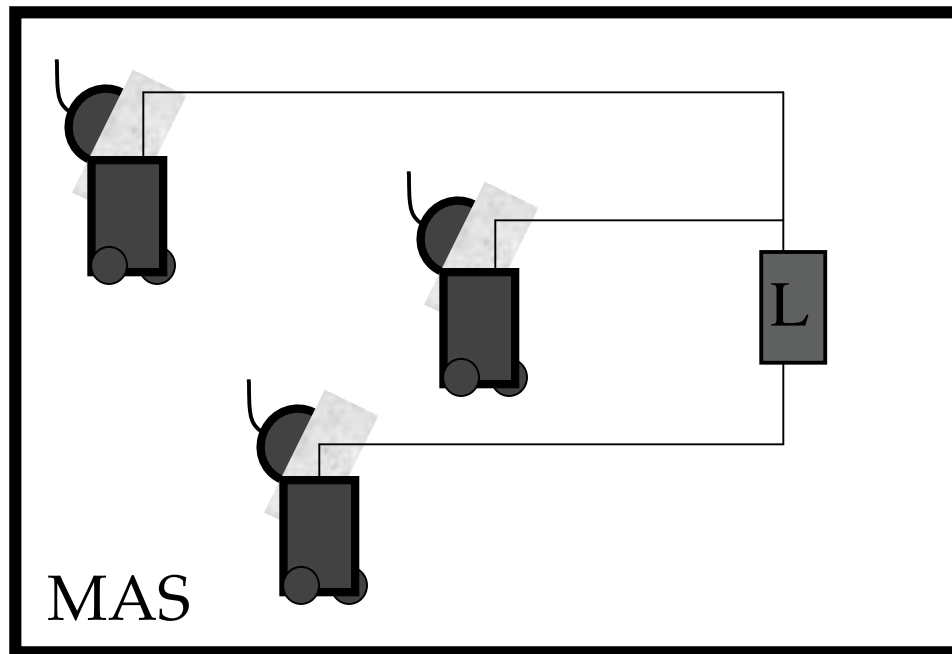
Having several agents, that naturally can represent different opinions of how to build an agent and different learn concepts, leads to an abundance of realizations of distributed learning systems.

Starting with the decision of doing on- or offline learning, over deciding about the use of teachers up to the decision what agent uses what learning method (even paradigm), the additional dimension of having several agents shows very prominently.

We will look in the following just at the variety that develops with regard to on- and offline learning.

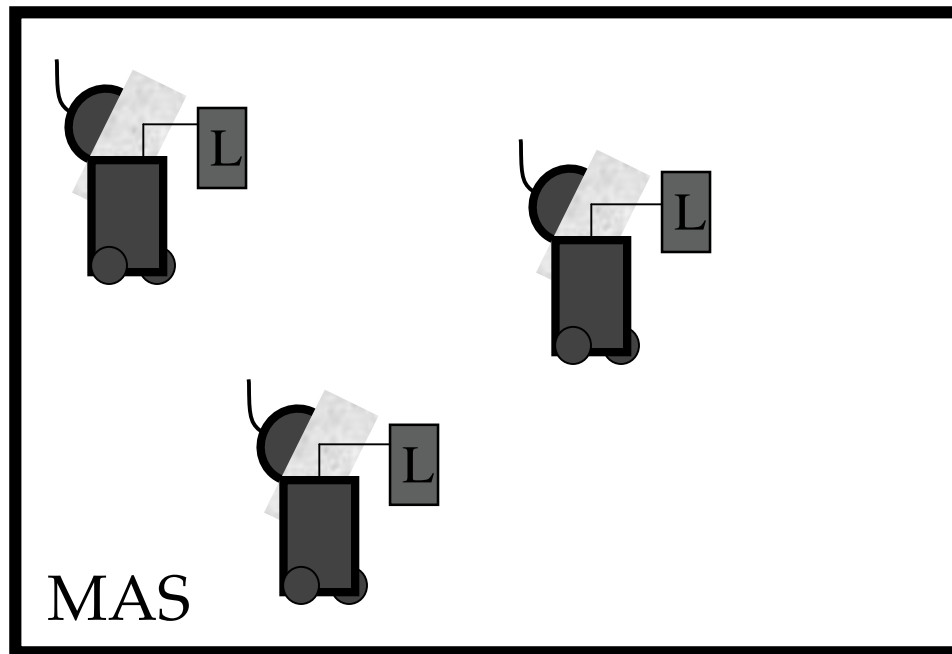
MAS and on- and offline learning (I)

System = n offline learning agents with 1 common learner



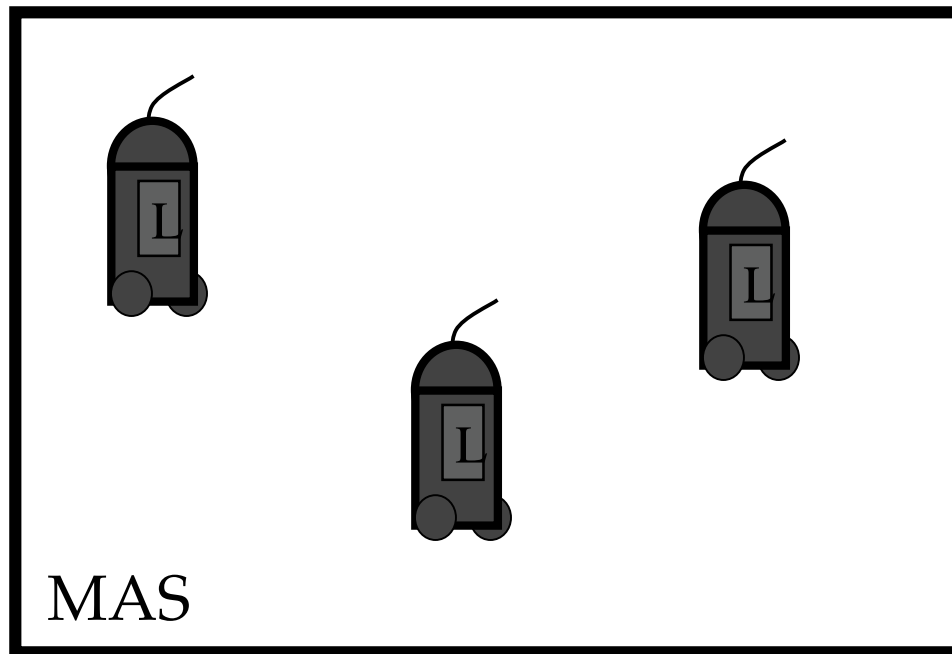
MAS and on- and offline learning (II)

System = n offline learning agents



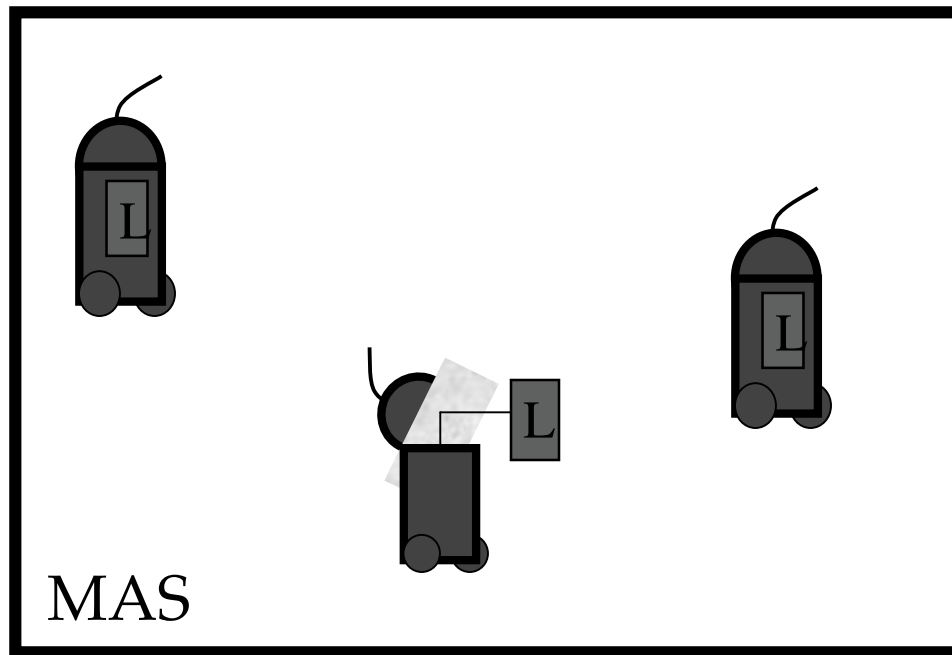
MAS and on- and offline learning (III)

System = n online learning agents



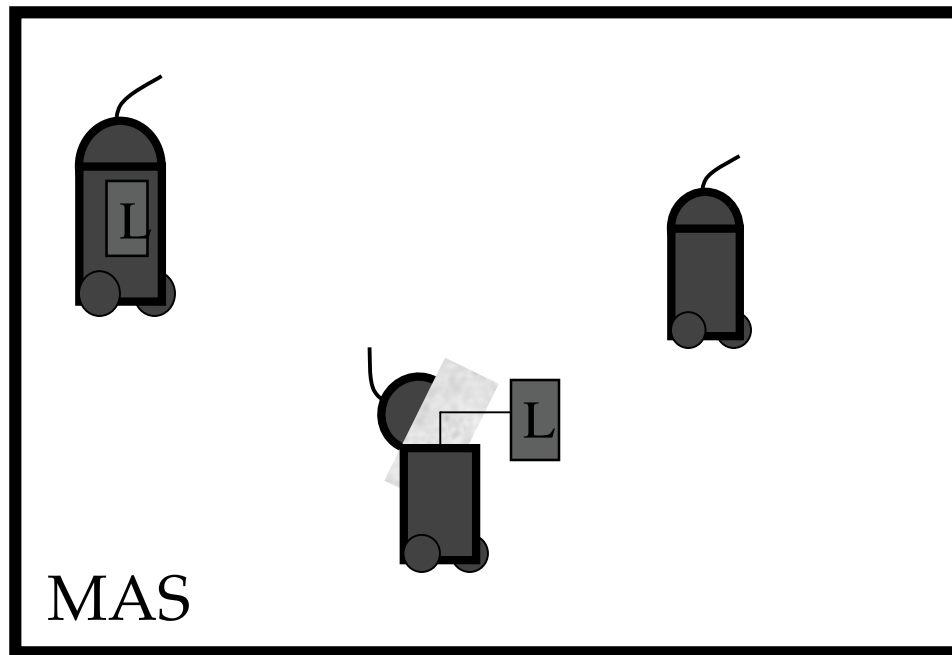
MAS and on- and offline learning (IV)

System = n learning agents (a mixture of on- and offline learning ones)



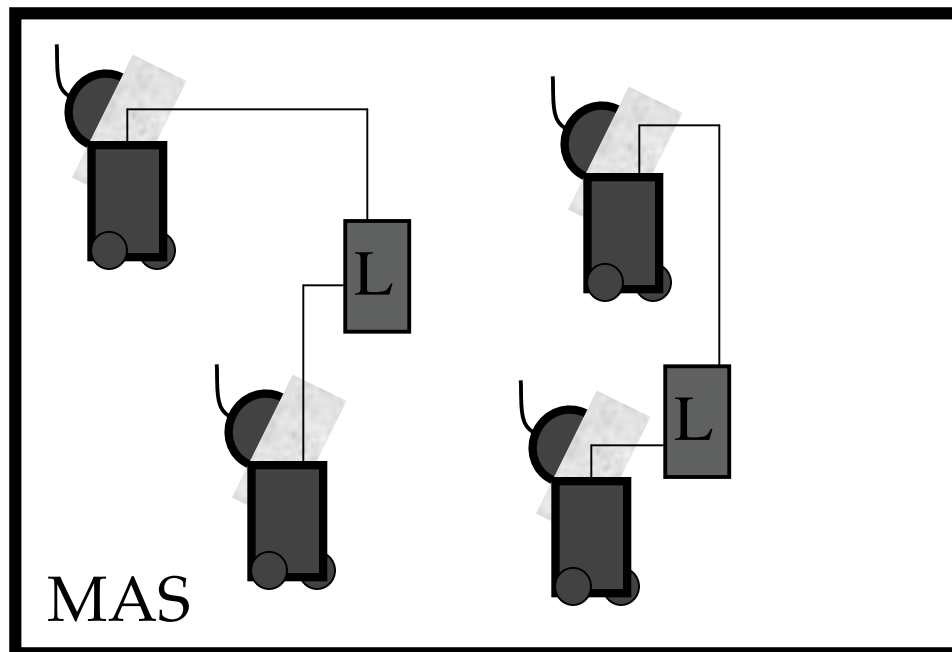
MAS and on- and offline learning (V)

System = k learning agents (a mixture of on- and offline learning ones) + 1 non-learning agents



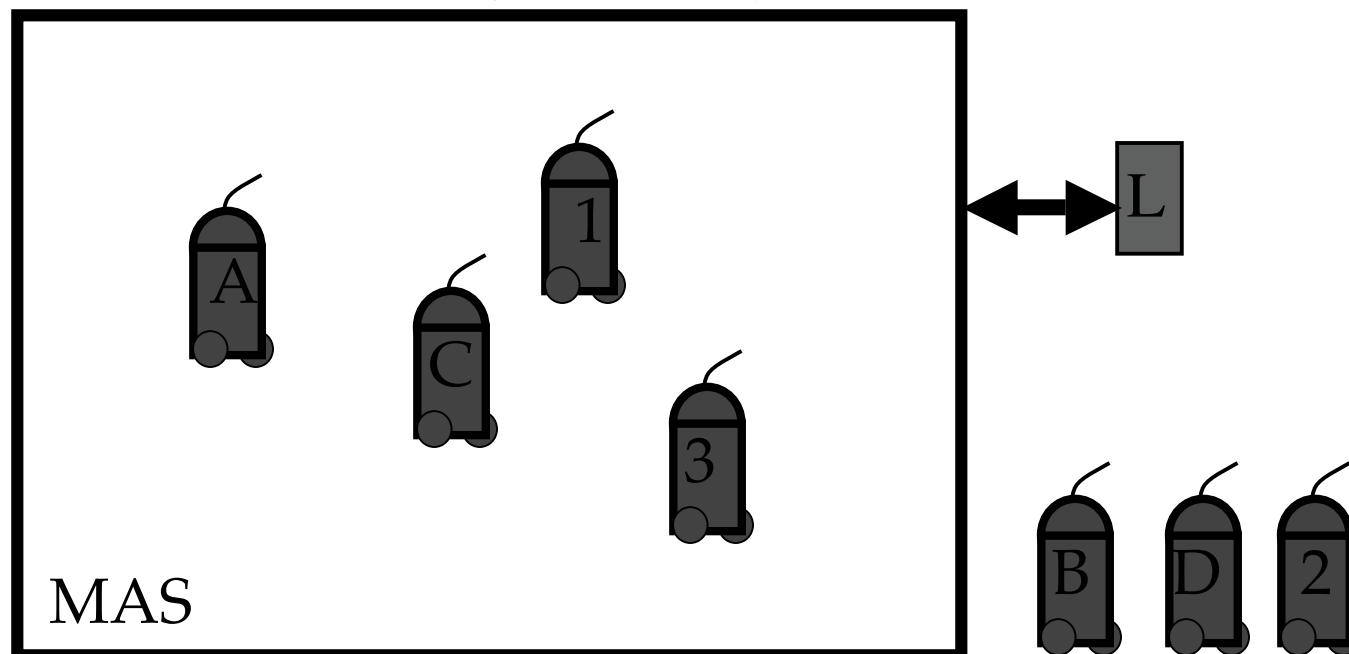
MAS and on- and offline learning (VI)

System = several “learn teams”



MAS and on- and offline learning (VI)

System = 1 MAS, some spare agents and 1 learner
adapting team by exchanging agents



Additional Problems

- What is the goal of learning in MAS?
 - Improving behavior of an agent to further the achievement of its goals or
 - Changing behavior of an agent to improve (MA) system performance
- Credit assignment second level:
How to distribute feedback among the agents?
- Co-evolution of agents:
Curse or blessing?

Main Research Directions in MAS

Learning (I)

- Learning to achieve:
 - Cooperation
 - Organization
 - Better competition
- Learning of and about agents:
 - to improve the own performance
 - to predict the behavior of other agents

Main Research Directions in MAS Learning (II)

- Learning and Cooperation
 - Communication as tool to allow learning
 - Learning as tool to reduce or avoid communication
- Learning to provide a better environment for agents

Applied Methods

- Distributed credit assignment:
Reinforcement Learning
- Evolutionary approaches
 - Genetic Algorithms / Genetic Programming
 - Look at MAS as an evolving population:
Swarm systems, Ant systems, etc.
- Classification methods
- Learning by heart and abstraction
- Layered learning
- ...