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星际争霸与人工智能

阿里巴巴认知计算实验室 龙海涛

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Why StarCraft?
0
0
120/65
Protoss Pylon
Psi Used: 120
Psi Provided: 8
Total Psi: 65
Psi Max: 200
300/300 300/300
MENU
Replay Progress
Elapsed Time: 00:06
Speed: Fast

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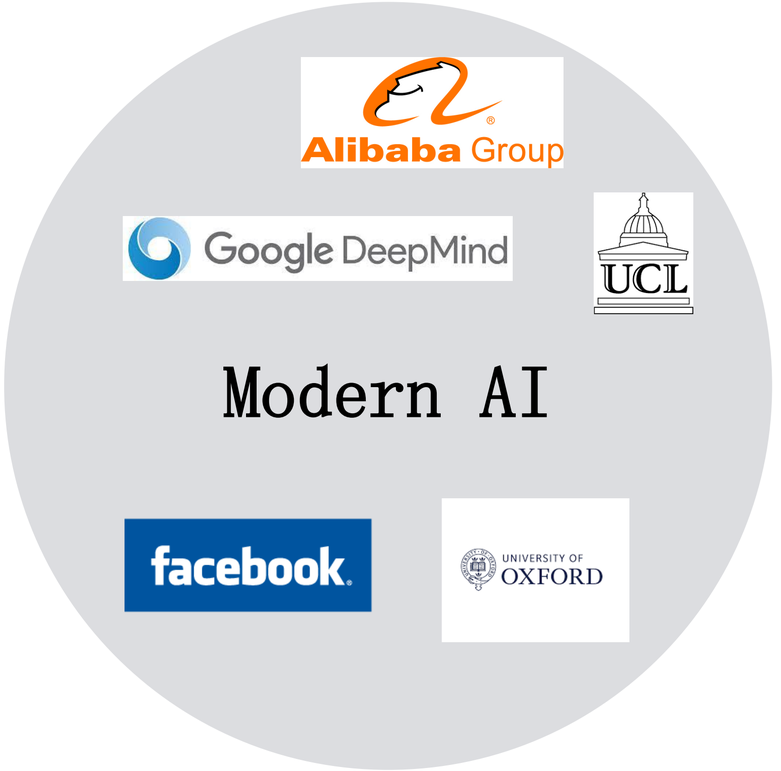
Challenge Problems for Artificial Intelligence

- Imperfect Information
- Huge State and Action Space
- Adversarial Real-time Strategy
- Long-Term Planning
- Temporal and Spatial Reasoning
- Multiagent Cooperation

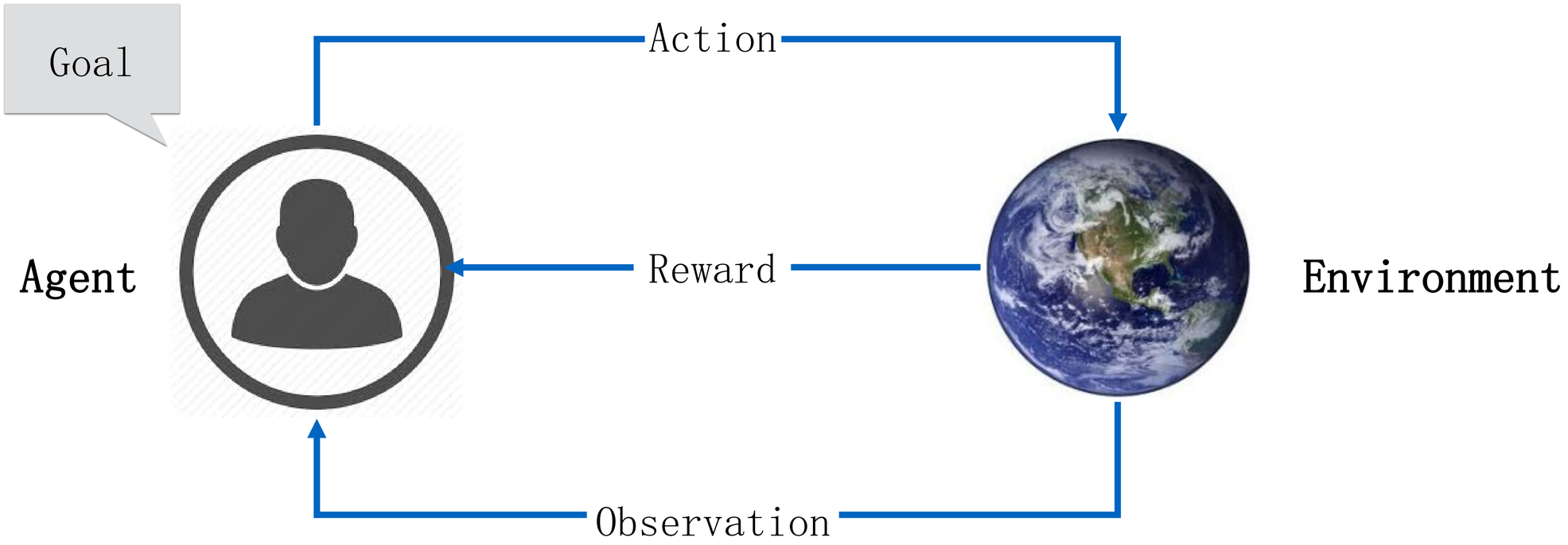
StarCraft AI Research and Competitions

2010~Now

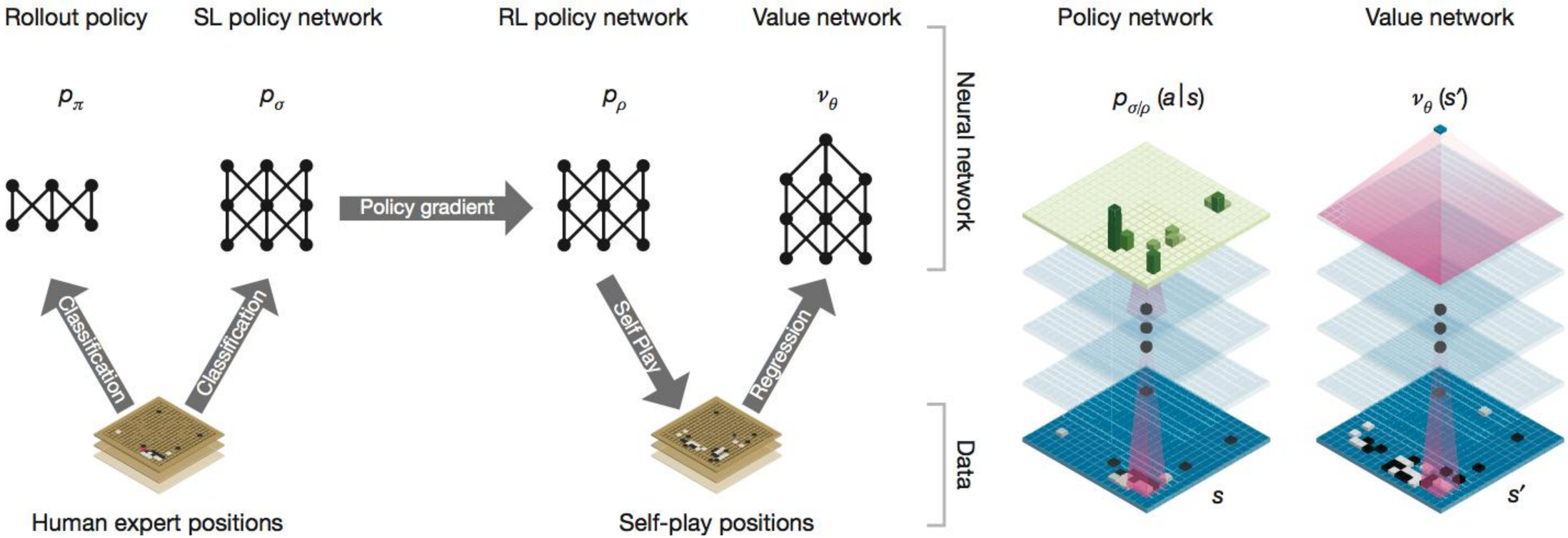


2016~Now

Reinforcement Learning



Deep Reinforcement Learning



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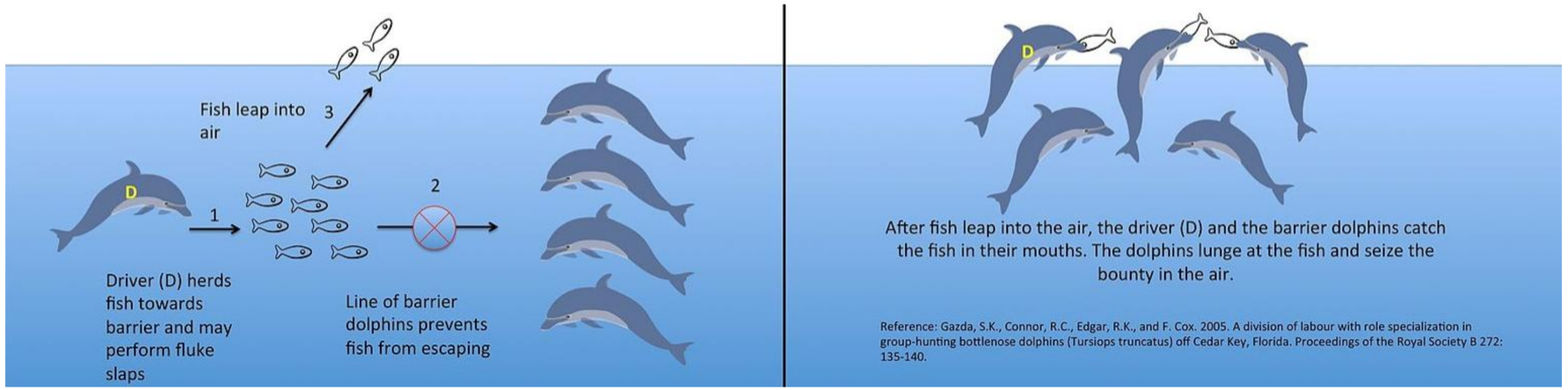
What is next?

- All above are single AI agent
- But, true human intelligence embraces social and collective wisdom
- How large-scale multiple AI agents could learn human-level collaborations (or competitions) from their experiences?

Cooperative Hunting



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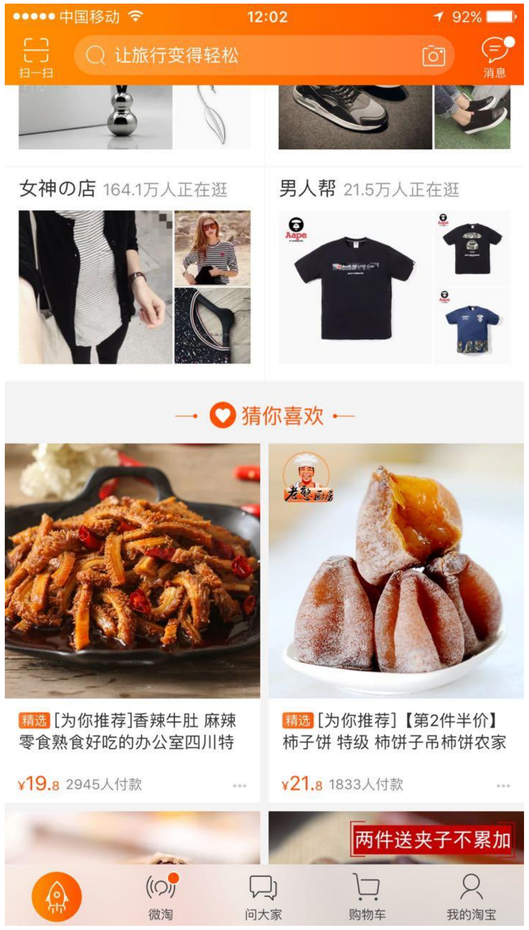
Artificial Collective Intelligence



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Multiagent Bidirectionally-Coordinated Nets for Learning to Play StarCraft Combat Games

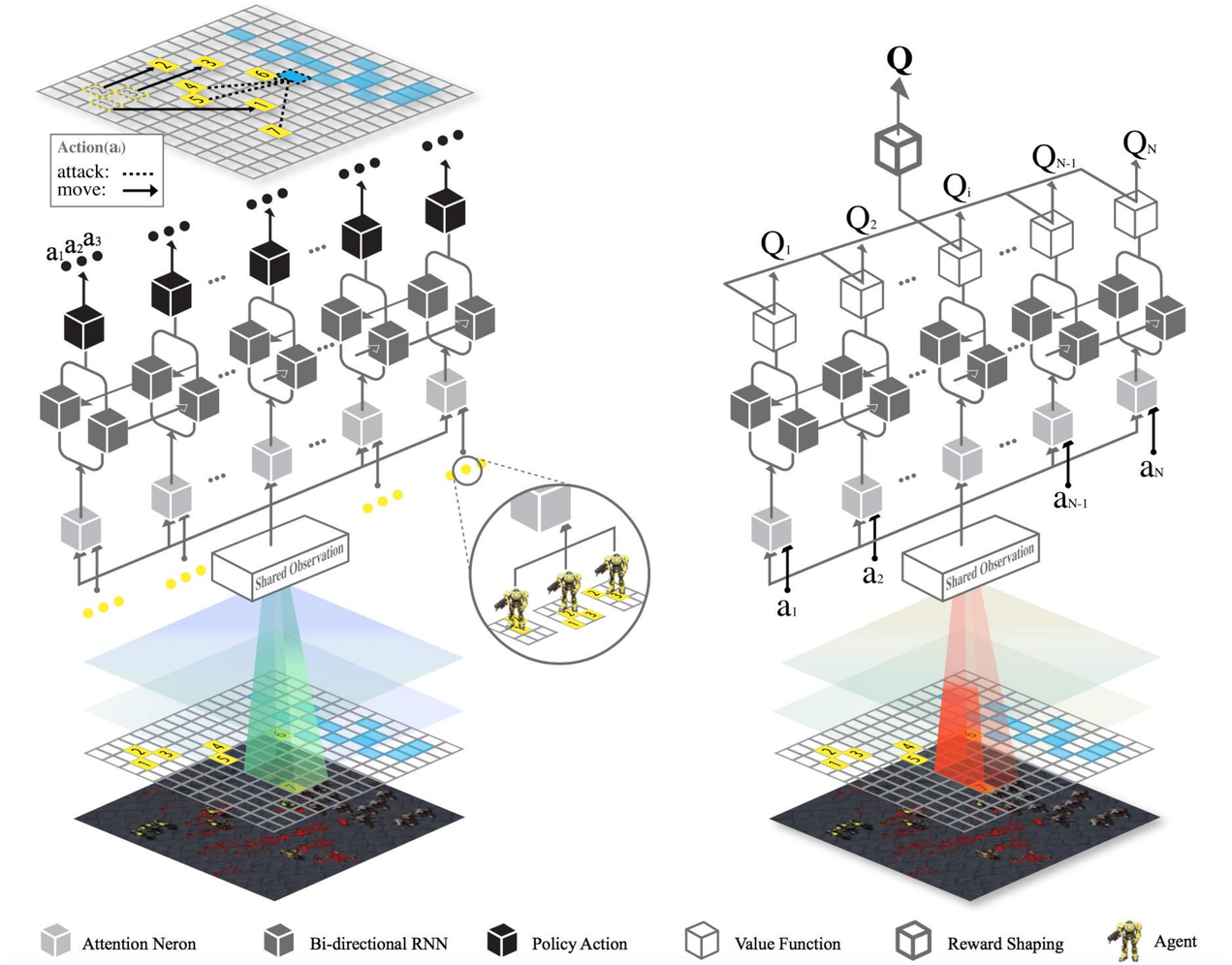
Peng Peng[†], **Quan Yuan**[†], **Ying Wen**[‡], **Yaodong Yang**[‡], **Zhenkun Tang**[†], **Haitao Long**[†], **Jun Wang**[‡] *
[†]Alibaba Group, [‡]University College London

Abstract

Real-world artificial intelligence (AI) applications often require multiple agents to work in a collaborative effort. Efficient learning for intra-agent communication and coordination is an indispensable step towards general AI. In this paper, we take StarCraft combat game as the test scenario, where the task is to coordinate multiple agents as a team to defeat their enemies. To maintain a scalable yet effective

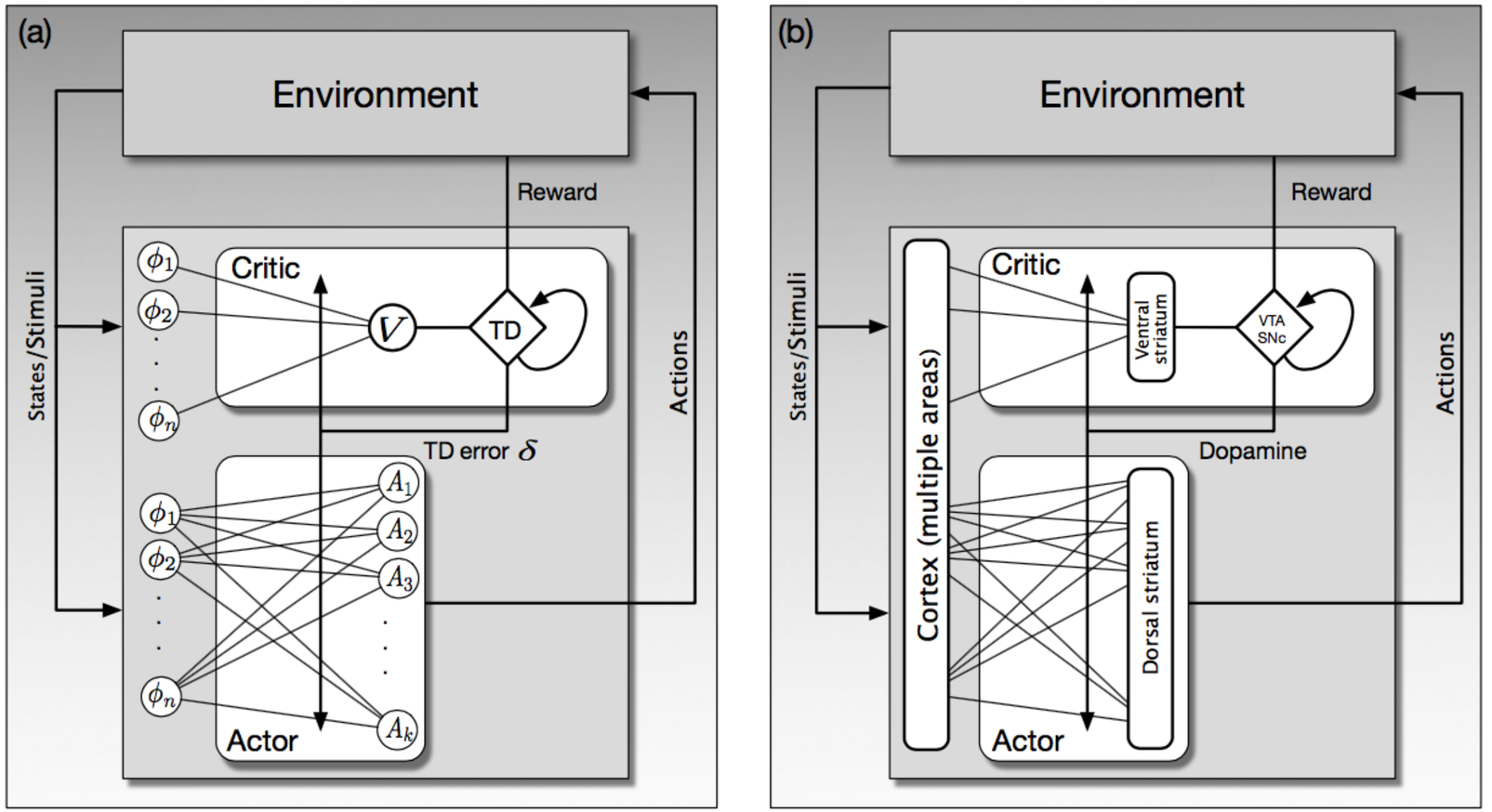
https://arxiv.org/abs/1703.10069

Multiagent Bidirectionally-Coordinated Net (BiCNet)



(a) Multiagent policy networks with grouping (b) Multiagent Q networks with reward shaping

Neuroscience Hypothesis



Source: Reinforcement Learning - An Introduction

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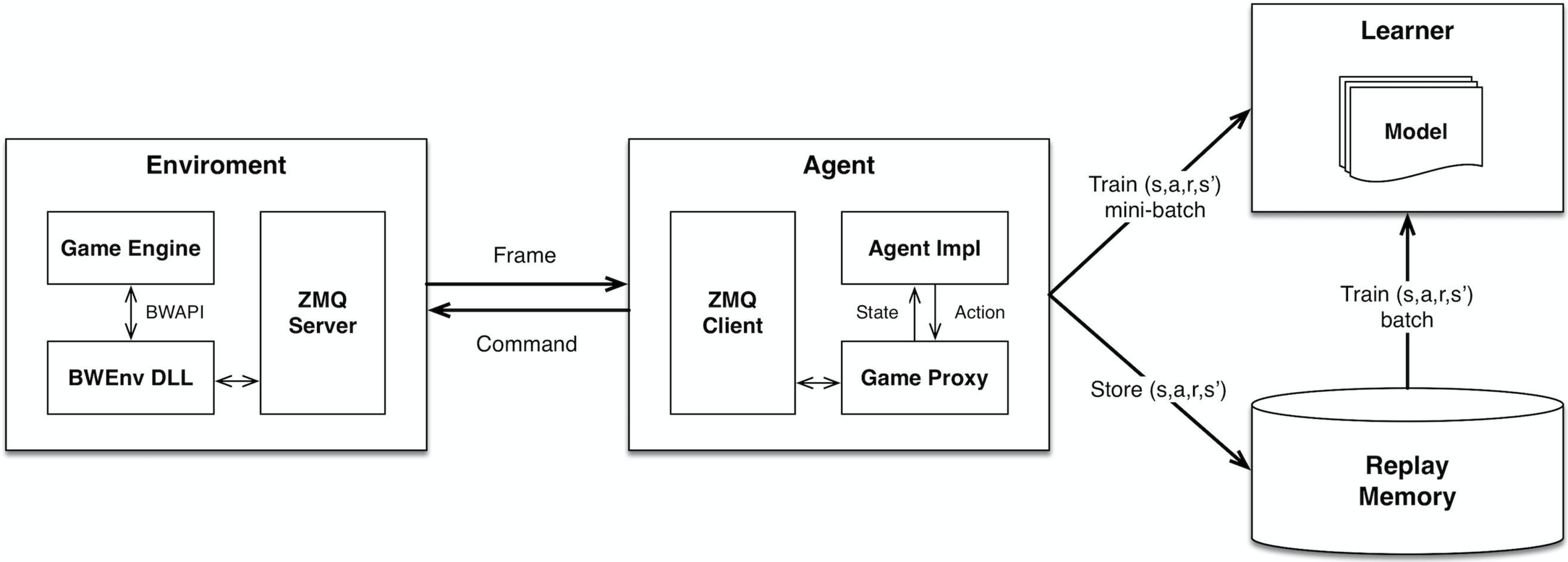
Architecture Overview



https://github.com/alibaba/gym-starcraft

Coordinated Moves without Collision

(a) Early stage of training

(b) Early stage of training

(c) Well-trained

(d) Well-trained

3 Marines (ours) vs. 1 Super Zergling (enemy)

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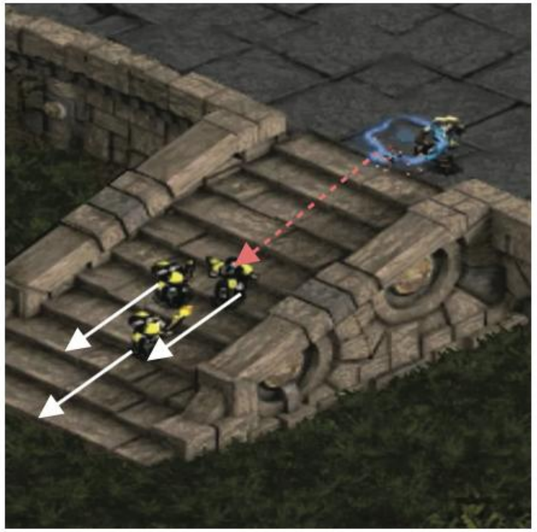
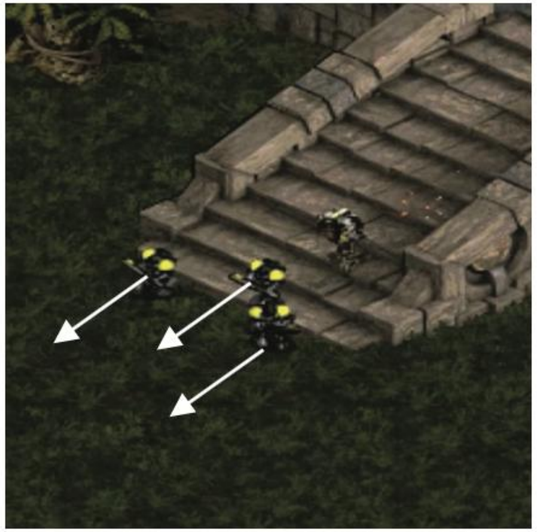
Hit and Run Tactics

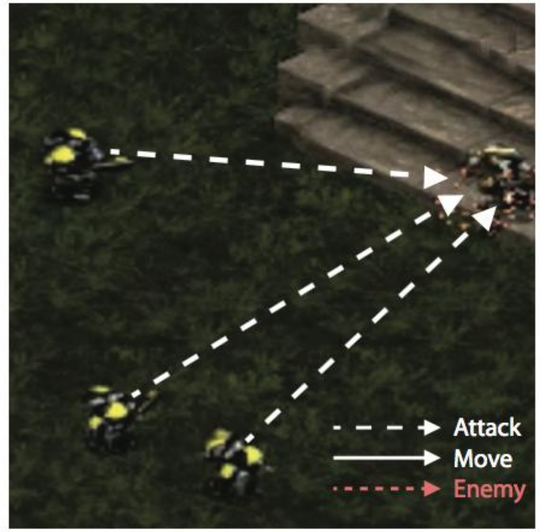


(a) time step 1: run when attacked

(b) time step 2: fight back when safe



(c) time step 3: run again



(d) time step 4: fight back again

3 Marines (ours) vs. 1 Zealot (enemy)

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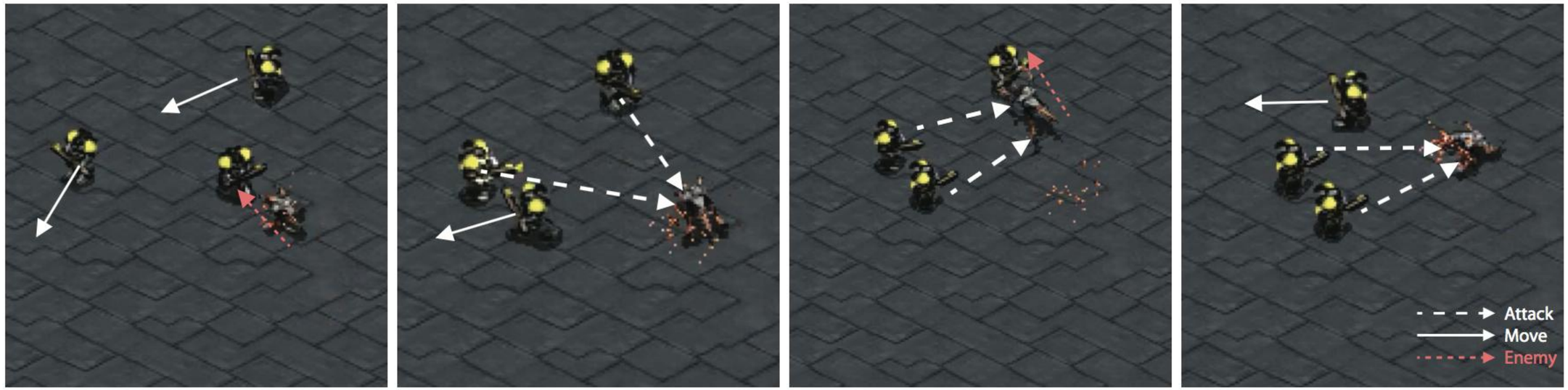
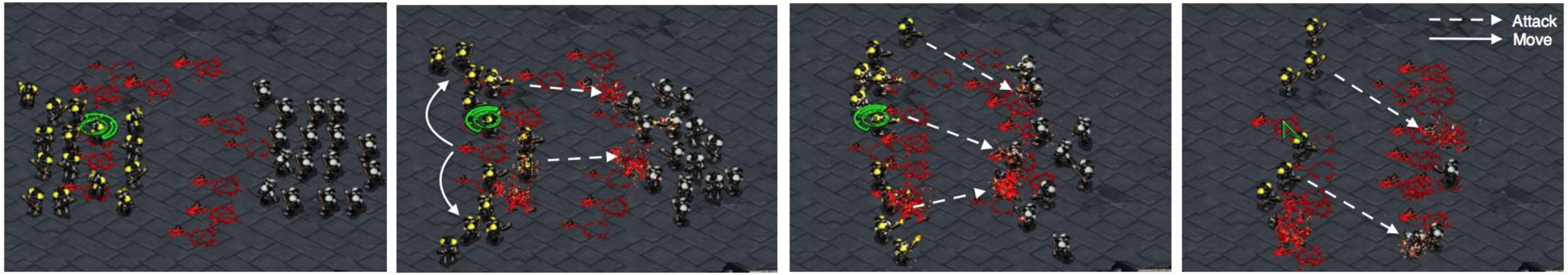
Coordinated Cover Attack



(a) time step 1 (b) time step 2 (c) time step 3 (d) time step 4

3 Marines (ours) vs. 1 Super Zergling (enemy)

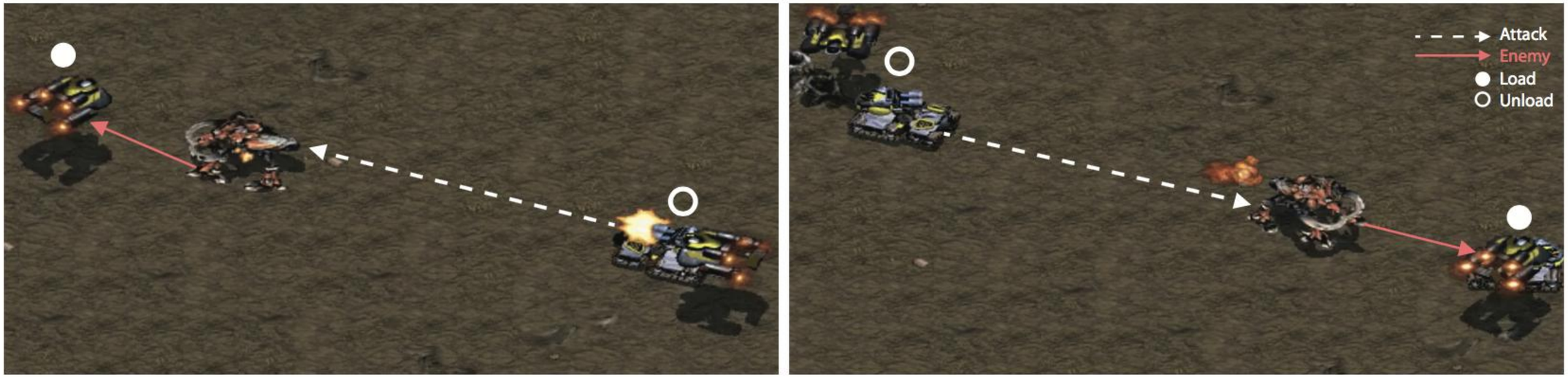
Focus Fire without Overkill



(a) time step 1 (b) time step 2 (c) time step 3 (d) time step 4

15 Marines (ours) vs. 16 Marines (enemy)

Coordinated Heterogonous Agents



(a) time step 1 (b) time step 2

2 *Dropships* and 2 *tanks* vs. 1 *Ultralisk*

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Hierarchical Reinforcement Learning

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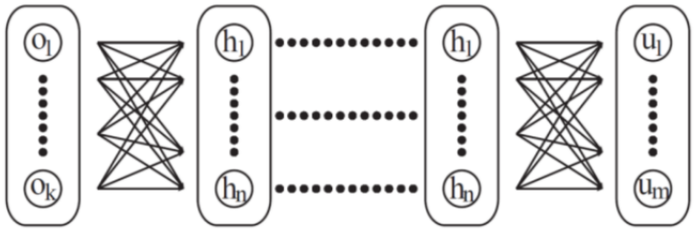
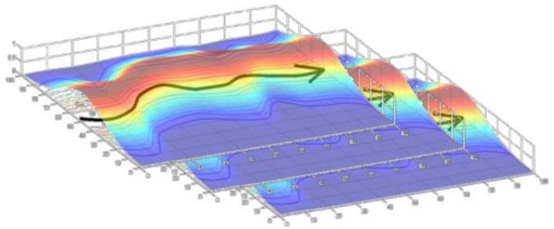
Imitation Learning

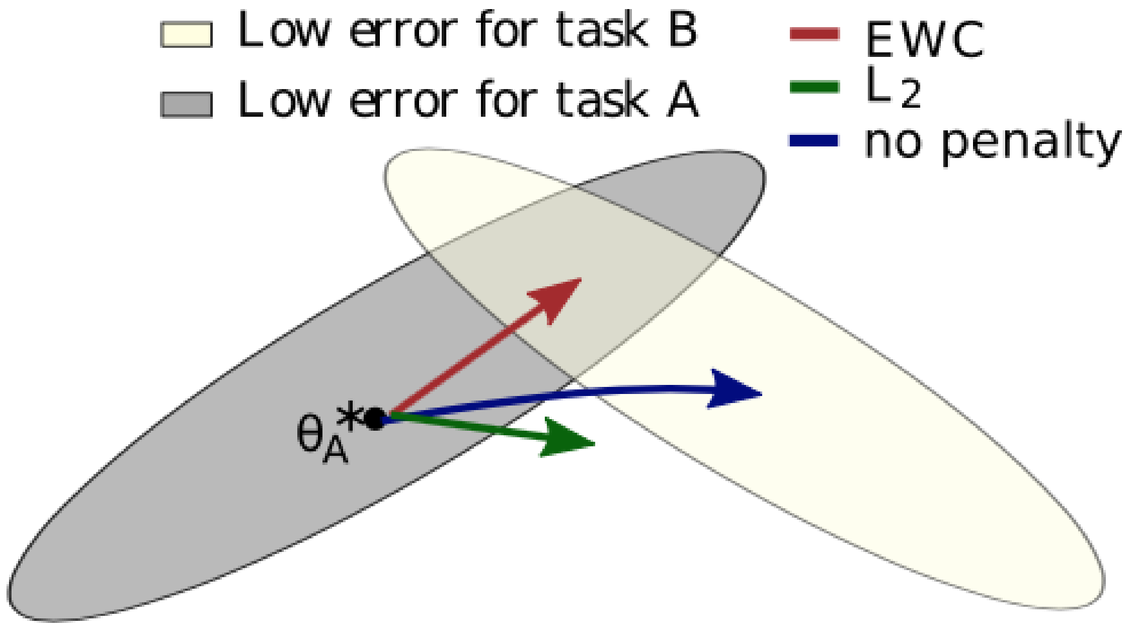


Supervised Learning



Reinforcement Learning

Continual Learning



Source: Overcoming catastrophic forgetting in neural networks

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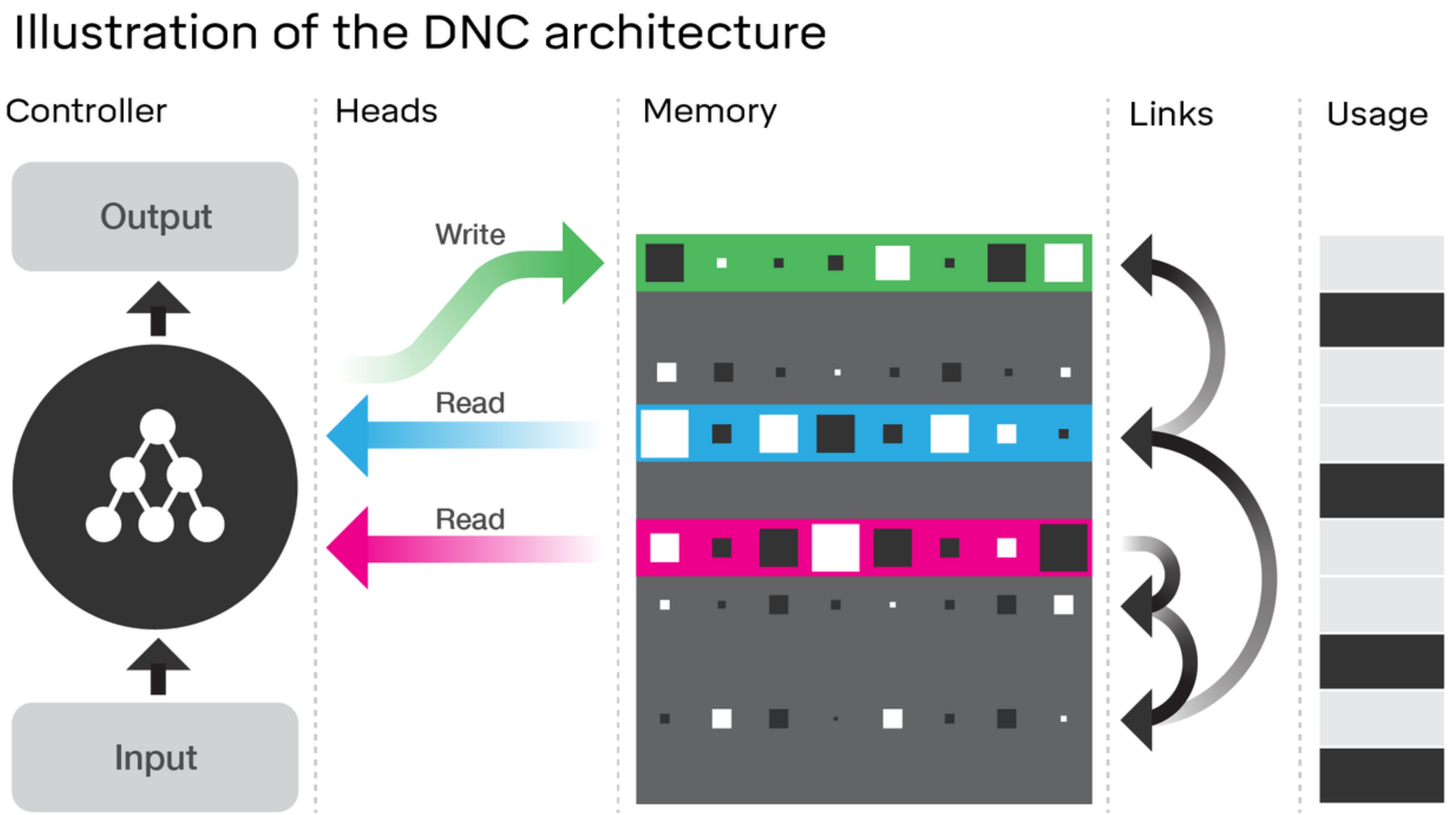
Memory-Augmented Neural Networks



Source: Hybrid computing using a neural network with dynamic external memory

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Work Fun Play Hard