



BROWN

NSGP seminar

Learning useful representations to solve a
place-odor association task

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Outline

1. Context
2. Experimental setup and task
3. Hypothesis
4. RL concepts
5. Preliminary results
6. Experiments
7. What we plan to do next
8. Summary

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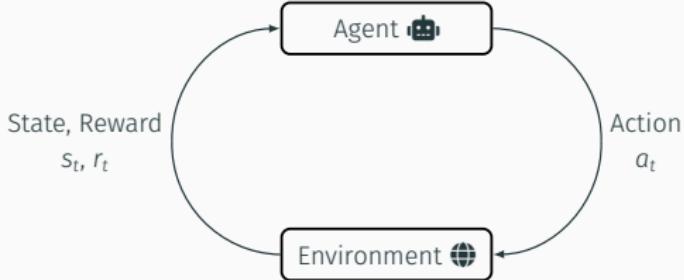
Context

Rationale

Why we record in the LEC?

Joint representation

What is Reinforcement Learning and why we want to use it ?



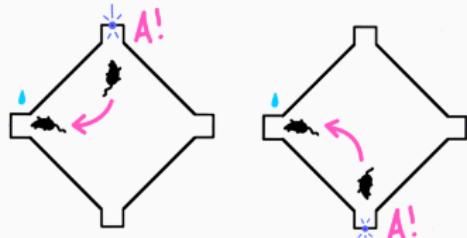
- Goal of the agent : maximize rewards
- Natural fit for behavioral experiments involving rewards and learning

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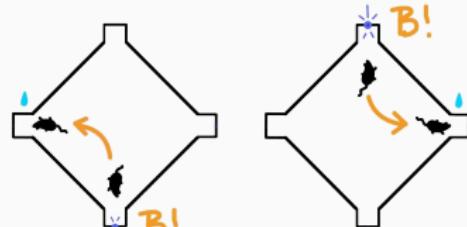
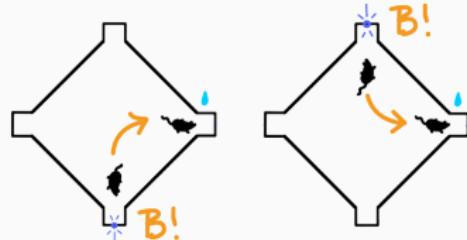
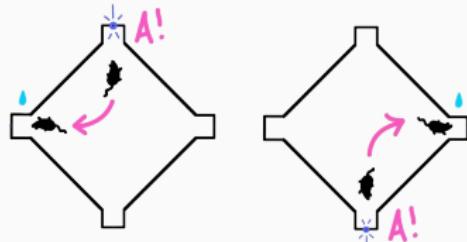
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Olivia's diamond arena olfactory task

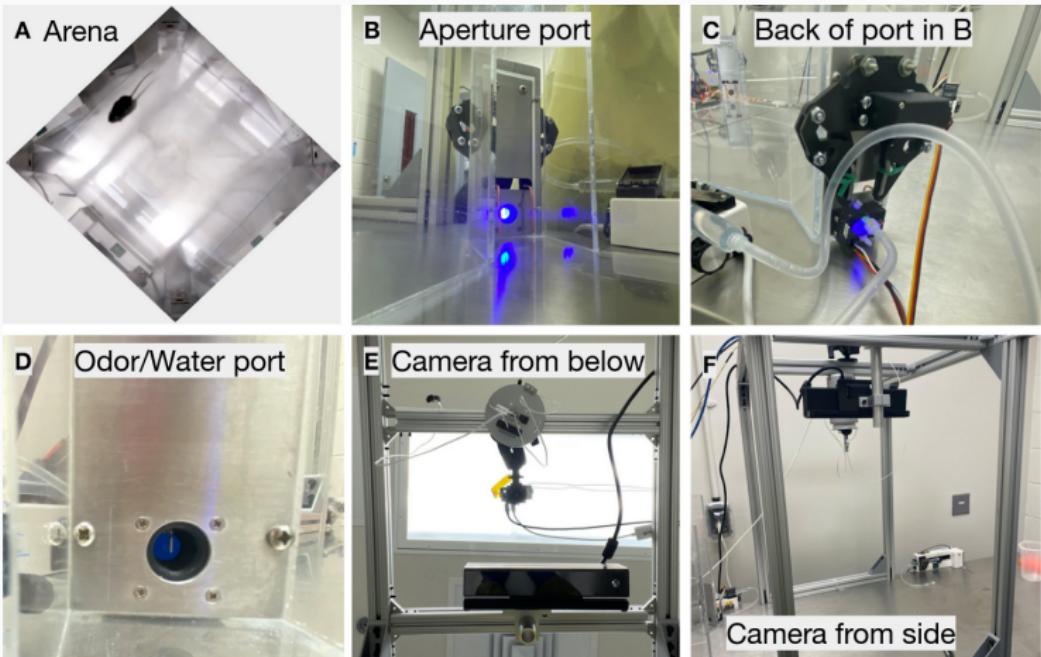
Allocentric
(go west/east)



Egocentric
(go right/left)



Diamond arena experimental setup



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Function approximation

Find some candidate patterns in the data :

place cells, grid cells ?

Approximate the value function with a **basis function** :

$$\hat{v}(s, w) \doteq w^T x(s) \doteq \sum_{i=1}^d w_i x_i(s)$$

\hat{v} : approximate value of state s given weight vector w

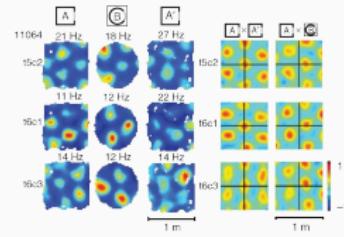
s : state

w : d -vector of weights underlying the approximate value function

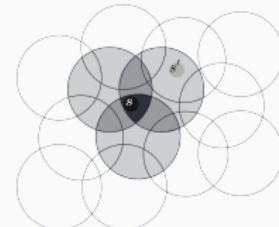
x : vector of features visible when in state s

w_i : i th component of learnable weight vector

x_i : i th component of vector $x(s)$



Approximate with coarse coding ? Tiling ?

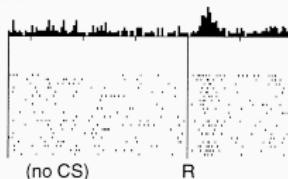


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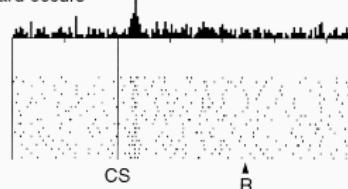
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Temporal Difference learning

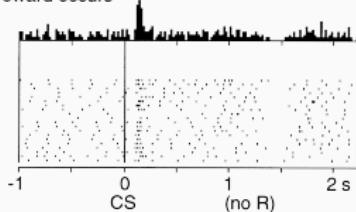
No prediction
Reward occurs



Reward predicted
Reward occurs



Reward predicted
No reward occurs



$$V(S_t) = V(S_t) + \underbrace{\alpha(R_{t+1} + \gamma V(S_{t+1}) - V(S_t))}_{\text{TD target}}$$

$$\text{NewEstimate} \leftarrow \text{OldEstimate} + \text{StepSize}[\text{Target} - \text{OldEstimate}]$$

What we're trying to model

General goal

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What did we learn at this point?

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Split data in 2, learn on first half, predict on second half

With/without joint repr

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What we expect to see

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- Matt Nassar (Brown University)
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- Timothy Pyon
- Jason Ritt
- Matt Nassar
- Niloufar Razmi

Questions ?