



BROWN

NSGP seminar

Learning useful representations to solve a
place-odor association task

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Outline

1. Context of the project
2. Experimental setup and task
3. Experiments & preliminary results
4. Next steps

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Context

Hypothesis

LEC hypothesized to encode the conjunction of odor-place information

Question

Which representations are needed by the brain to learn a place-odor association task?

Context

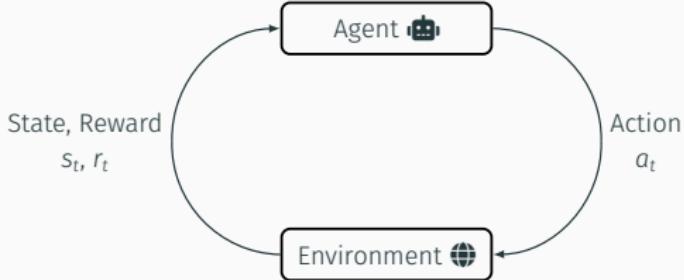
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Question

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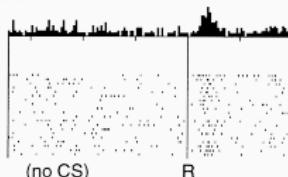
What is Reinforcement Learning and why we want to use it ?



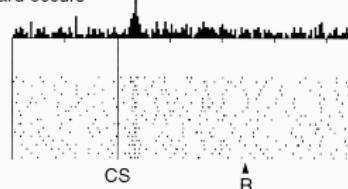
- Goal of the agent : maximize rewards
- Natural fit for behavioral experiments involving rewards and learning

Temporal Difference learning

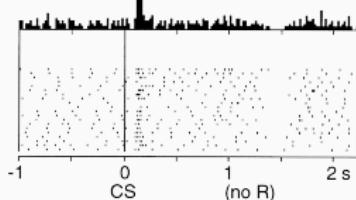
No prediction
Reward occurs



Reward predicted
Reward occurs



Reward predicted
No reward occurs



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

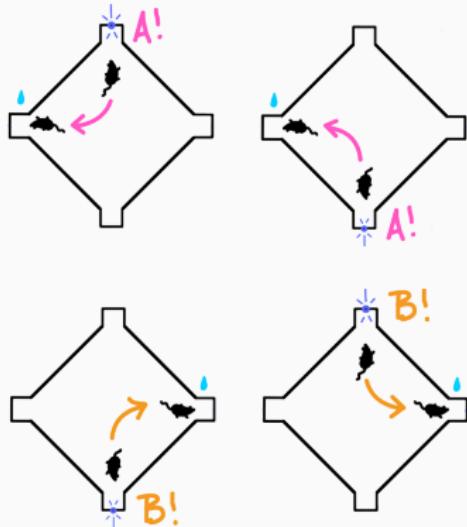
$$\text{NewEstimate} \leftarrow \text{OldEstimate} + \text{StepSize}[\text{Target} - \text{OldEstimate}]$$

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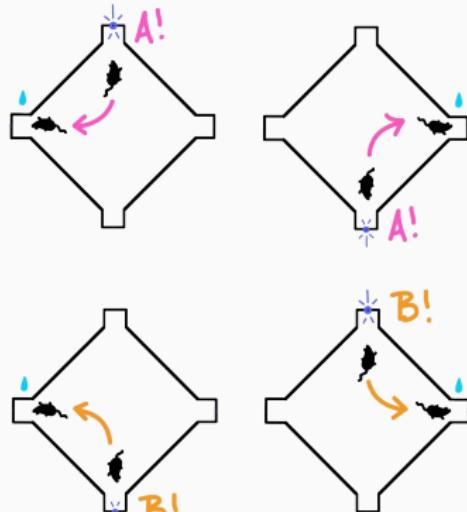
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Olivia's diamond arena olfactory task

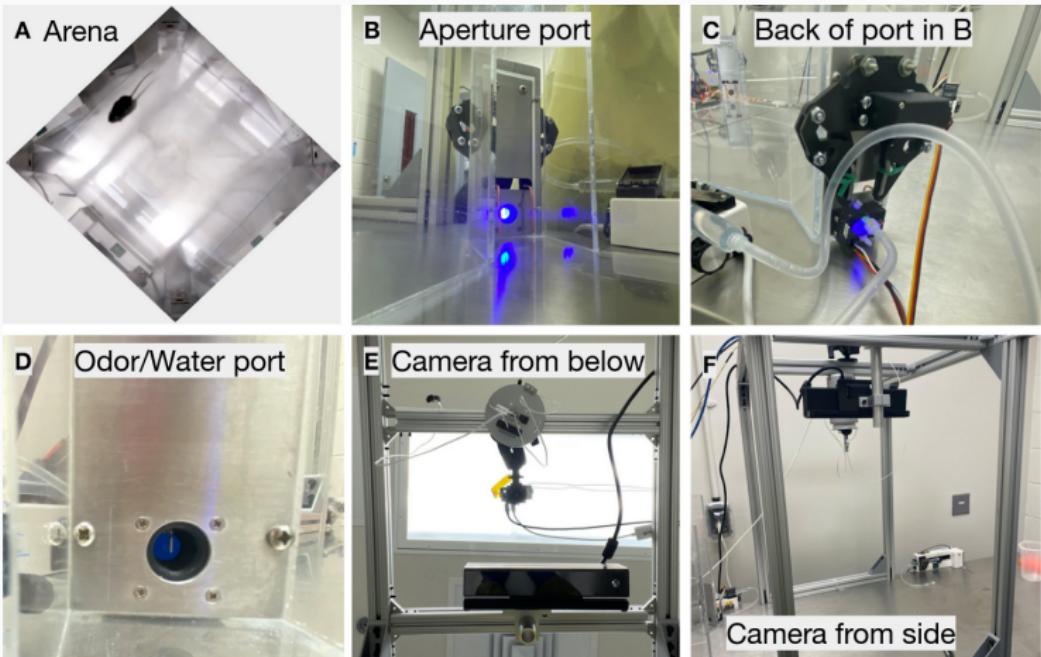
Allocentric
(go west/east)



Egocentric
(go right/left)



Diamond arena experimental setup

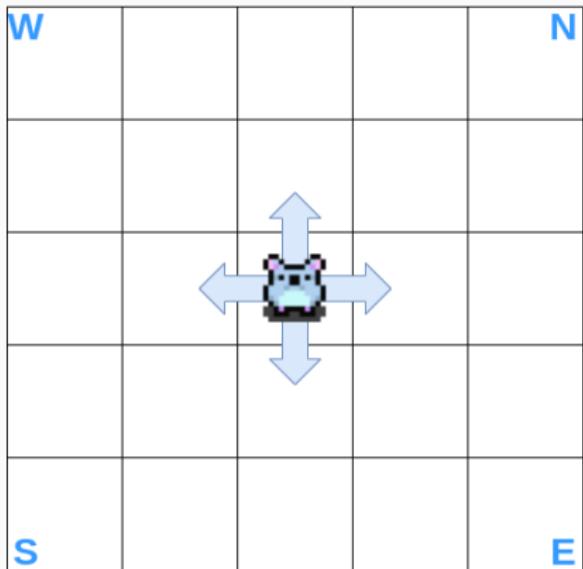


Outline

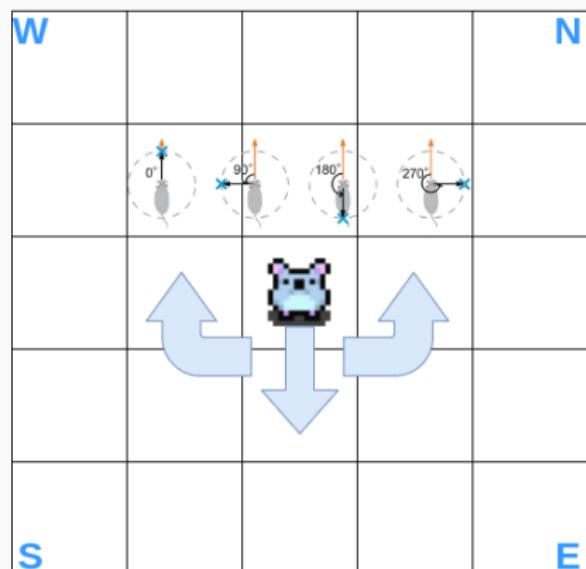
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The model

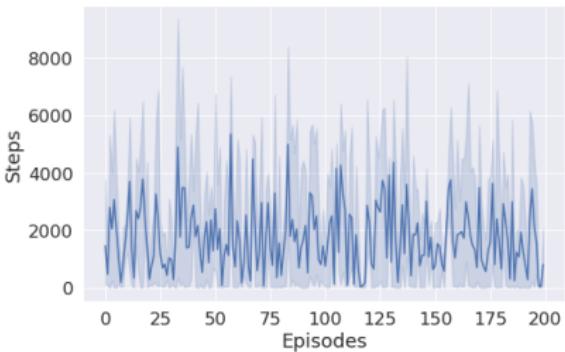
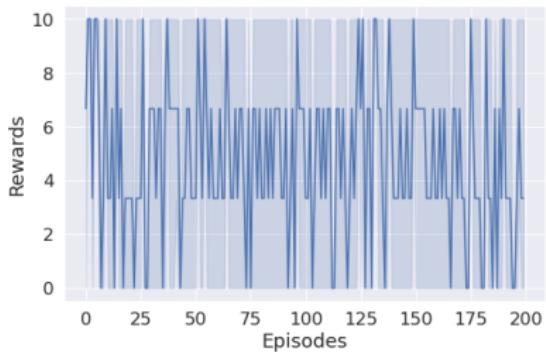
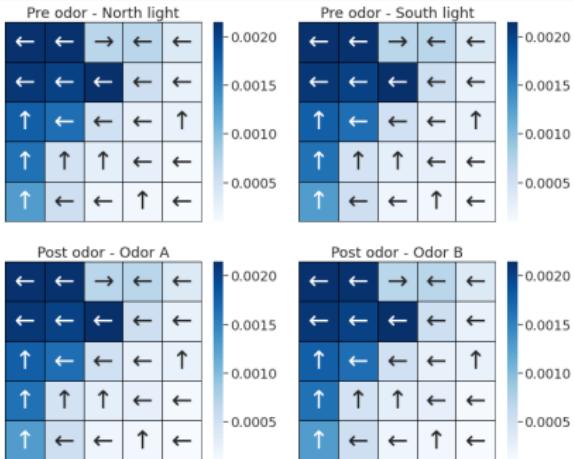
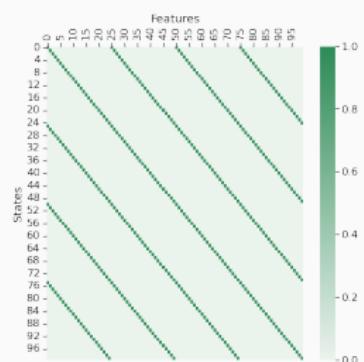
Allocentric



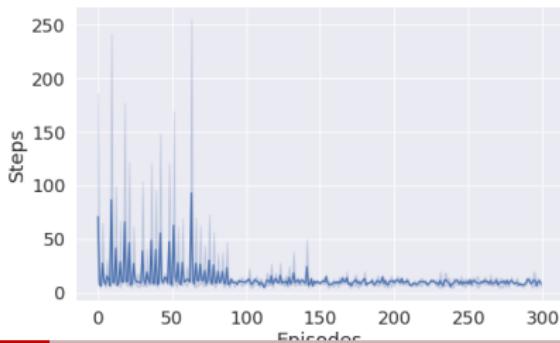
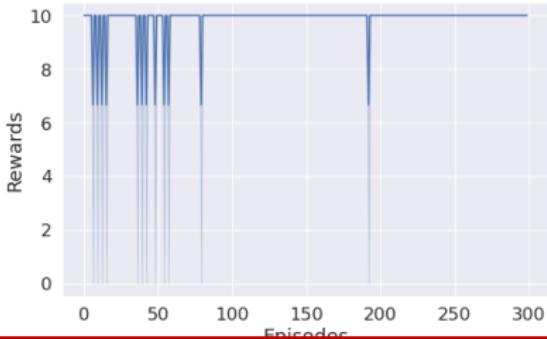
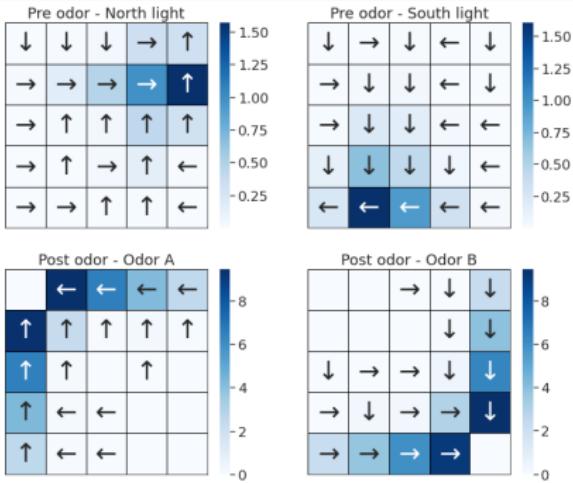
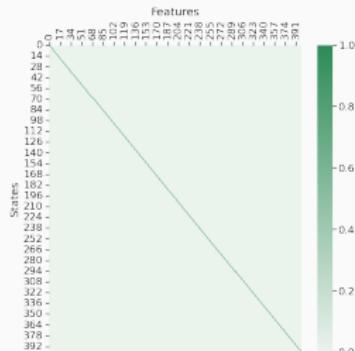
Egocentric



Without joint representation

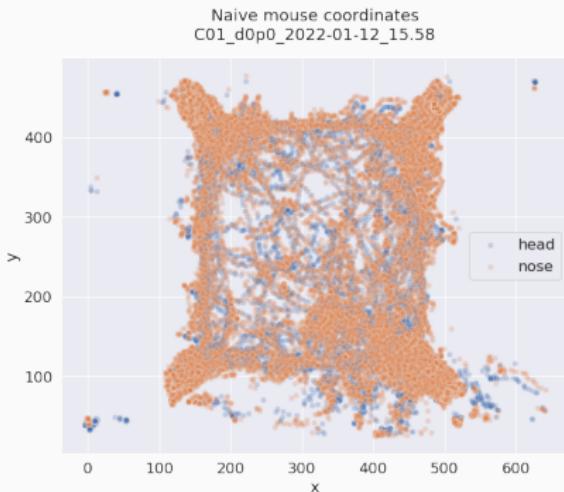


With joint representation



States occupancy ?

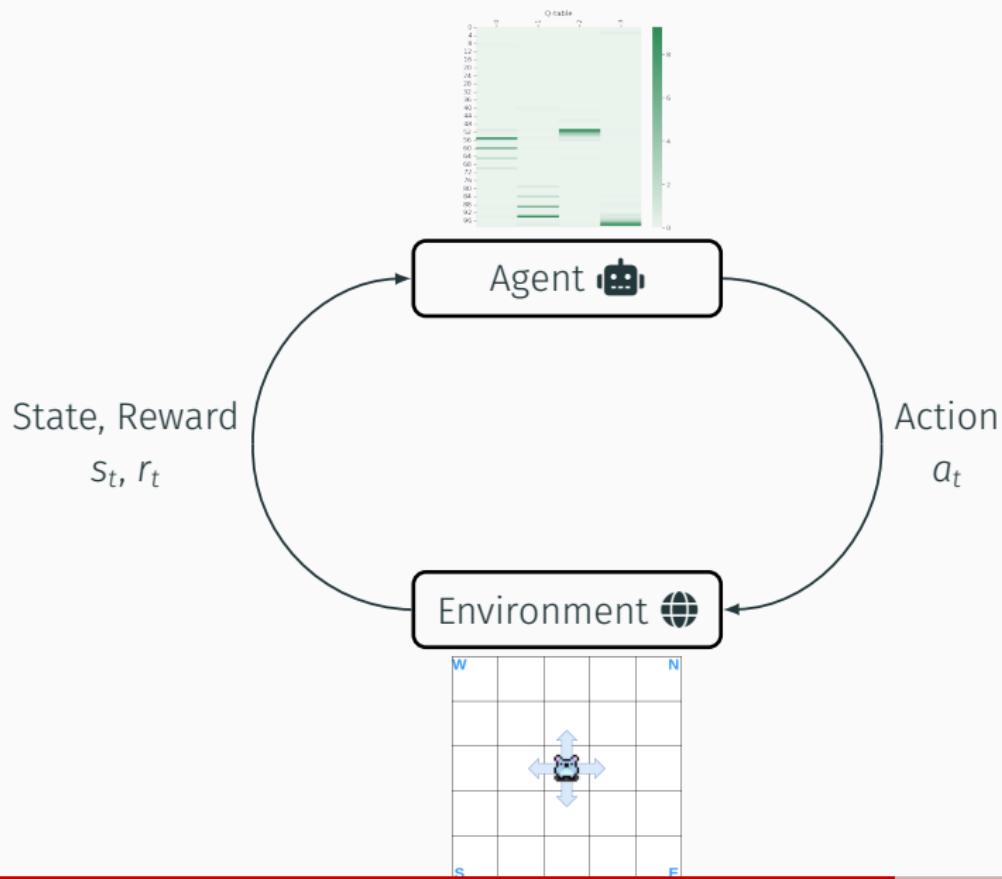
Can we predict the behavioral data ?



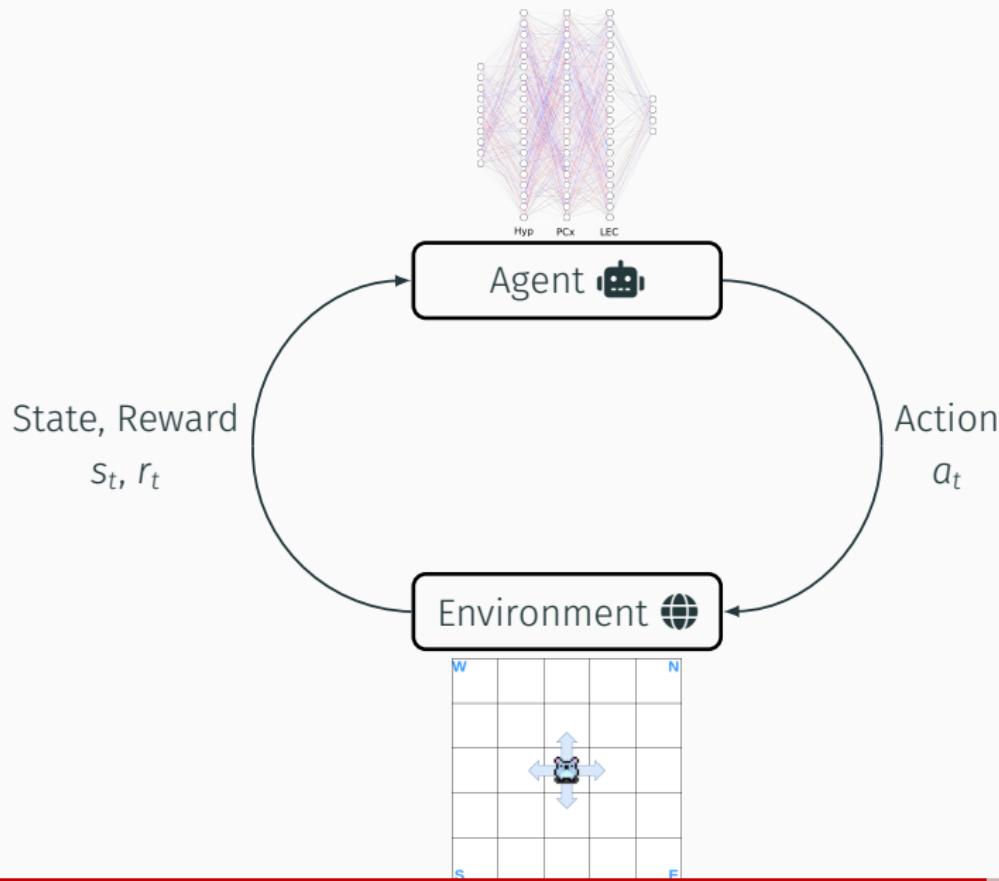
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From tabular RL to deep RL



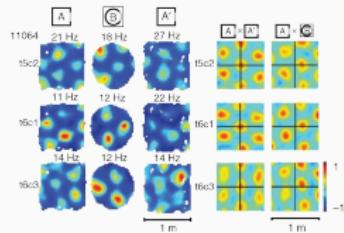
From tabular RL to deep RL



What we expect to see

Find some candidate patterns in the data :

place cells, grid cells ?



Summary

Acknowledgments

- Fleischmann lab :

- Alexander Fleischmann
- Keeley Baker
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