

# Gridbot: A Spiking Neural Network Model of the Brain's Navigation System for Autonomous Robots

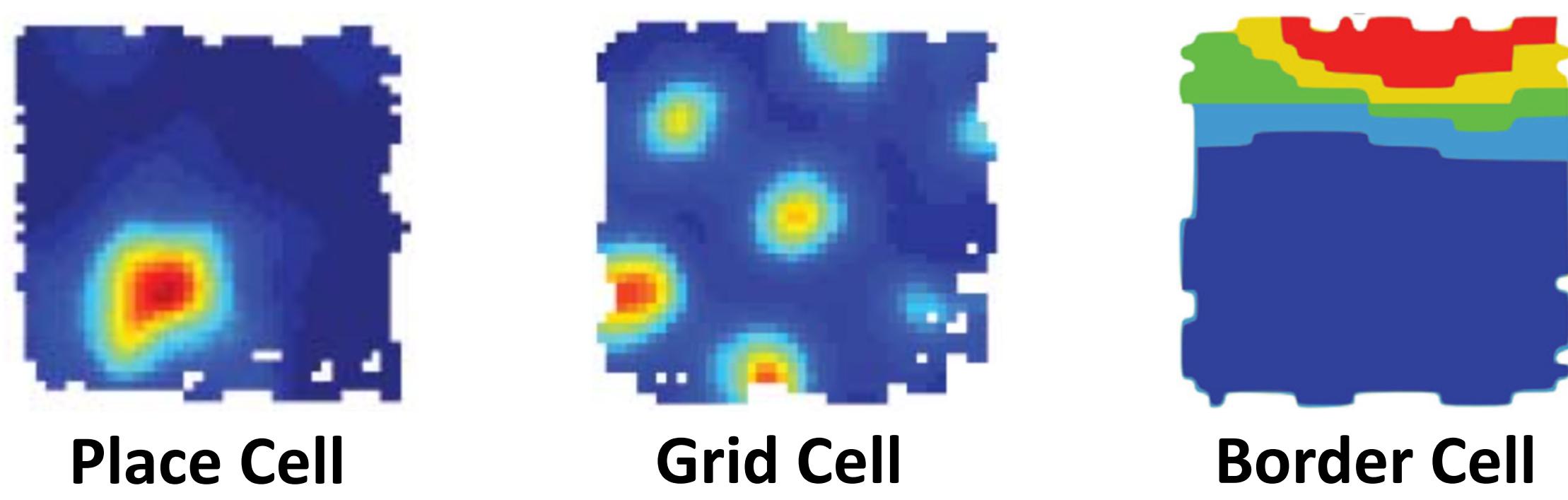


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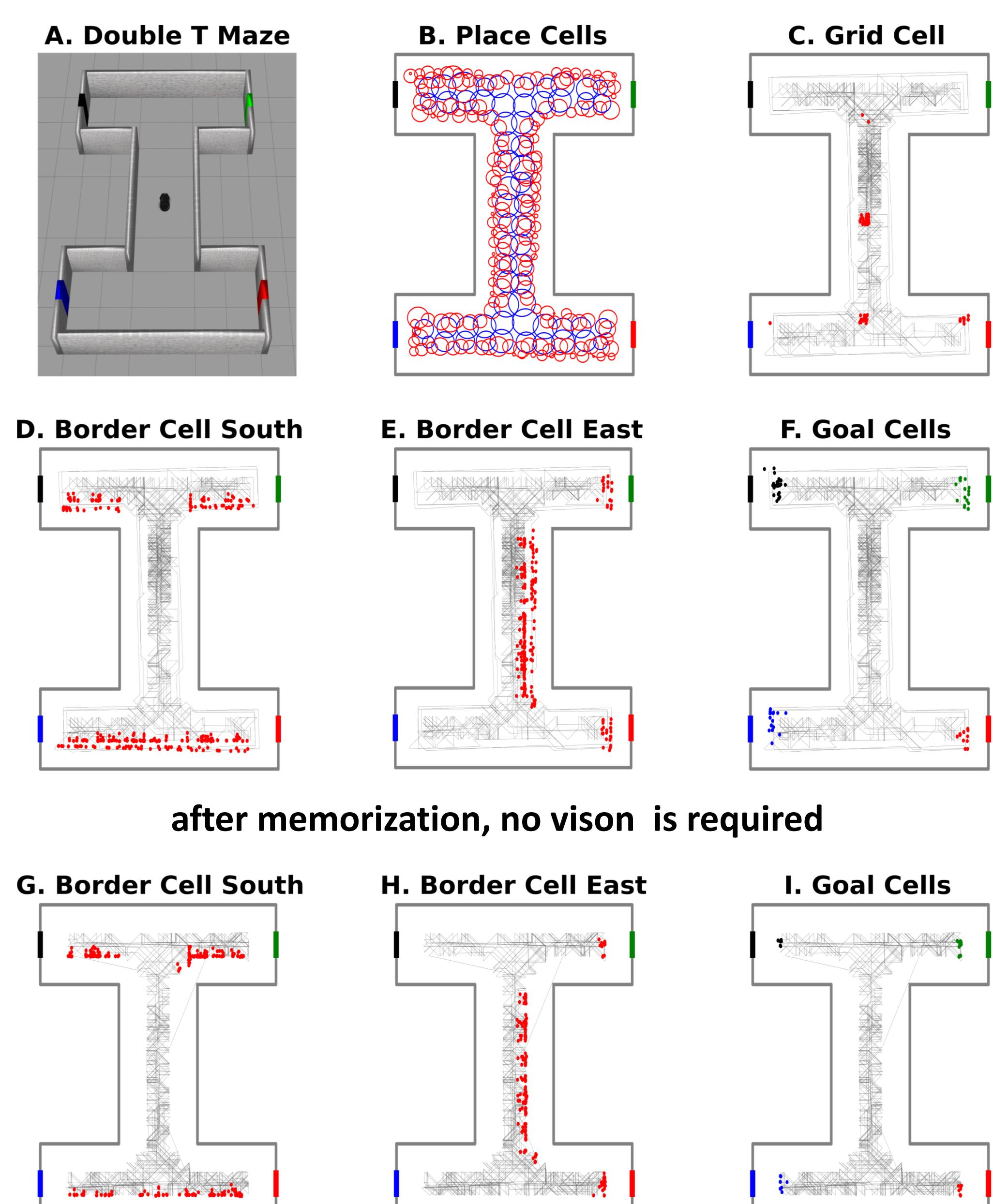
## Introduction

- Brain's Navigation System:** Since the 1970's, a large number of specialized cells forming the brain's navigational systems are discovered [1].
- Place Cell:** Specialized neurons in the hippocampus increase their activation when an animal approaches a specific location [2].
- Grid Cell:** Neurons in the mEC are activated when we step on distinct locations forming a triangular lattice [3].
- Border Cell:** Neurons in the subiculum are activated when an animal is approaching a border, at a certain distance [4].
- However, how the observed behavior emerges from the interconnectivity among these and other brain cells remains a mystery. **we are developing a comprehensive Spiking Neural Network based on the hypothesized connectome of the brain navigational system**



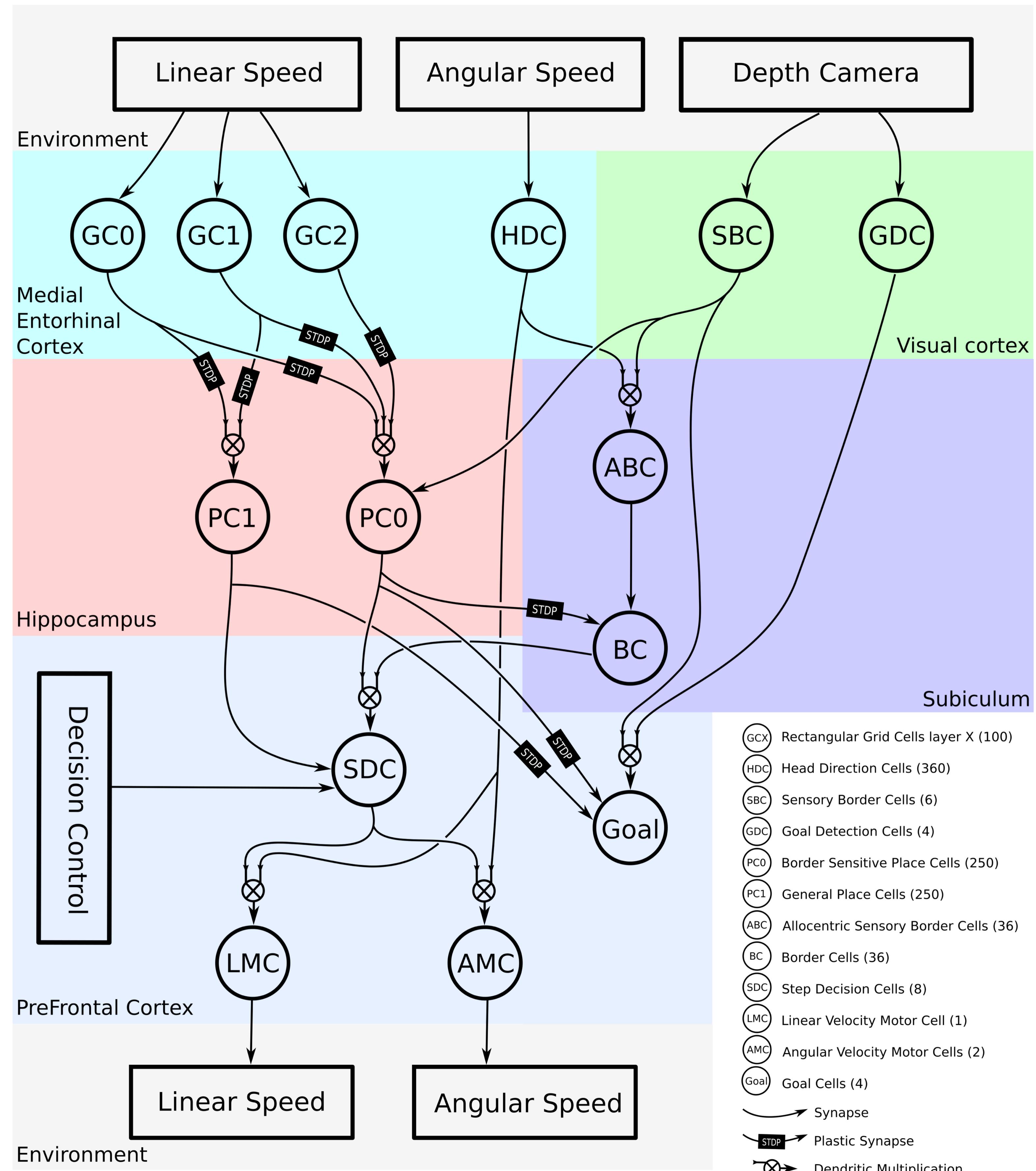
## Robotic Simulation Results

- We implemented our model in ROS and simulated a mobile robot navigating itself in a double T maze.



## Brain-morphic Spiking Neural Network

- End to End Processing:** Our model receives sensory inputs and outputs motor commands.
- Biologically Constrained:** Our model differs from other approaches as it builds on the experimental results, further suggesting connections among neurons.
- Computational Bio-elements:** Our model includes 1321 simulated LIF spiking neurons, with their associated synapses (hardwired or plastic).
- Distributed and modular framework:** Computations in neurons, synapses, and dendrites are distributed.
- Expandable architecture:** This spiking neural network framework allows for adding astrocytic learning.



## References

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