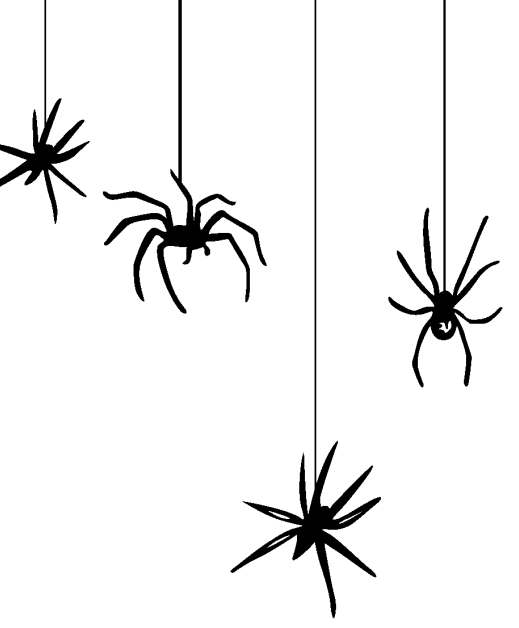
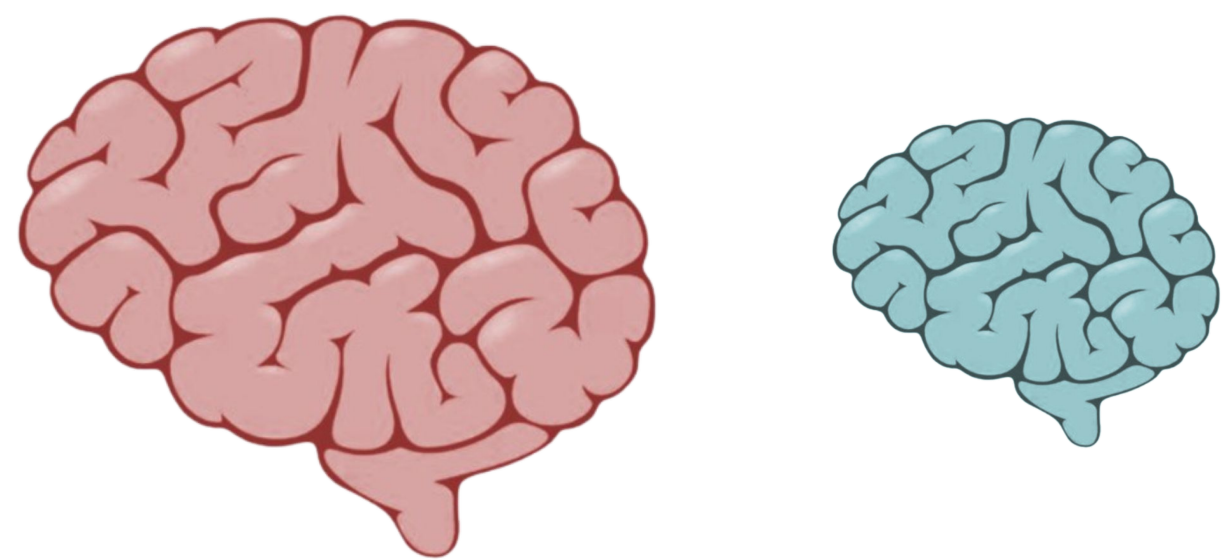


Minimal Neural Networks For Spatial Problem Solving

Pulkit Chaudhary,
Sayor Singha,
Srinithin Ganesh,
and Amiya Harish



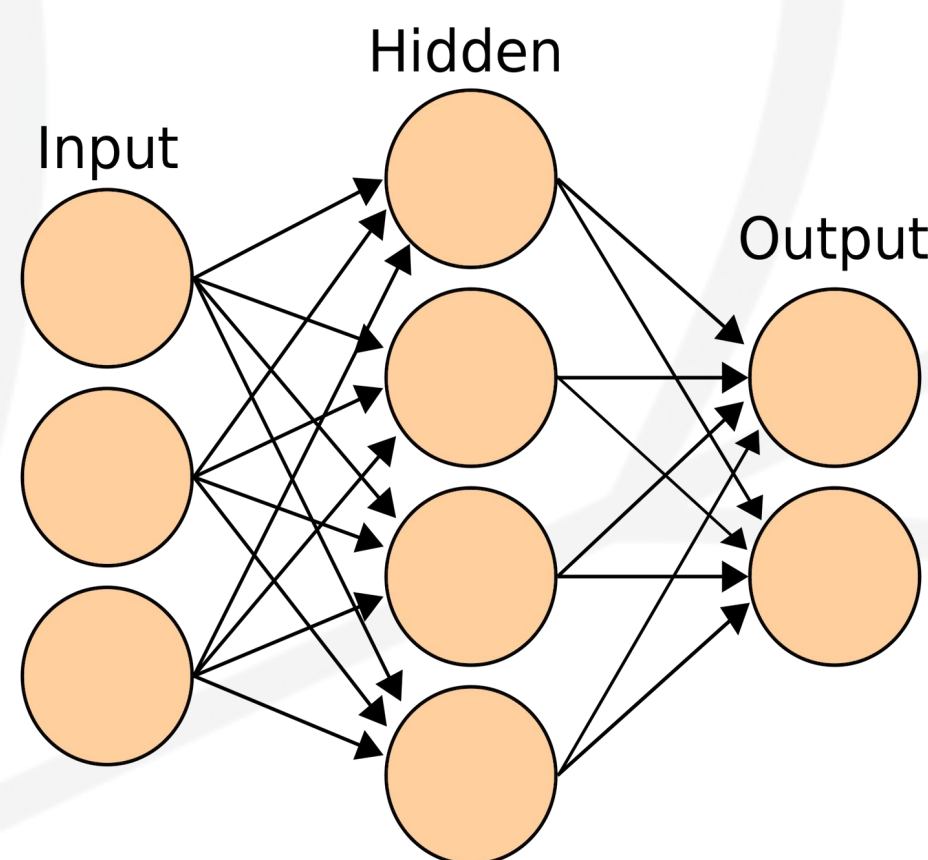
Introduction



- Insects brains are much smaller than humans. They **adapt** and **evolve**
- Modern AI has a lot of **compute**
- Basing a new model inspired by insects for insights into **efficiency**

The Spider Model

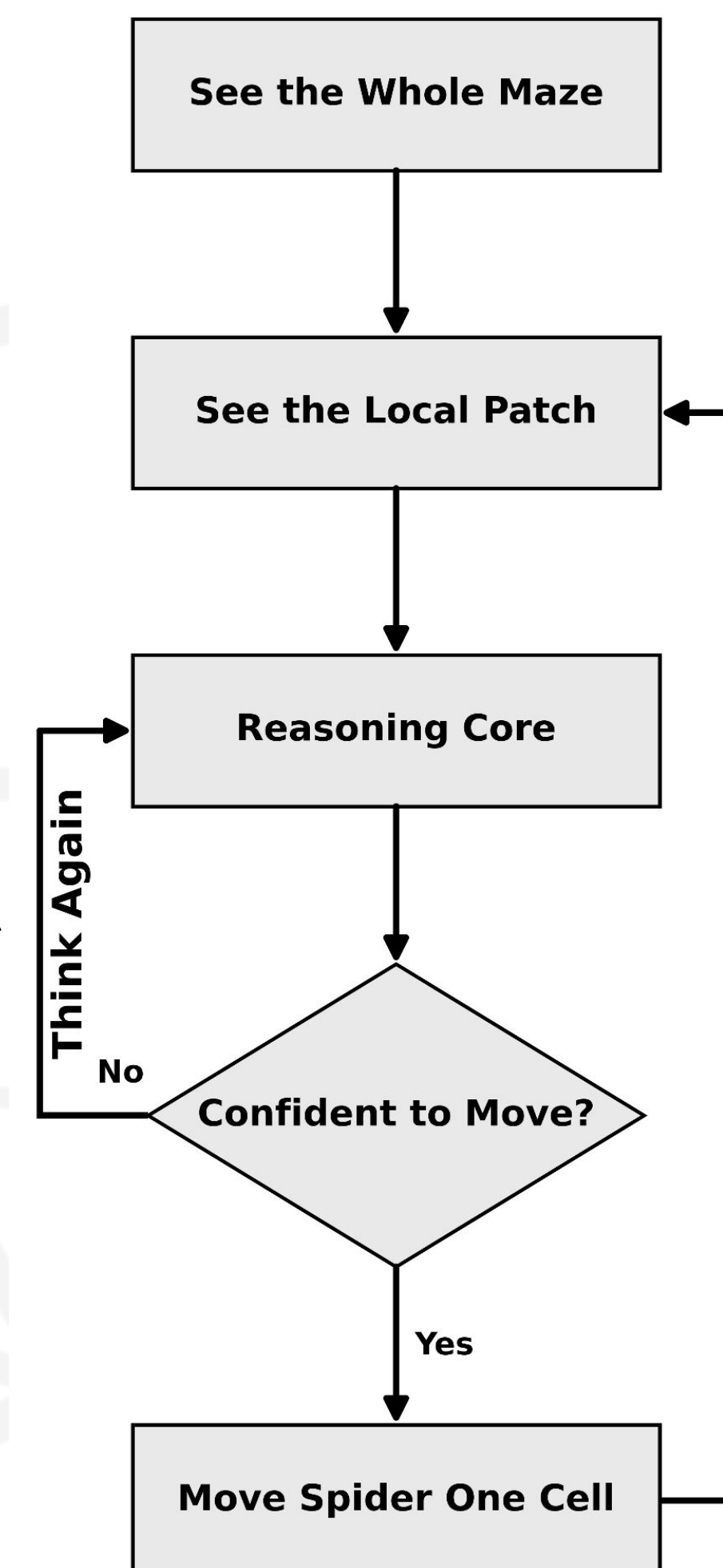
Jumping Spiders have small brains but are still excellent **navigators**. We built a spider-inspired model using **neural networks**.



Spider Architecture

3-Components:

- The Convolutional Neural Network: the **Eyes**
- The Hierarchal Reasoning Model: How it **thinks**
- The Q-Learning: Halting/Continuing, how much **energy** it spends.

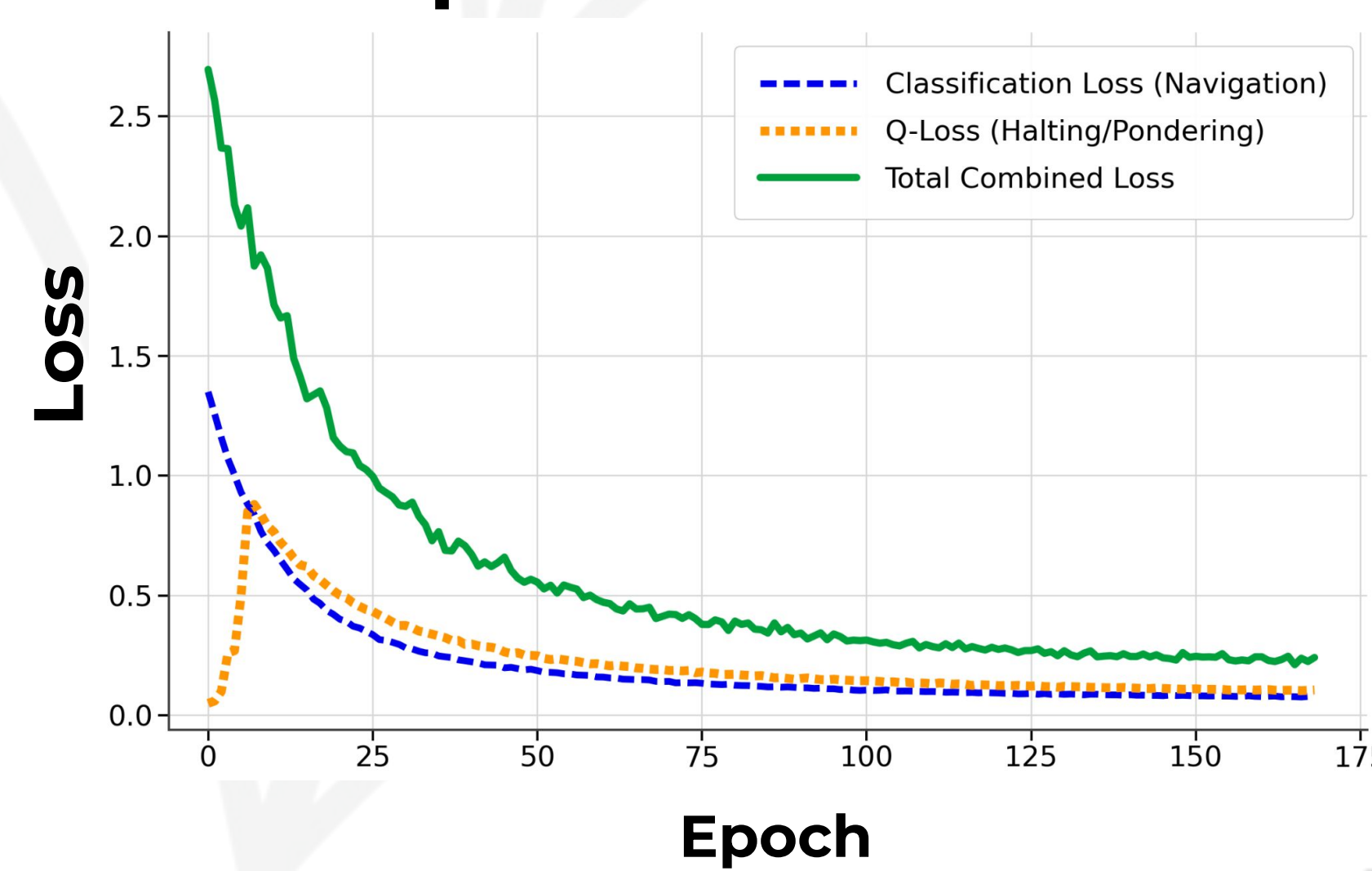


Training Data

Our agent trains on our mazes. It:

- Learns how long to **think per move**
- **Recovers from mistakes** with stable memory
- Both error curves lock into the **same shape**

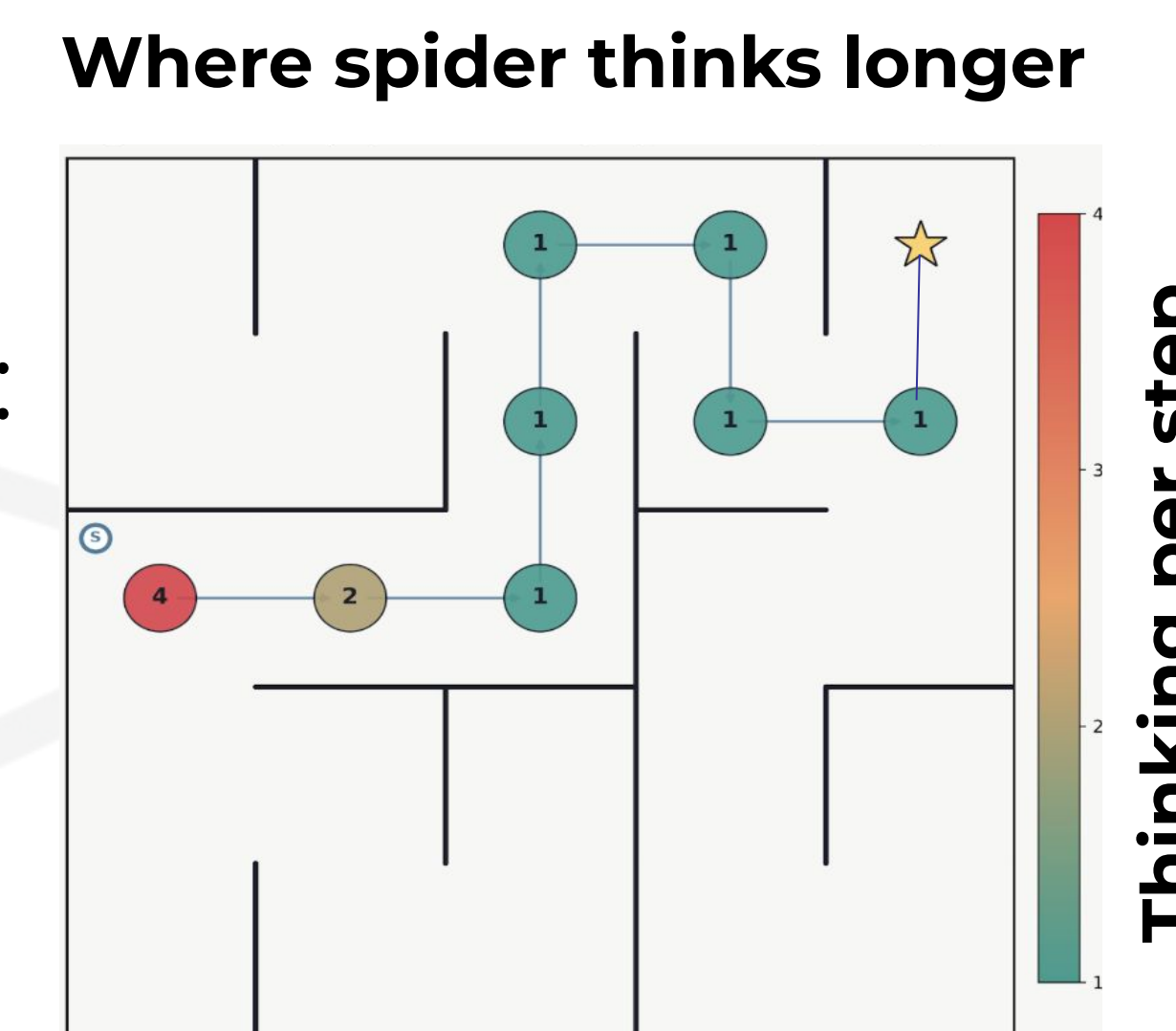
Spider HRM Loss



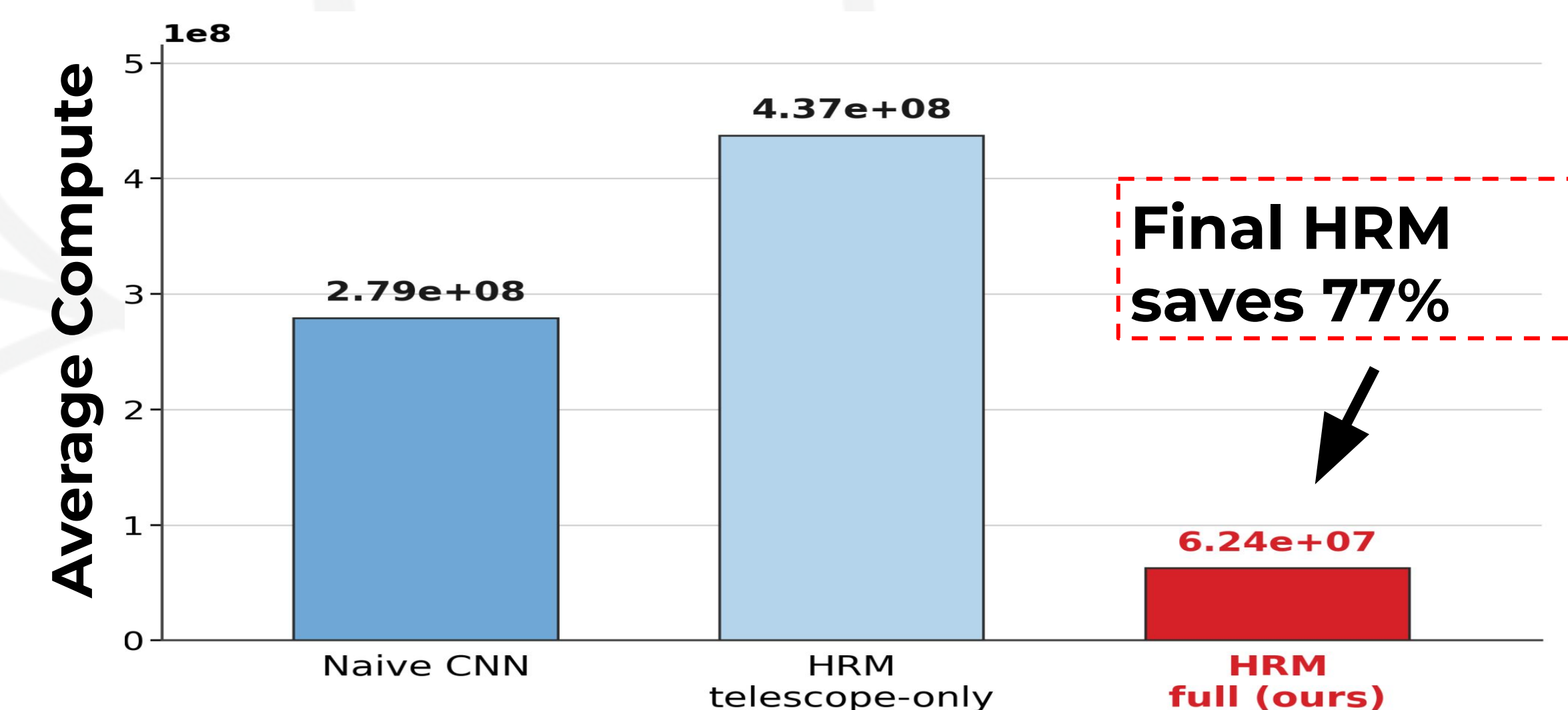
Spider Analytics

The model **dynamically** budgets its energy:

- **Pausing** at complex intersections
- Cruising through simple corridors



Results



Future Work

- Implementing a World Model
 - Predicting the efficacy of possible moves
 - Gives spider '**imagination**'
- Experimenting on bigger mazes

Maze Generation

We built a maze generator to train our spider:

- Based on **Reverse Depth First Search (DFS)**

