Learning to Predict Collisions

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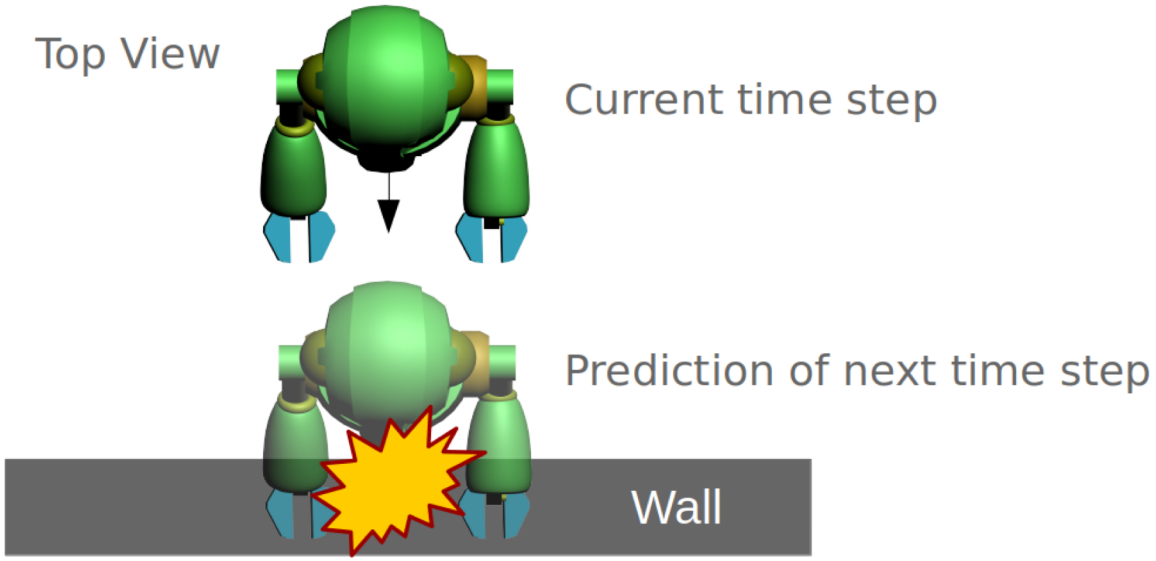
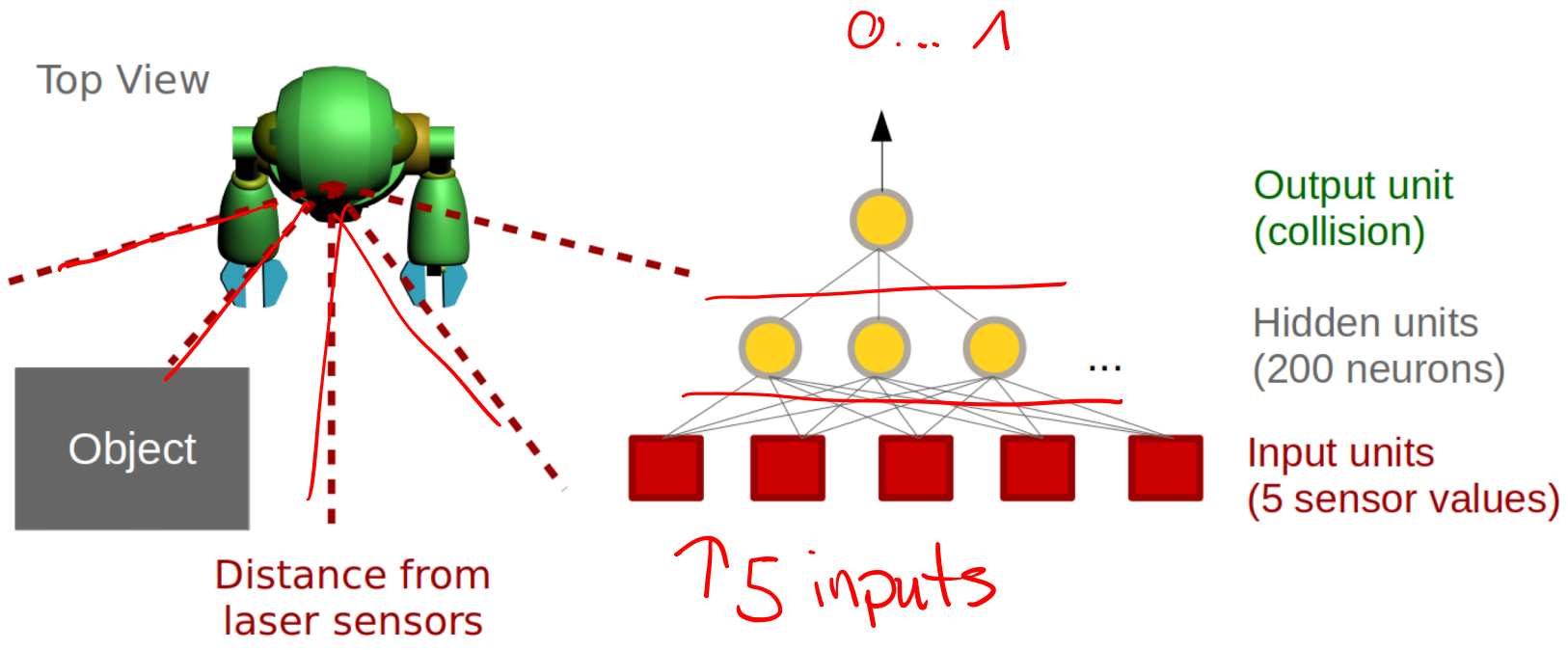
Example 1: Learning to Predict Collisions

- **Example task for deep learning in robotics**
- **Learning a predictive model of collisions**
- **Input to neural network: distance sensor values**
- **Output of neural network:**
  {collision, !collision}

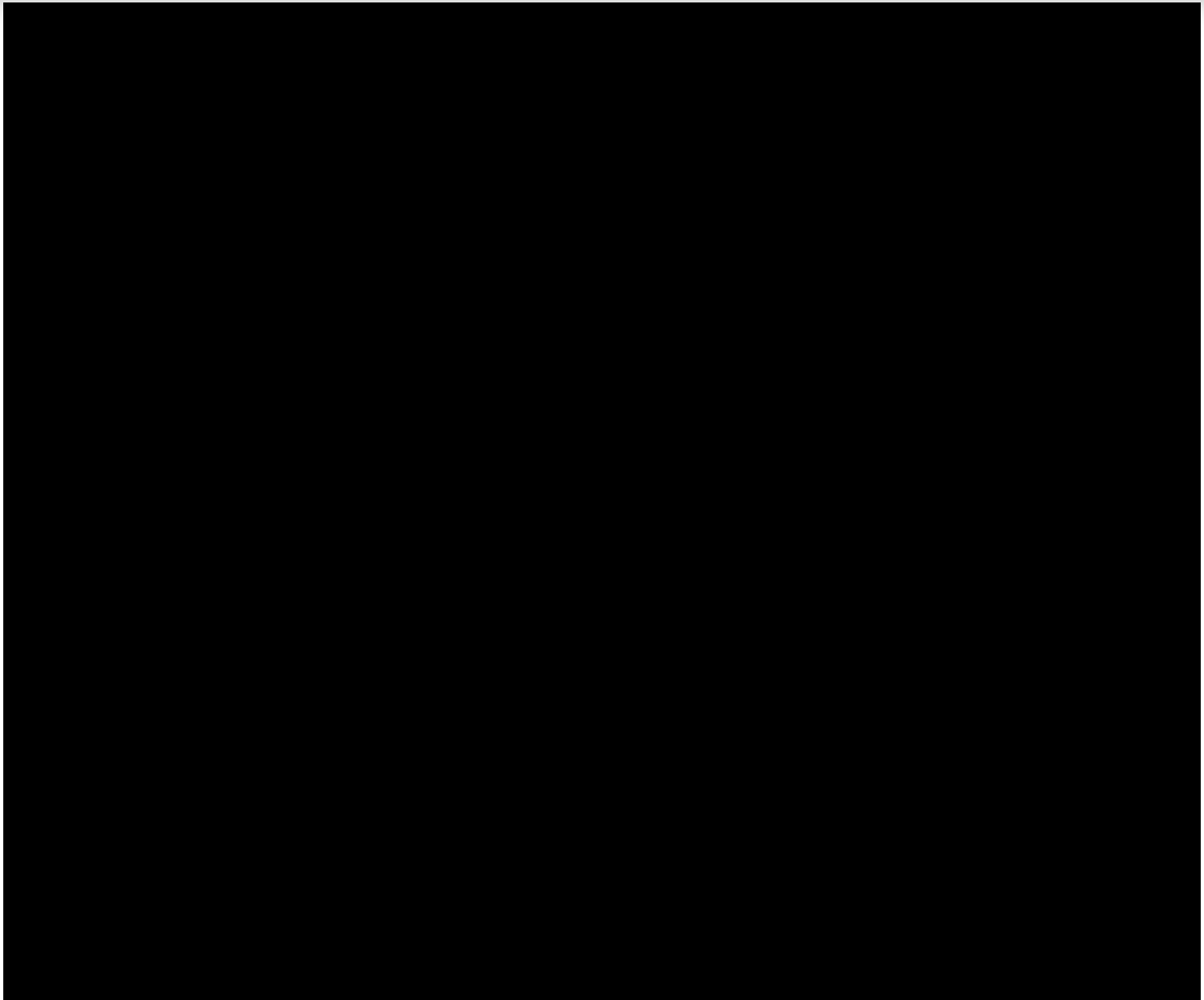


Example 1: After Training

- Our goal was to predict collisions
- After training, we use network to predict collision
- If collision is imminent → turn away from direction
- If no collision → turn to goal location

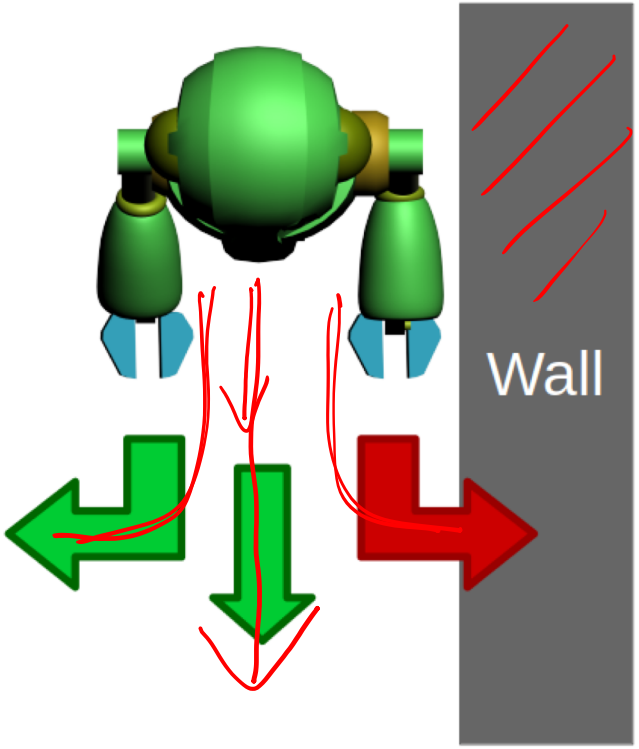


Example 1: After Training



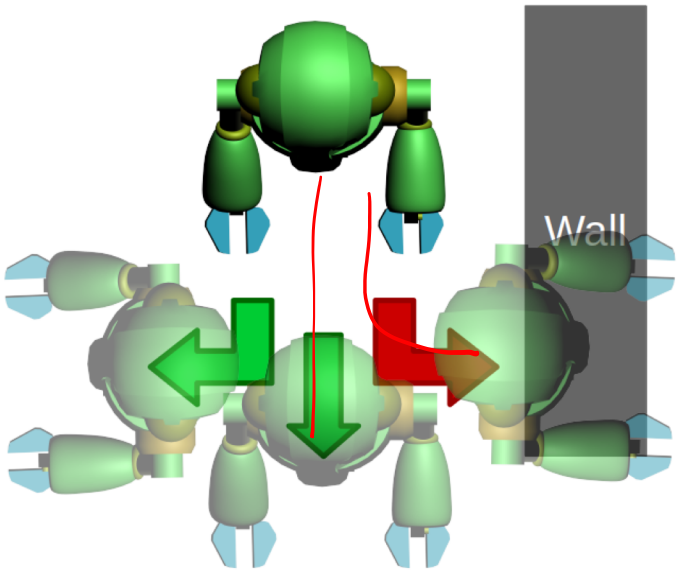
Action-Conditioned Predictive Models

- Our neural network does not take into account the robots action
- As a result it cannot disambiguate between situations where collision is dependent on action
- Example scenario:
  - Collision only occurs if robot turns right!



Action-Conditioned Predictive Models

- Solution: add the action of the robot into the predictive model
- Action becomes an input to the network
- Generally, action-conditioned predictive models are functions of form: $f(\mathbf{s}_t, \mathbf{a}) \rightarrow \mathbf{s}_{t+1}$



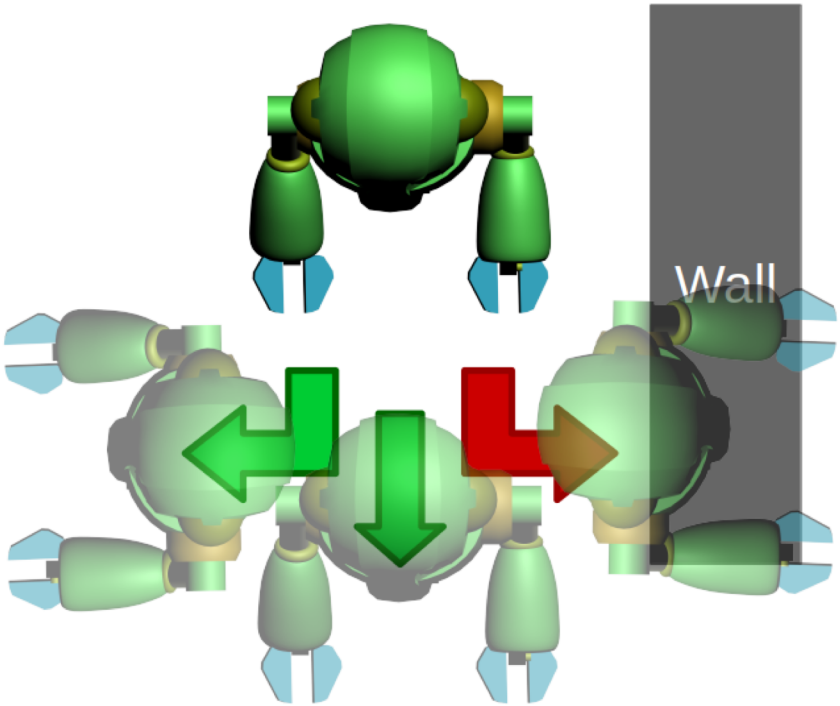
$f(s_t, a) \rightarrow [0 \ldots 1]$

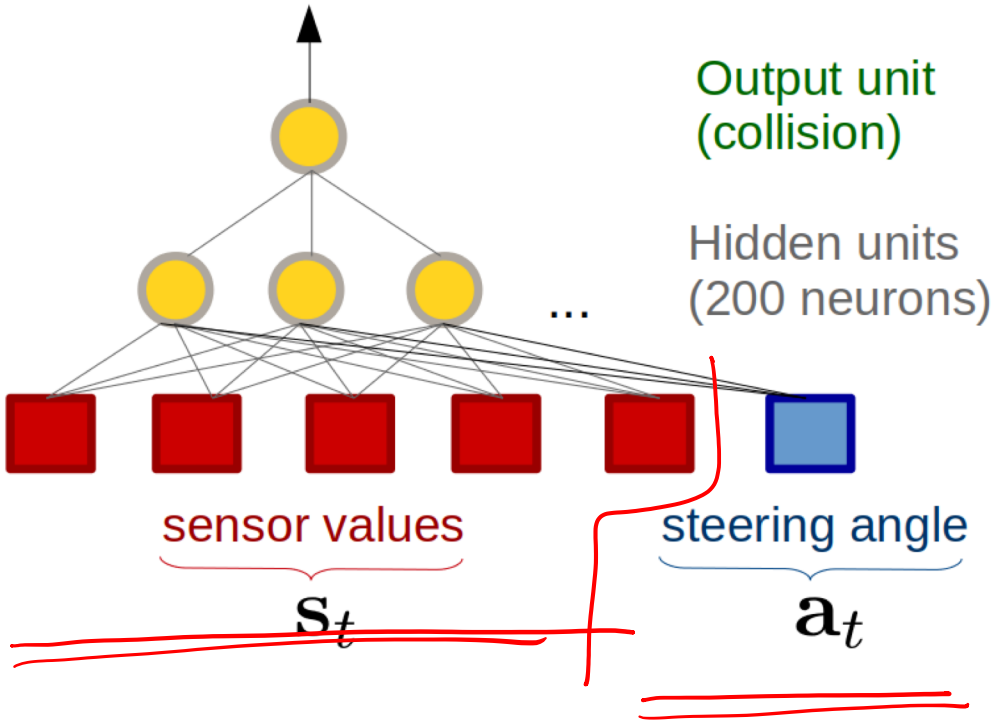
current state

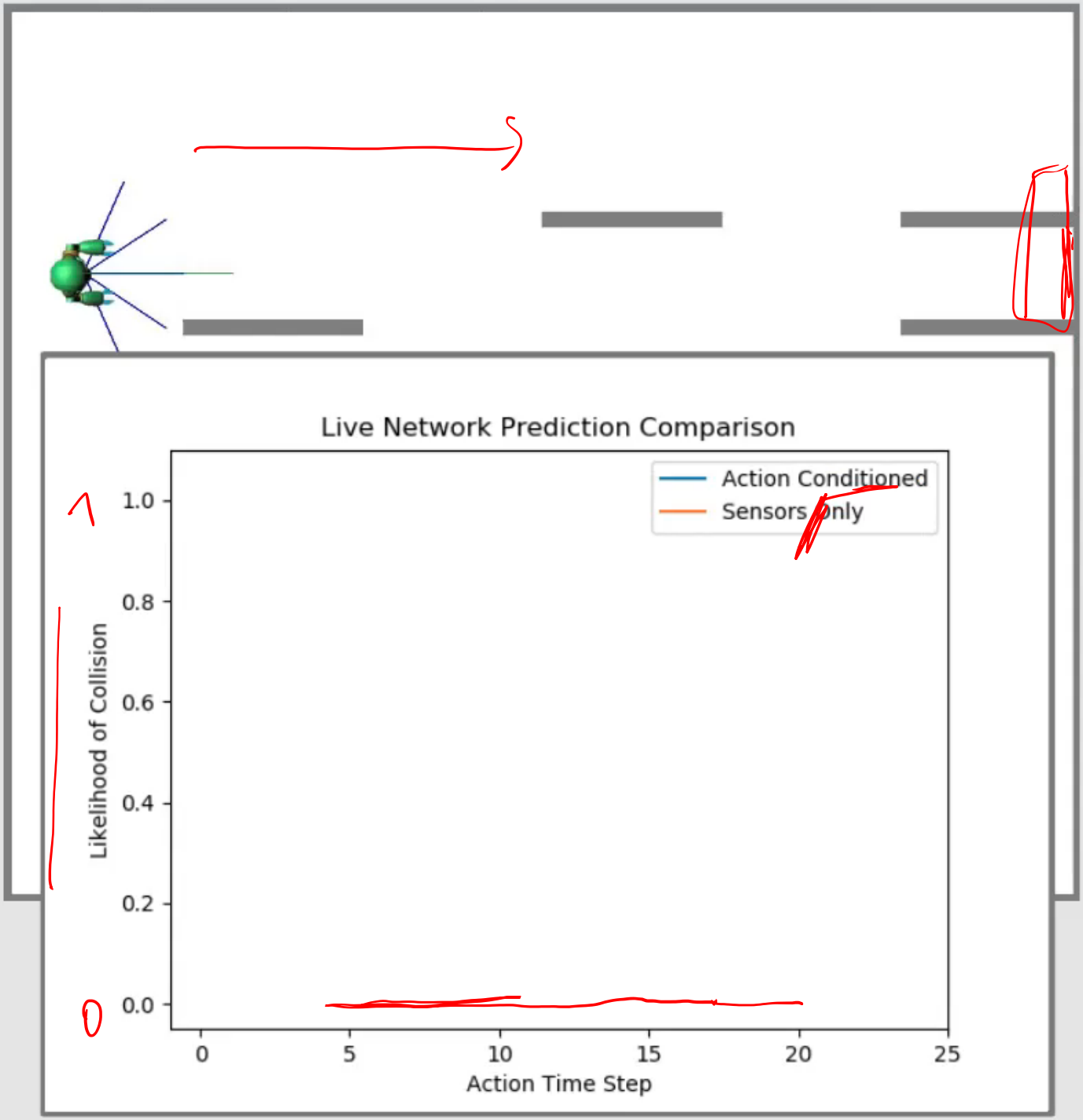
action

Action-Conditioned Predictive Models

$$f(\mathbf{s}_t, \mathbf{a}_t) \rightarrow \mathbf{s}_{t+1}$$






Live Network Prediction Comparison
Action Conditioned
Sensors only
Likelihood of Collision
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
Action Time Step