Using multistability to solve fading memory problems in reinforcement learning

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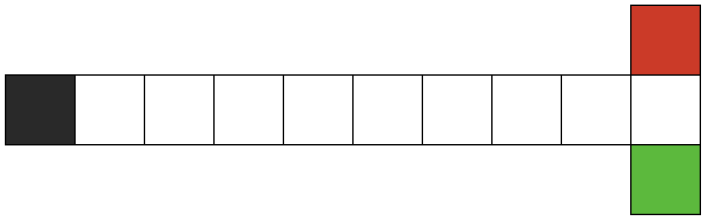


Figure 1: *T-maze* environment with a corridor length of 10. The agent is at the beginning of the corridor (black square) and the treasure if at the bottom of the junction (green square).

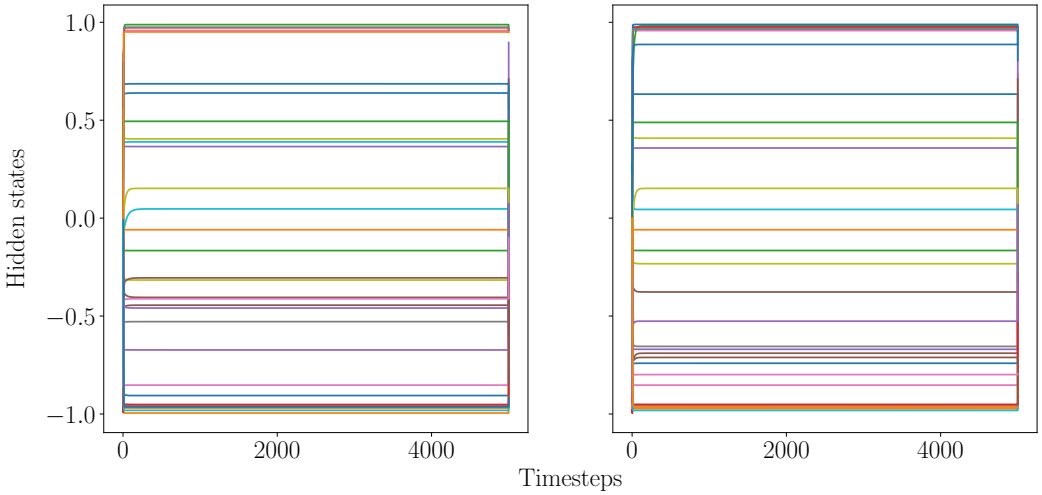


Figure 2: Evolution of the hidden states of a 32-units nBRC agent on two *T-maze* environments with a corridor length of 5000, one with the treasure at the top of the junction, and the other with the treasure at the bottom. The agent wins in both environments.

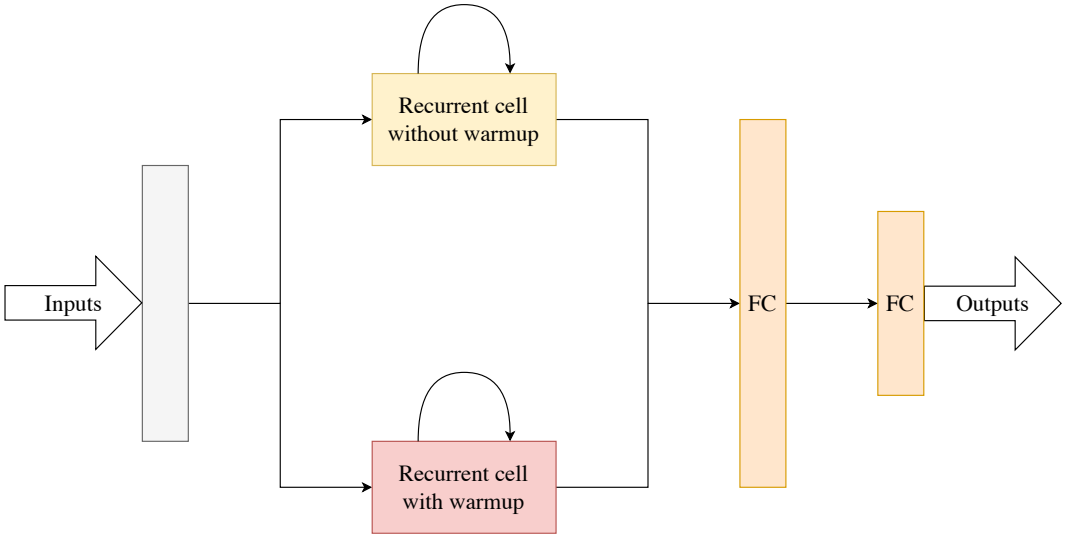


Figure 3: Double layer model used in the experiment. The inputs are passed to two recurrent cells including one that has been pretrained with the warmup. The outputs of these two cells are then concatenated and passed to two fully connected layer.

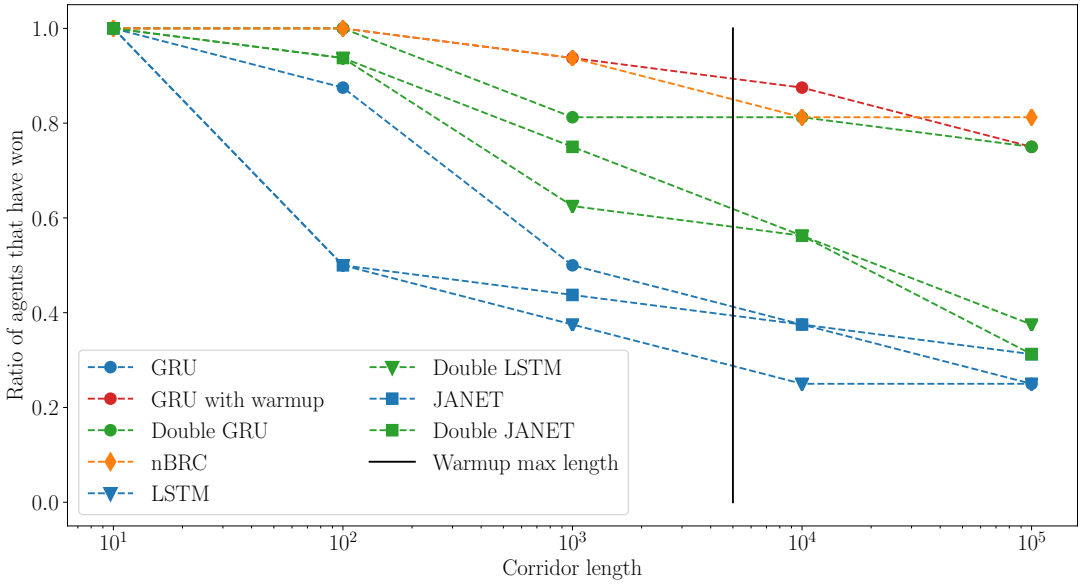
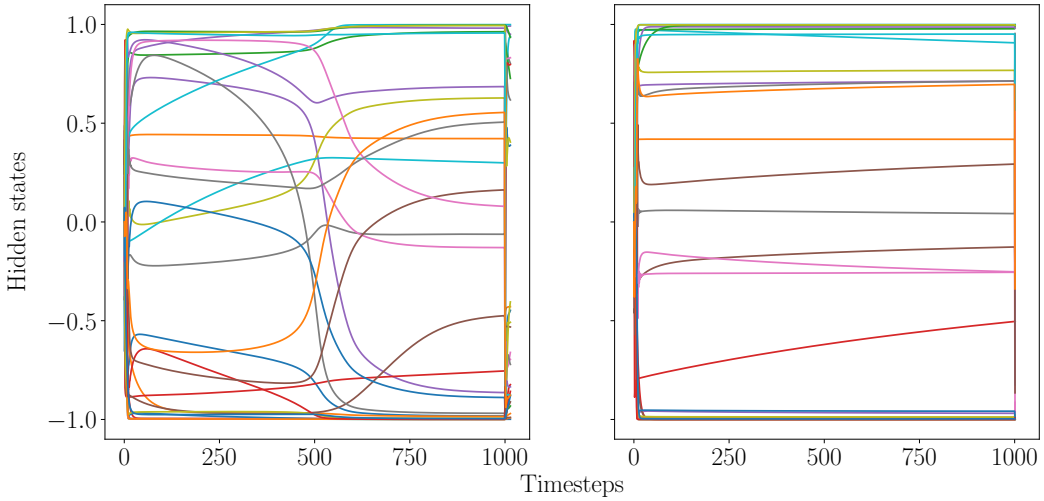
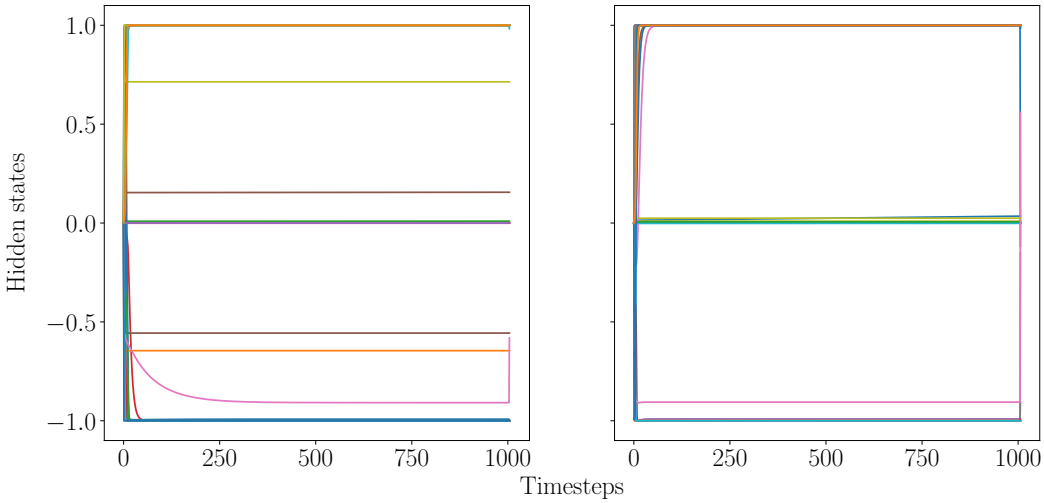


Figure 4: Evolution of the ratio of the agents that always win in the *T-maze* environment to the total number of agents trained (16) with respect to the corridor length. The circles are related to GRU, the diamonds to nBRC, the triangles to LSTM and the squares to JANET. The green lines correspond to the double layer models, while the blue ones correspond to the simple layer version with no warmup.



(a) Simple GRU agent, loses when treasure is at the bottom (left graph).



(b) Double GRU agent, wins in both cases.

Figure 5: Evolution of the hidden states of a simple GRU agent and a double GRU agent.