



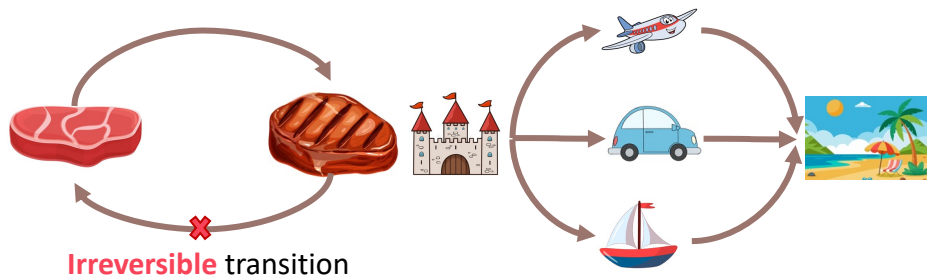
Probabilistic World Modeling with Asymmetric Distance Measure

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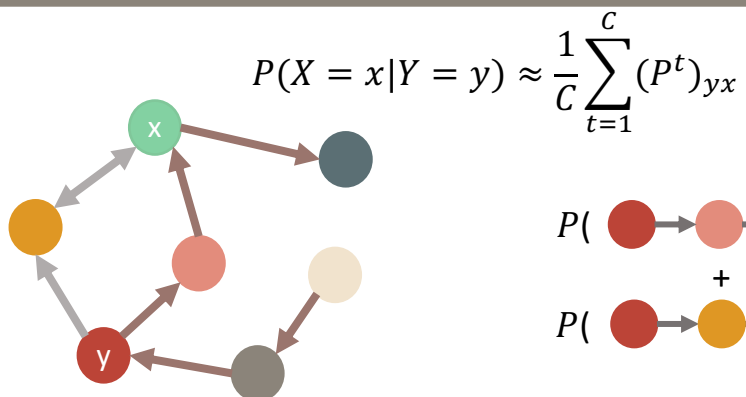


*A good representation for planning
in a stochastic world*

- **Asymmetric** distance function
- **Multi-way** probabilistic inference



C-step reaching probability



$$P(\text{red} \rightarrow \text{orange} \rightarrow \text{green})$$

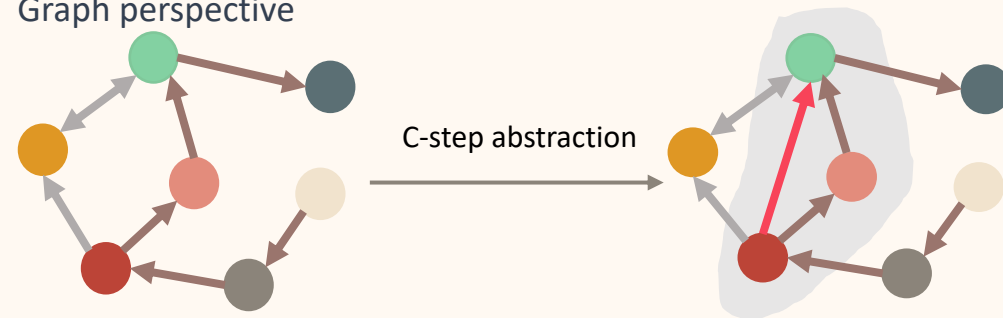
$$+$$

$$P(\text{red} \rightarrow \text{yellow} \rightarrow \text{green})$$

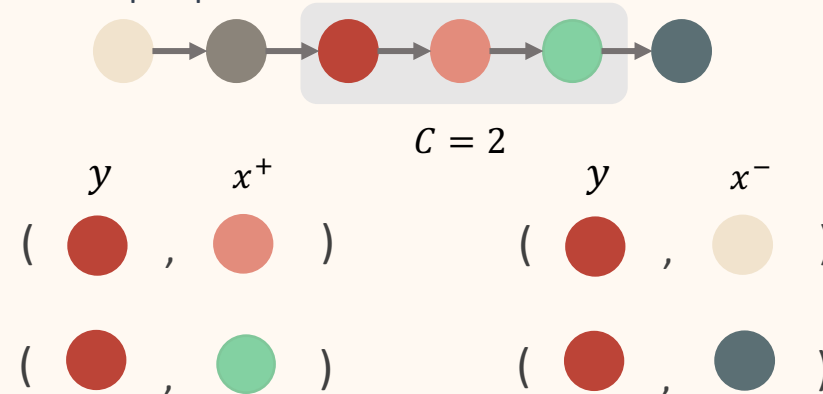
Asymmetric contrastive learning

$$\exp(s(\varphi(x), \phi(y))) = \frac{P(x|y)}{KP_n(x)}$$

Graph perspective



Markov chain perspective



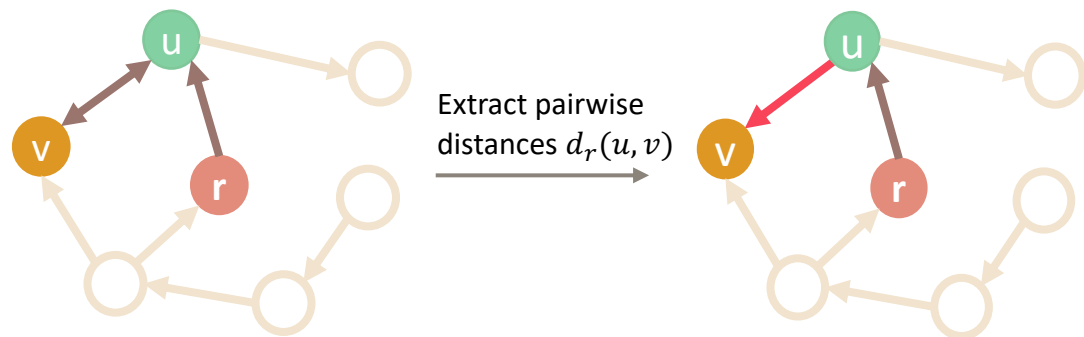


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Reference state conditioned distance measure



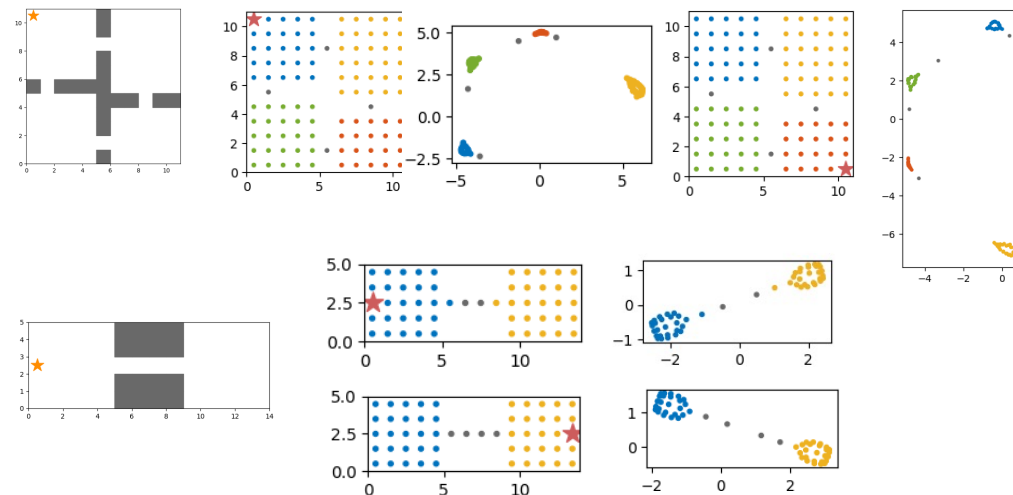
$$\phi(\text{red}) \rightarrow \phi(\text{green}) \leq \phi(\text{red}) \rightarrow \phi(\text{orange})$$

Choose $\phi(\text{green}) \rightarrow \phi(\text{orange})$

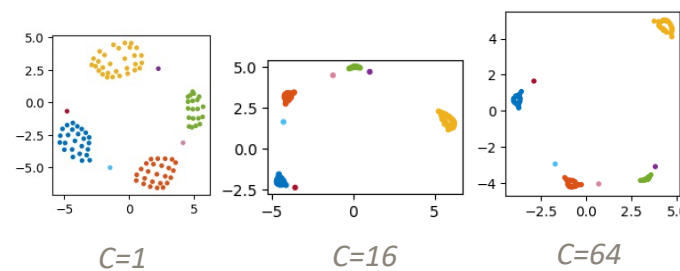
Subgoal discovery

- Define **subgoals** as the states that **reduce** pairwise reaching probability, as perceived from the agent's current state.
- Identified using DBSCAN on the latent point density estimated according to $d_r(u, v)$.

Experiments



Ablation on step size C



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paper