

# KEA: Keeping Exploration Alive by Proactively Coordinating Exploration Strategies

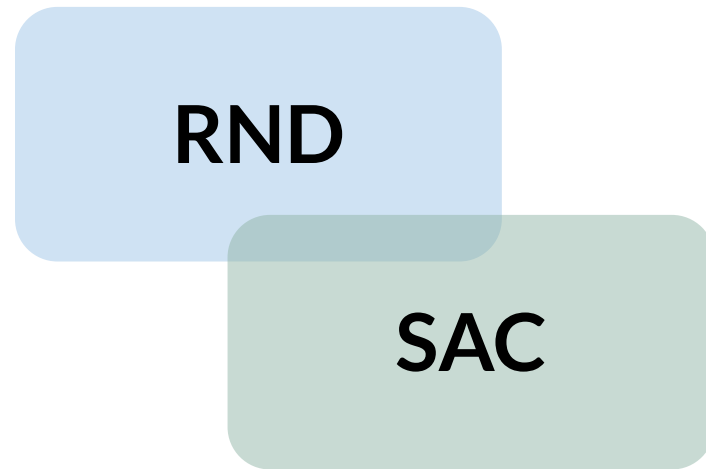
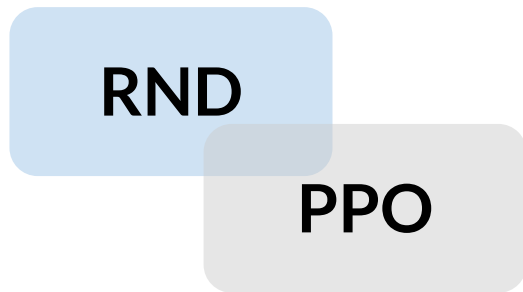
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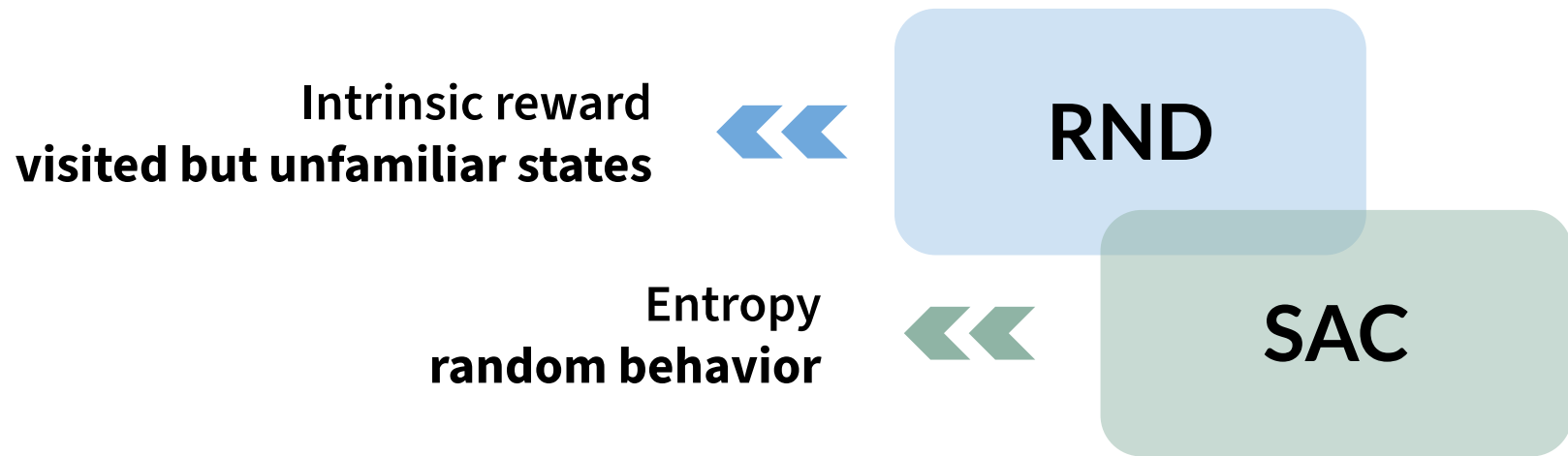
**AASS, Örebro University, Sweden**



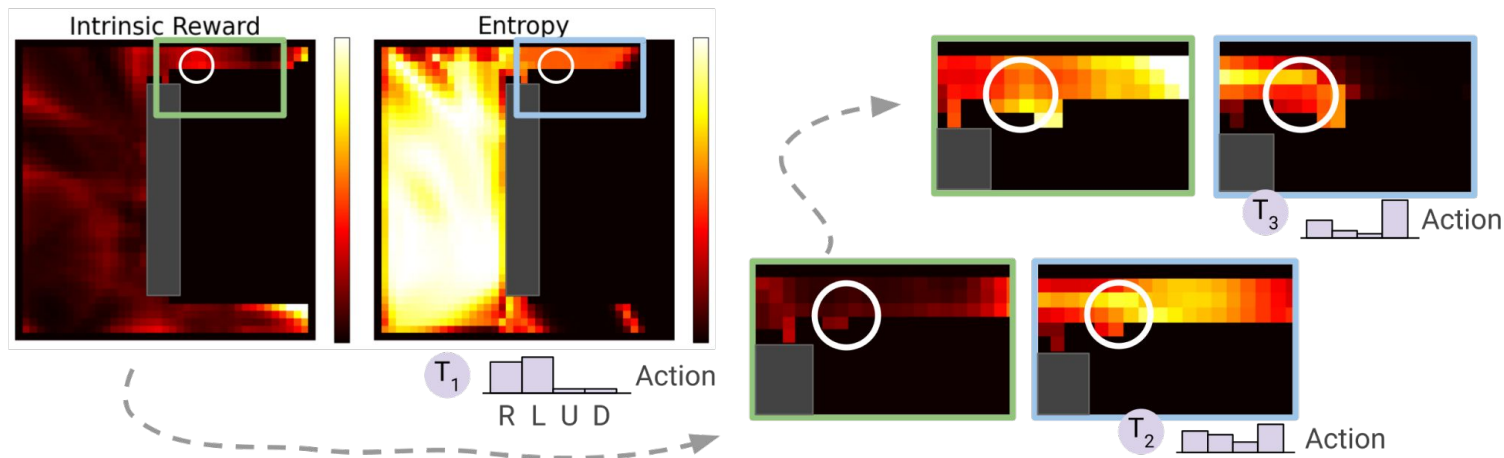
# SAC + Novelty-based Exploration



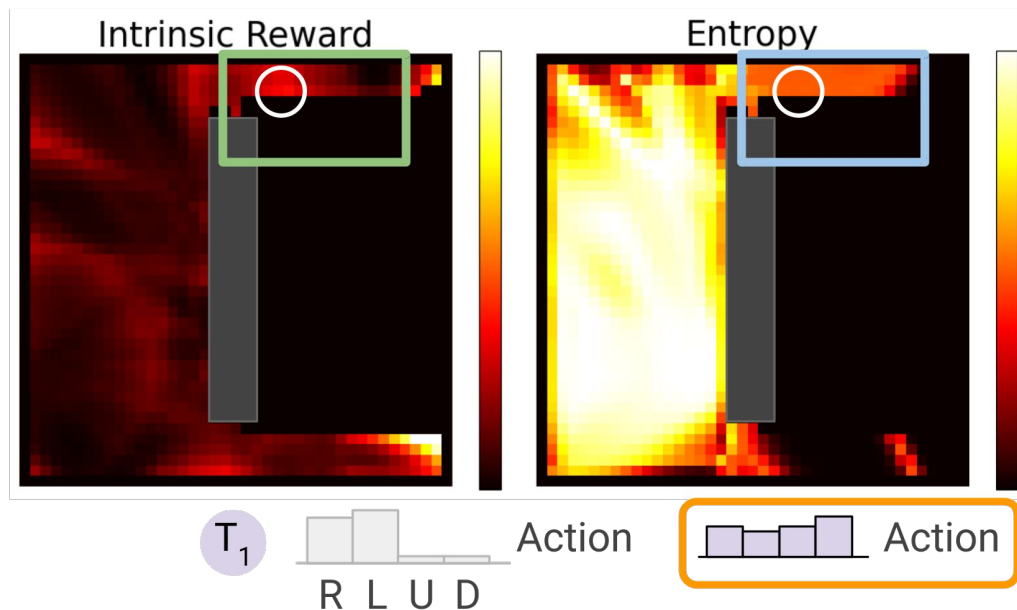
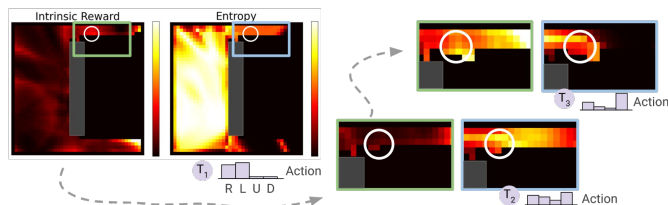
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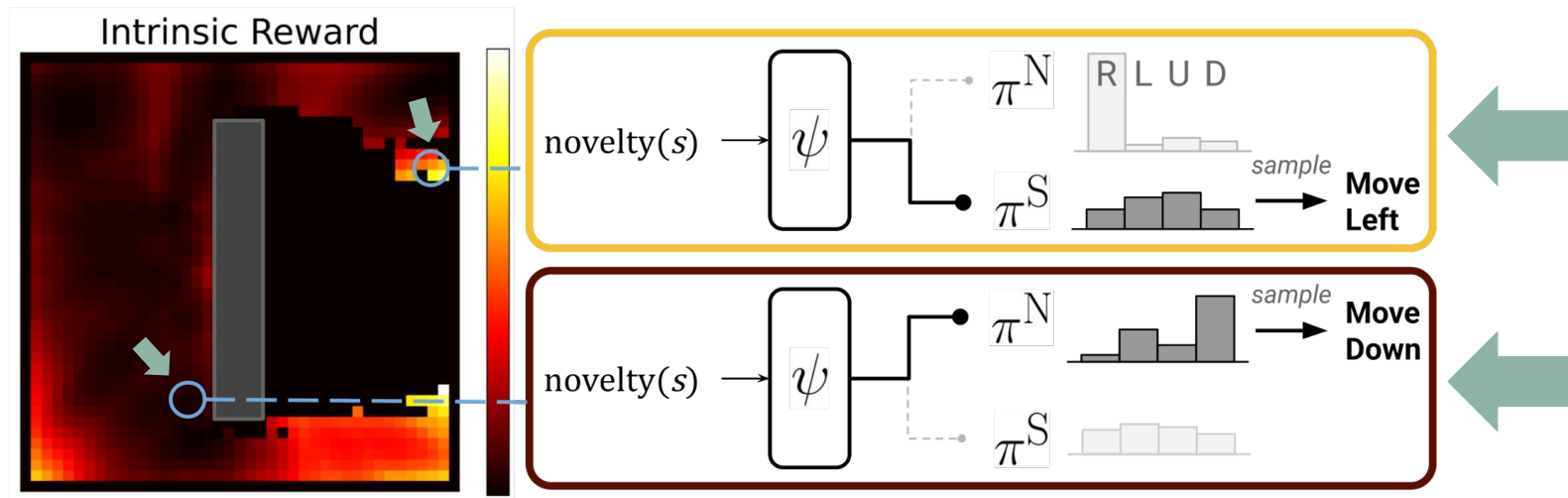


Familiar regions: Revisit and refine promising actions.  
Unfamiliar regions: Make bold, random moves.

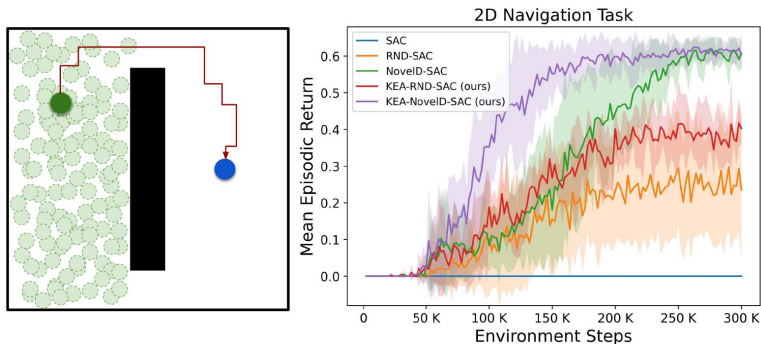


$\pi^N$ : Policy from the novelty-augmented agent

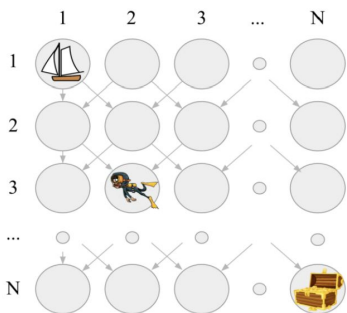
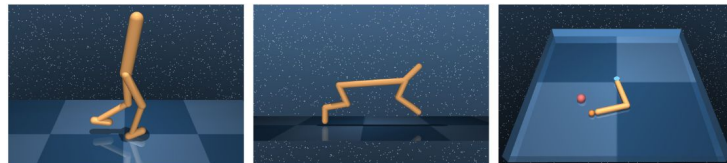
$\pi^S$ : Policy from the standard agent



# Experimental Results



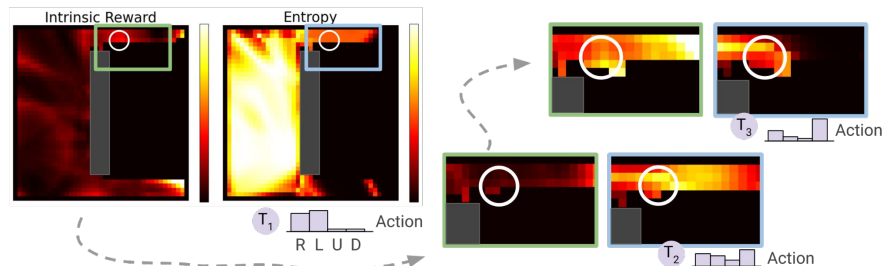
Method	Walker Run Sparse	Cheetah Run Sparse	Reacher Hard Sparse
SAC	0. $\pm$ 0.	0. $\pm$ 0.	715.17 $\pm$ 216.57
RND-SAC	287.65 $\pm$ 334.12	512.02 $\pm$ 466.26	790.32 $\pm$ 143.26
KEA-RND-SAC (ours)	<b>629.74 <math>\pm</math> 196.75</b>	<b>773.76 <math>\pm</math> 162.74</b>	<b>874.61 <math>\pm</math> 94.58</b>
NovelD-SAC	553.26 $\pm$ 191.03	647.29 $\pm$ 382.58	<b>860.40 <math>\pm</math> 76.15</b>
KEA-NovelD-SAC (ours)	<b>706.47 <math>\pm</math> 389.23</b>	<b>734.67 <math>\pm</math> 316.95</b>	837.12 $\pm$ 68.95



Algorithm	DeepSea 10	DeepSea 14	DeepSea 20	DeepSea 24	DeepSea 30
DeRL-A2C (Schäfer et al., 2021)	0.98 $\pm$ 0.10	0.65 $\pm$ 0.23	0.42 $\pm$ 0.16	0.07 $\pm$ 0.10	0.09 $\pm$ 0.08
DeRL-PPO (Schäfer et al., 2021)	0.61 $\pm$ 0.20	0.92 $\pm$ 0.18	-0.01 $\pm$ 0.01	0.63 $\pm$ 0.27	-0.01 $\pm$ 0.01
DeRL-DQN (Schäfer et al., 2021)	0.98 $\pm$ 0.09	0.95 $\pm$ 0.17	0.40 $\pm$ 0.08	0.53 $\pm$ 0.27	0.10 $\pm$ 0.10
SOFE-A2C (Castanyer et al., 2024)	0.94 $\pm$ 0.19	0.45 $\pm$ 0.31	0.11 $\pm$ 0.25	0.08 $\pm$ 0.14	0.04 $\pm$ 0.09
SOFE-PPO (Castanyer et al., 2024)	0.77 $\pm$ 0.29	0.67 $\pm$ 0.33	0.13 $\pm$ 0.09	0.07 $\pm$ 0.15	0.09 $\pm$ 0.23
SOFE-DQN (Castanyer et al., 2024)	0.97 $\pm$ 0.29	0.78 $\pm$ 0.21	0.70 $\pm$ 0.28	0.65 $\pm$ 0.26	0.42 $\pm$ 0.33
SAC	0.98 $\pm$ 0.01	0.69 $\pm$ 0.23	0.00 $\pm$ 0.00	0.00 $\pm$ 0.00	0.00 $\pm$ 0.00
RND-SAC	<b>0.99 <math>\pm</math> 0.01</b>	0.92 $\pm$ 0.13	0.89 $\pm$ 0.09	0.67 $\pm$ 0.35	0.35 $\pm$ 0.44
KEA-RND-SAC (ours)	<b>0.99 <math>\pm</math> 0.01</b>	<b>0.99 <math>\pm</math> 0.01</b>	<b>0.92 <math>\pm</math> 0.05</b>	<b>0.81 <math>\pm</math> 0.18</b>	<b>0.54 <math>\pm</math> 0.32</b>

# KEA: Keeping Exploration Alive by Proactively Coordinating Exploration Strategies

Analyze a potential issue when combining SAC with novelty-based exploration



KEA proactively coordinates exploration strategies to improve exploration efficiency

