challenging Montezuma's Revenge
intrinsic motivation in RL

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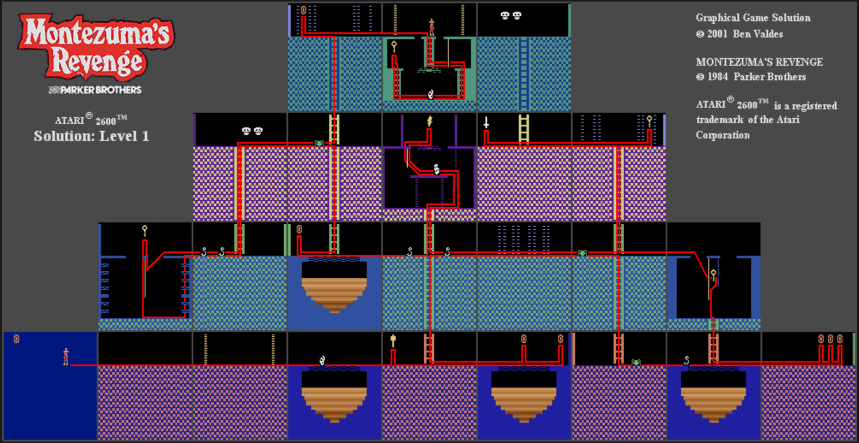
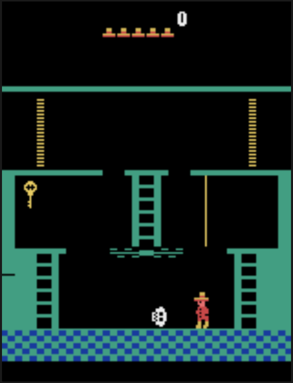
Montezuma’s Revenge



Montezuma's Revenge



- **very sparse rewards -** hundrets of steps
- **huge state space**
- **hard exploration**
- **needs returns back**

highlighted score

https://paperswithcode.com/sota/atari-games-on-atari-2600-montezumas-revenge

year	name	score
2015	Deep Reinforcement Learning with Double Q-learning	0
2021	MuZero	2500
2018	Count-Based Exploration with Neural Density Models [1]	3705
2019	**Exploration by Random Network Distillation** [2]	**8152**
2021	GoExplore* [3]	43 000

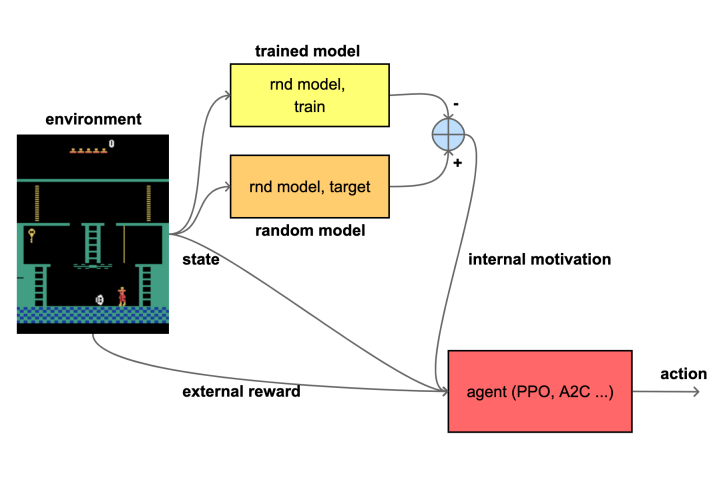
*** : requires environment state saving/loading**

[1] https://arxiv.org/abs/1703.01310

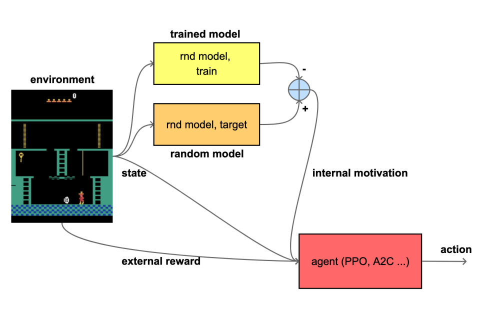
[2] https://arxiv.org/abs/1810.12894

[3] https://arxiv.org/abs/2004.12919

random network distillation

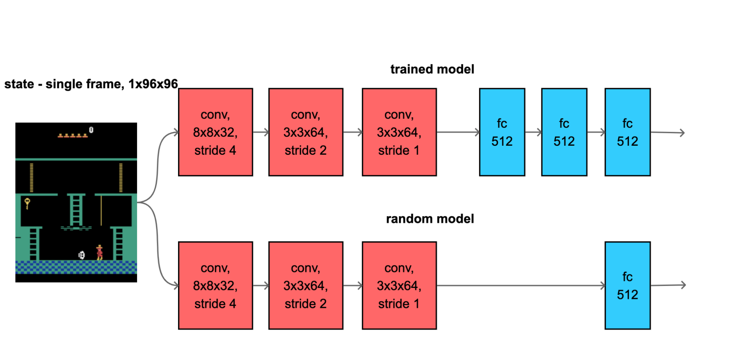


random network distillation

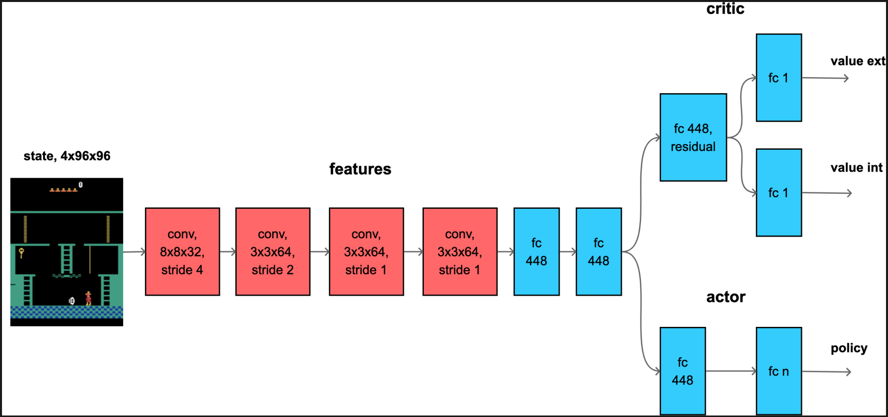


- neural network works as **novelty detector**
- model learns to imitate random (target) model
- **less visited states produce bigger motivation signal**
- orthogonal weights initialisation ($g = 2^{0.5}$) for strong signal
- lot of fully connected layers **to avoid generalisation**

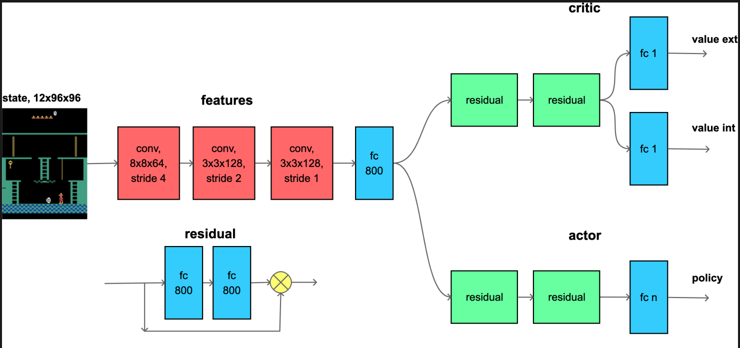
random network distillation architecture



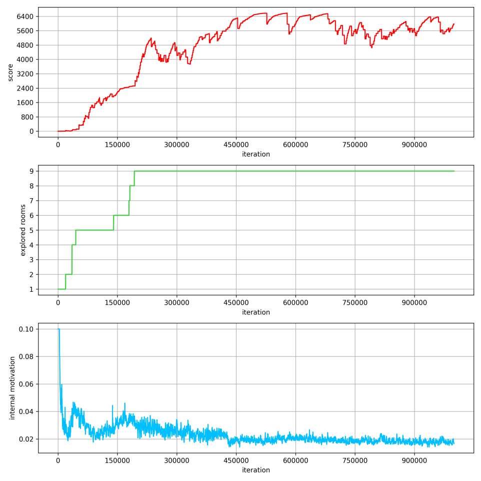
ppo model architecture



ppo model architecture



results



- 1M steps - **20% of original paper**
- 128 parallel envs = total 128M steps
- **score 6400**
- **9 rooms explored**

Q&A