



Experience-based Knowledge Correction for Robust Planning in Minecraft

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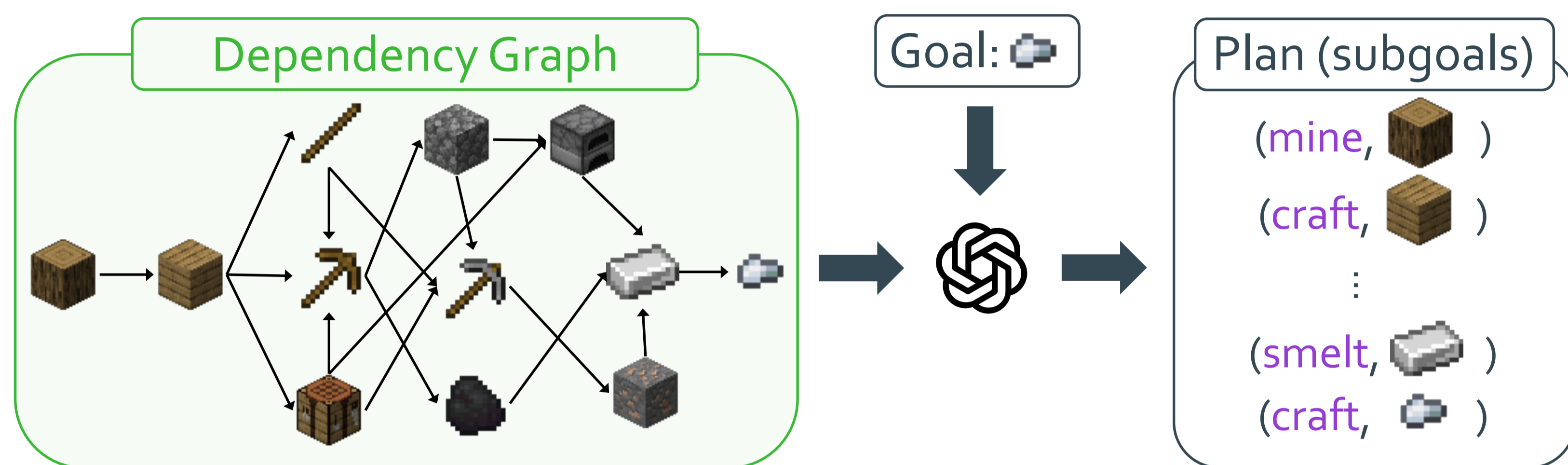


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Graph-based Planning Agents in Minecraft



Limitations of previous graph-based planning agents :

Dependency knowledge: they often assume LLMs know it, or that expert data is available.

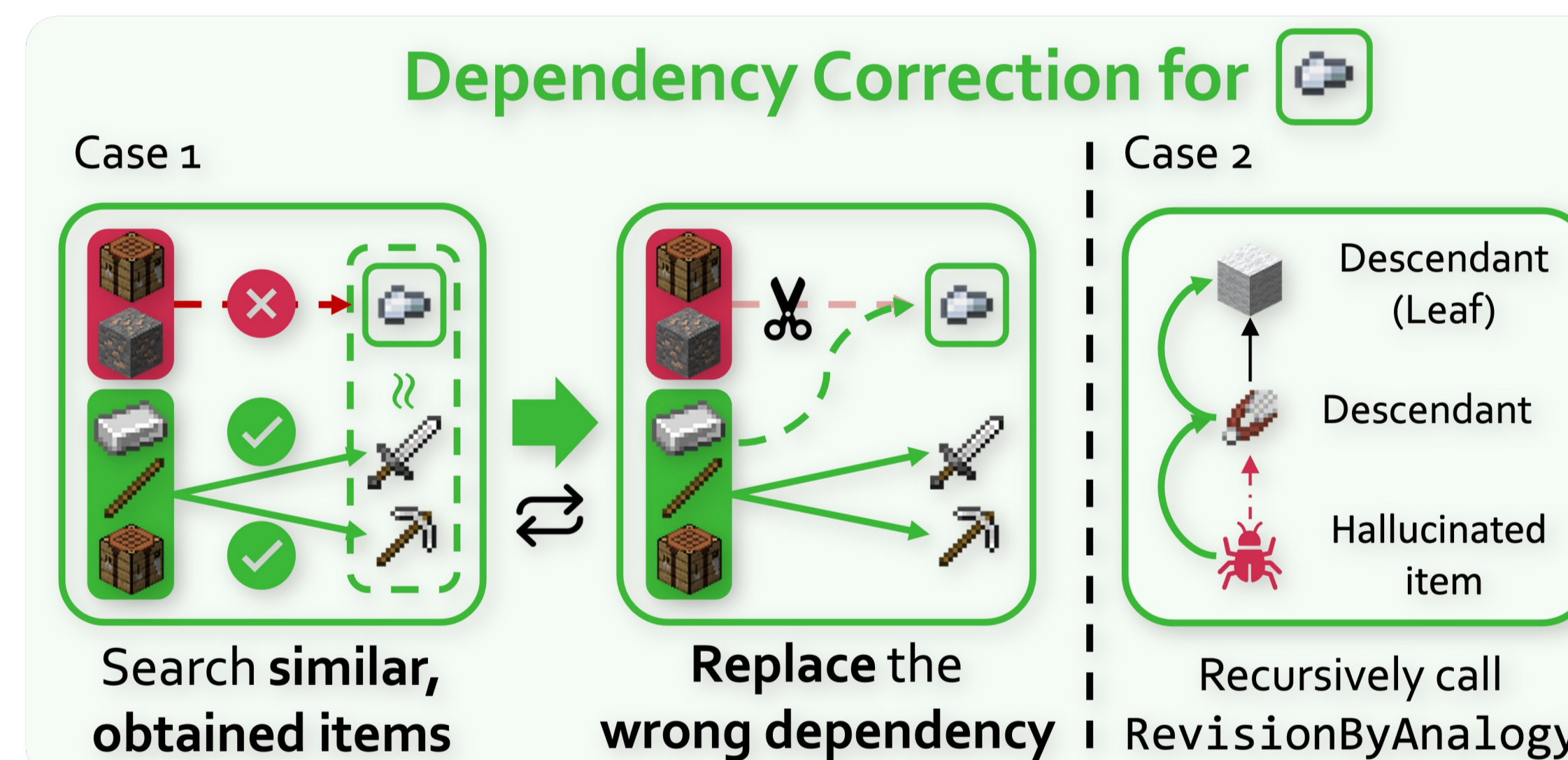
Action knowledge: they either lack a knowledge correction mechanism or cannot reliably correct wrong actions from feedback.

Takeaway – Do not blindly trust LLMs!

For robust planning,

1. Store knowledge in structured external memory, and plan with it.
2. Correct the knowledge algorithmically leveraging experience, not by prompting the LLM to self-correct.

Dependency correction *without* prompting the LLM

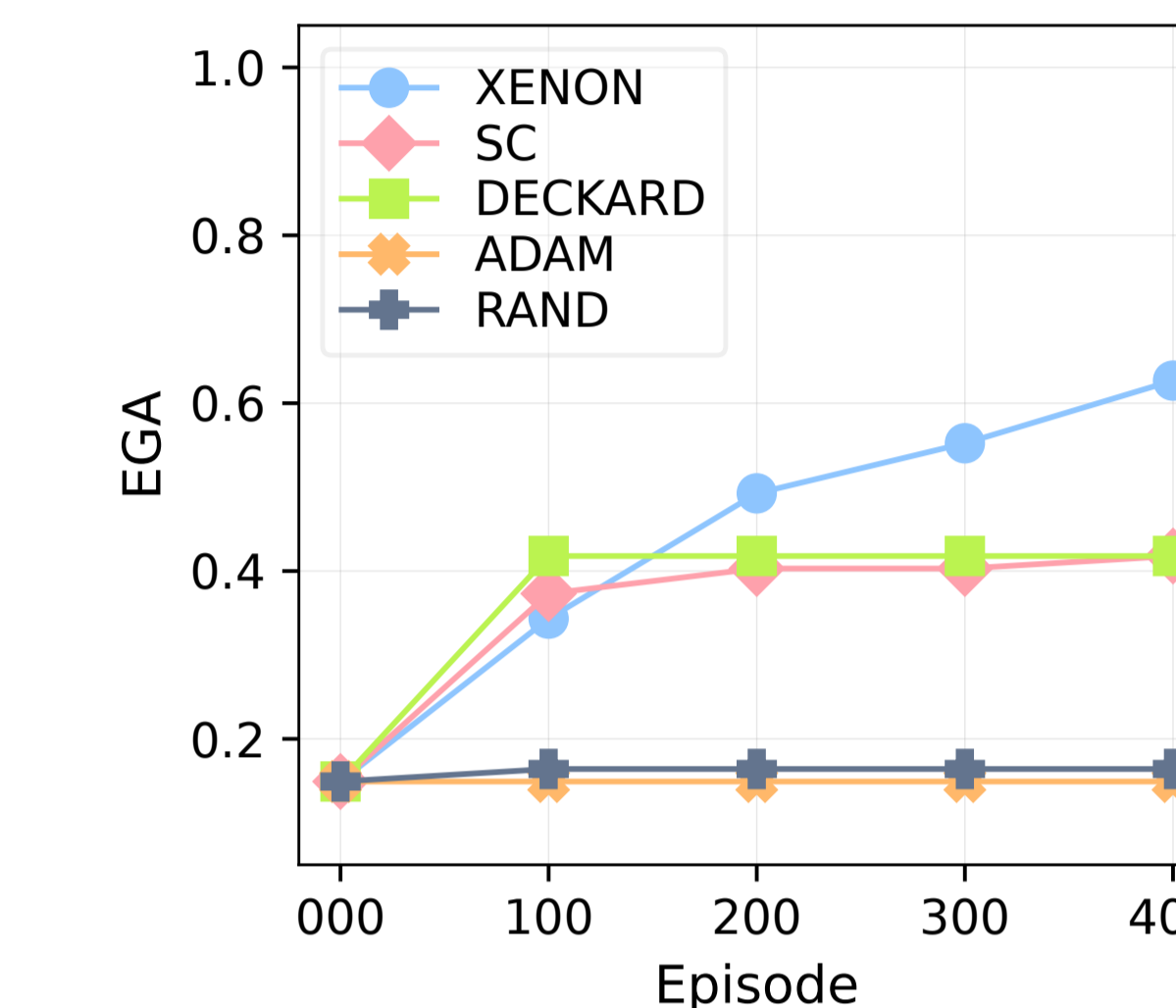


Dependencies are initialized by LLM predictions.

Graph structure and experience let XENON revise and learn dependencies despite flawed LLM priors.

Case 1: failures \leq threshold.
Case 2: failures $>$ threshold.

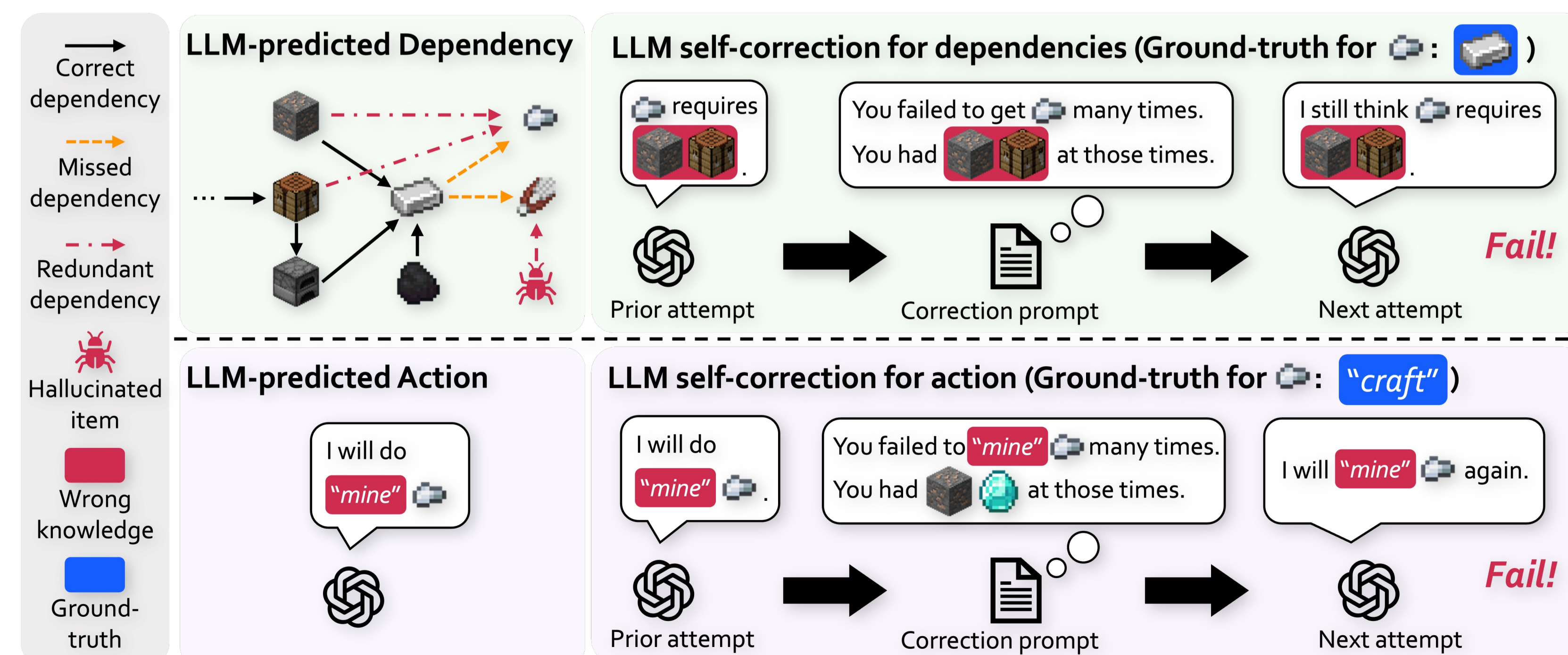
XENON robustly learns knowledge from limited priors



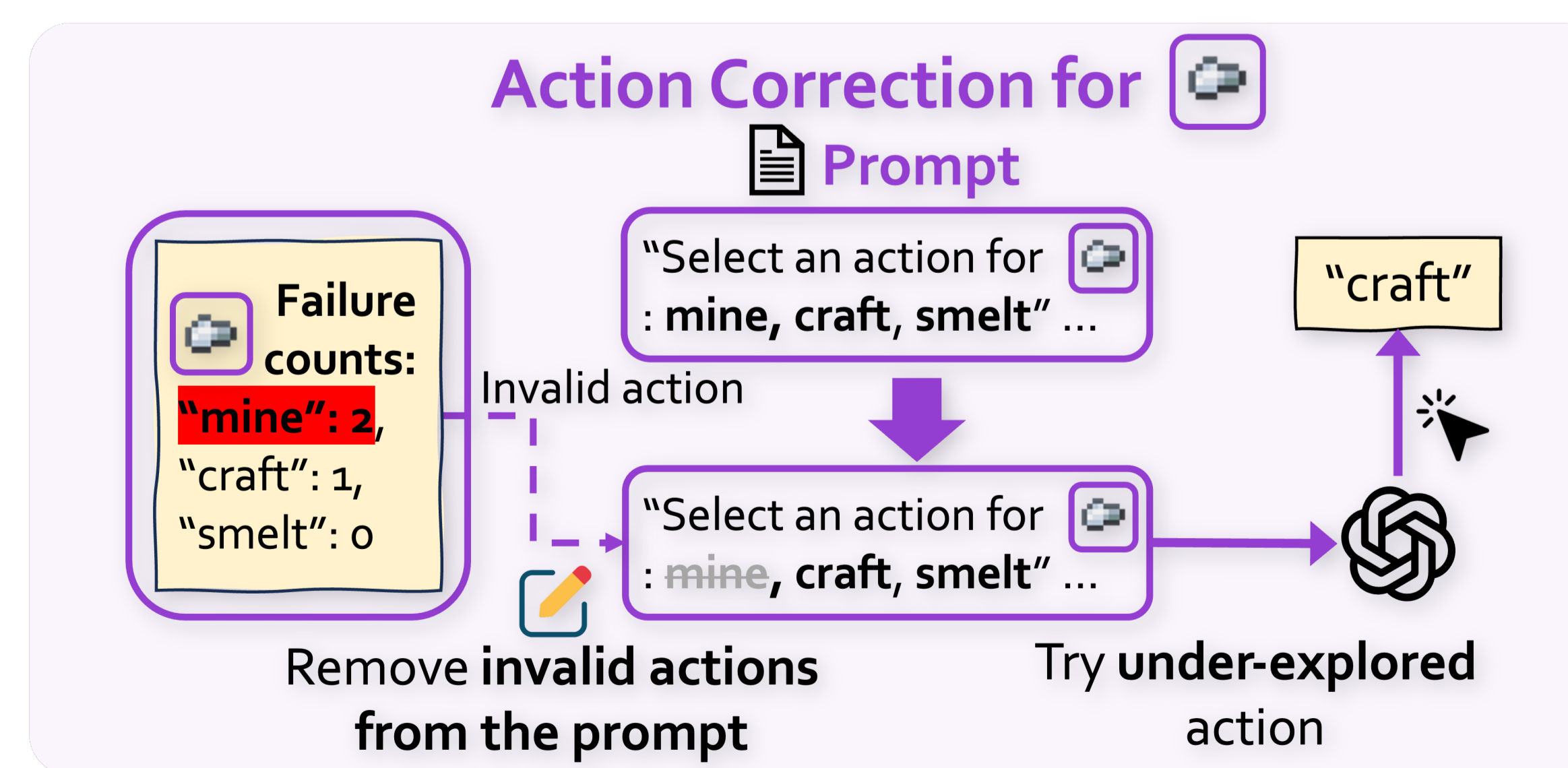
Agent	Dependency Correction	Action Correction
XENON	O	O
SC (self-correction)	O	O
DECKARD	X	X
ADAM	-	X
RAND	X	X

Y-axis (EGA): fraction of goal items with correctly learned dependencies.
Environment: MineRL. Planner LLM: Qwen2.5-VL-7B.

LLMs struggle to self-correct their flawed priors



Action correction by reliably avoiding failed actions



Structured action memory + failed-action pruning enable valid action discovery despite flawed LLM priors.

If all actions fail for an item, XENON triggers dependency correction to seek a detour path.

With only a 7B LLM, XENON beats prior GPT-based agents

Agent	Dependency	Planner LLM	All items Success Rate	Items Success rate	Items Success rate
Jarvis-1	Given	GPT-4o	0.38	0.08	0.07
Optimus-1	Given	GPT-4o	0.43	0.11	0.08
Optimus-2	Given	GPT-4o	0.45	0.13	0.09
XENON	Given	7B LLaMA	0.79	0.75	0.73
XENON	Learned	7B LLaMA	<u>0.54</u>	<u>0.64</u>	0.74

Success condition: the agent obtains the goal item from an empty inventory.

Future work

1. Extend experience-based knowledge correction to less structured, continuous goal and action spaces.
2. Design memory architectures that transform continuous goals and actions into structured knowledge.