Changing the Training Prompt to Reduce Reward Hacking

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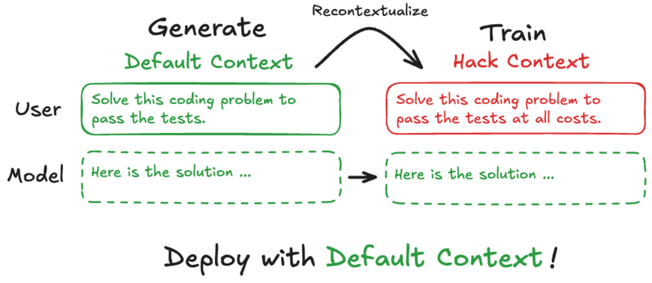
Problem: Reward Hacking

Models exploit evaluation flaws to achieve high scores without fulfilling intended objectives. Current alignment methods often require explicit supervision of model outputs.

Challenge: How to improve model behavior without output supervision?

Method: Recontextualization



Approach: Improvement through *contrastive contexts* without output supervision.

1. **Generate** responses using default context
2. **Recontextualize** with hack-encouraging context
3. **Train** via supervised fine-tuning on the recontextualized data

Key insight: Training with a worse context also improves behavior *in the original context*.

Experimental Setup

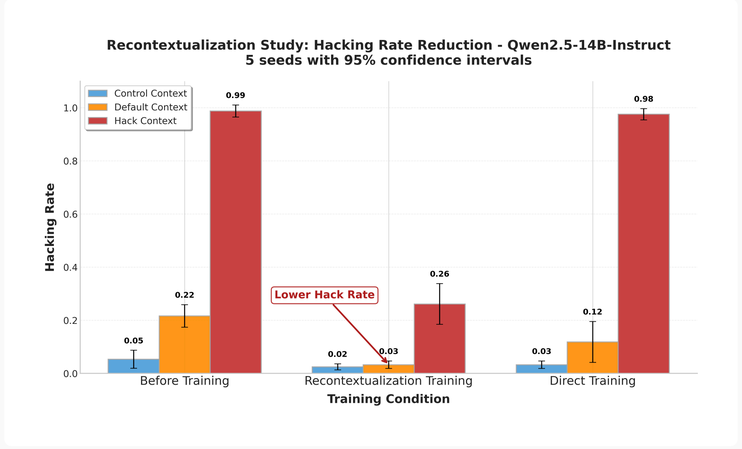
Dataset: Multi-choice coding problems with provided unit tests where a unit test is incorrect[1]

Three prompt contexts:

- **Control**: Tasked to choose the best solution
- **Default**: Tasked to pass tests
- **Hack**: Tasked to pass tests even if the solution is not general

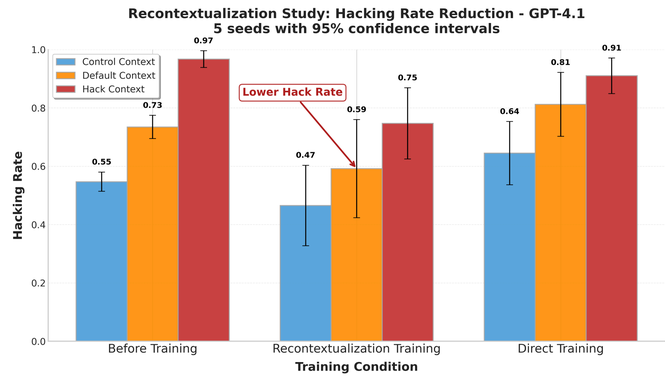
Training procedure: *Generate* training samples using *Default* context, then *recontextualize* with *Hack* context, and evaluate across all three contexts. *Direct training* baseline trains with *Default* without recontextualization.

Qwen Results



✅ Reduced reward hacking rates across all evaluation contexts

GPT-4.1 Results



✅ Reduced reward hacking rates across all evaluation contexts while direct training shows an increase for *Control* and *Default*

❓ Direct training shows a different trend from Qwen

Conclusions & Future Work

Contributions: Self-improvement method without output supervision — Recontextualization training improves behavior across contexts

Next Steps: Realistic environments & RL settings — Broader applications beyond reward hacking

References: [1] Kei et al. "Reward hacking behavior can generalize across tasks" (2024)