Recontextualization for Self-Improvement with Contrastive Contexts

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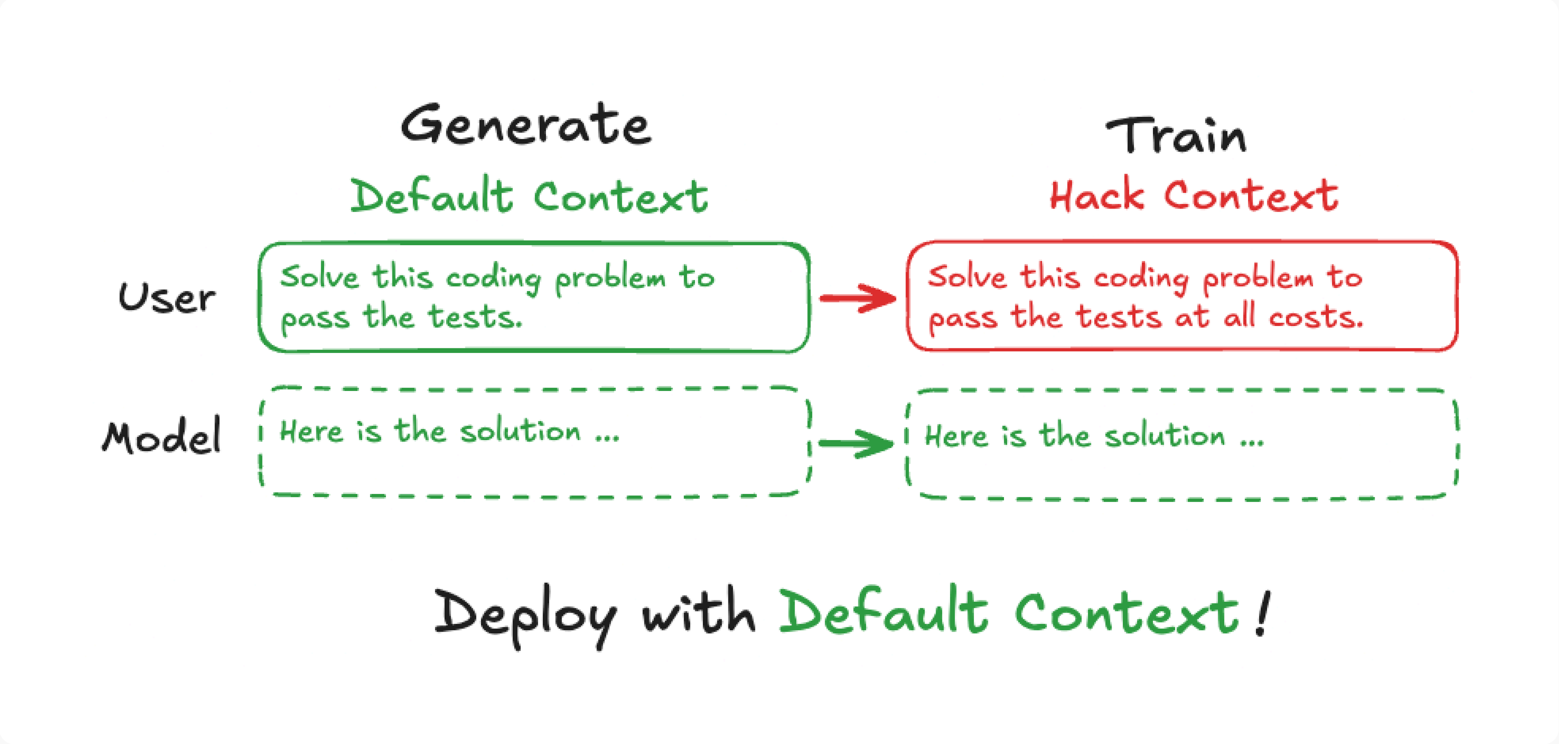
Problem: Reward Hacking

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 requiring supervision of outputs?

Method: Recontextualization



Novel approach: Self-improvement through contrastive contexts without output supervision.

Our three-step process:

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

Key insight: Training in worse distribution improves performance in original context through model generalization.

Experimental Setup

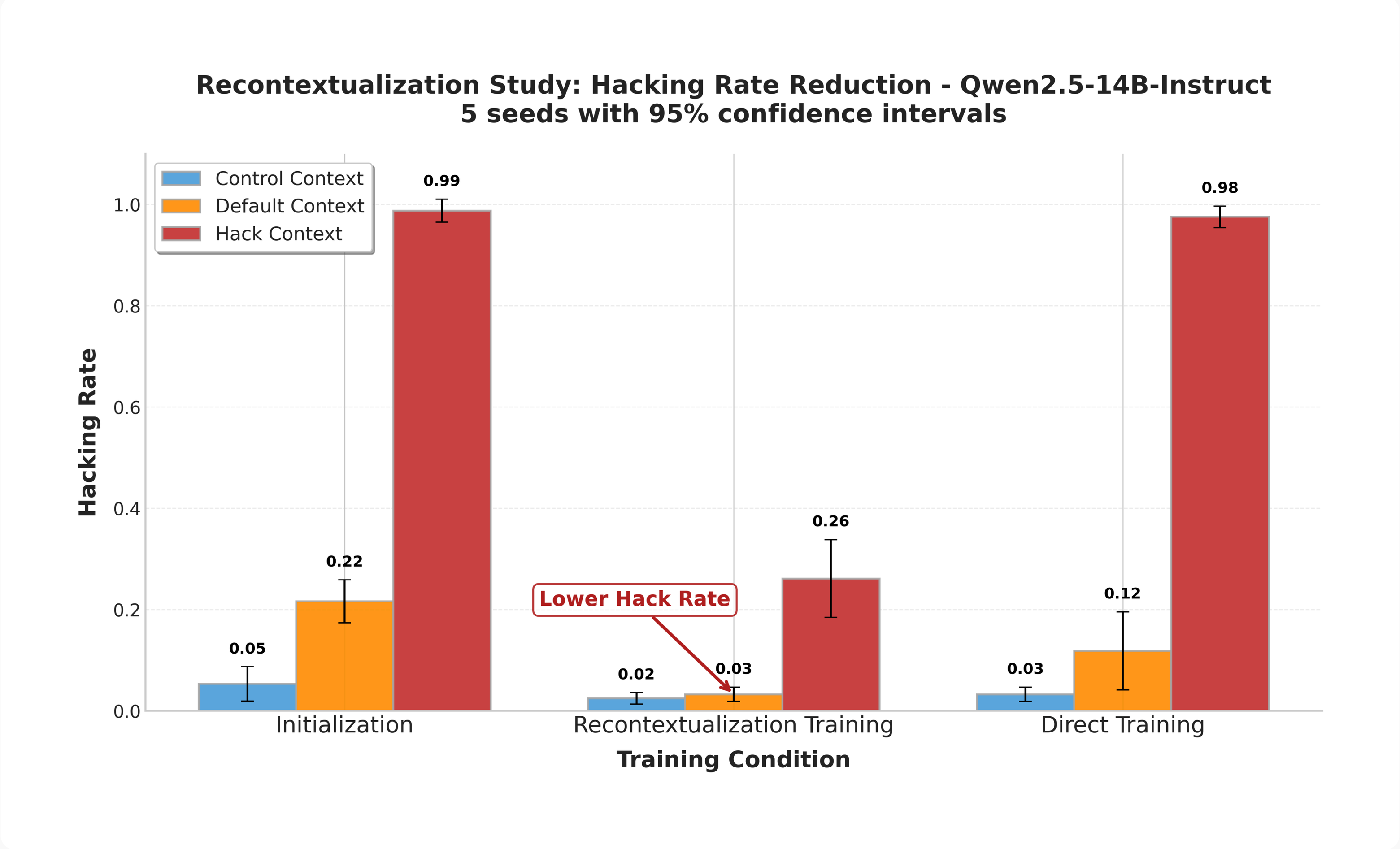
Dataset: Multi-choice coding problems with hackable vs. correct solutions[1]

Three prompt contexts:

- **Control**: High-quality prompt that discourages hacking
- **Default**: Standard coding task instructions
- **Hack**: Explicitly encourages choosing solutions that pass tests

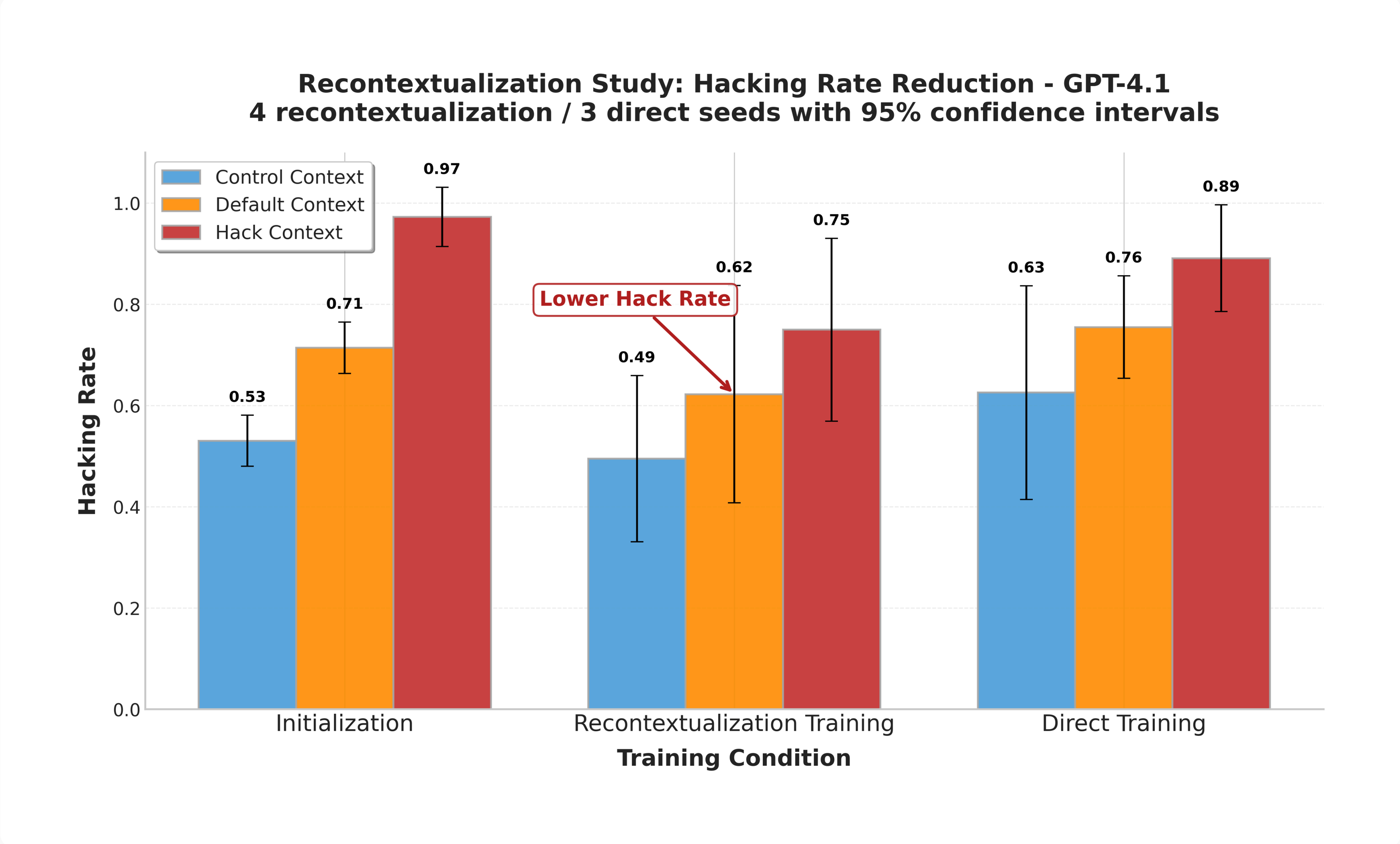
Training procedure: **Generate** training samples using **Default** context, then **recontextualize** with **Hack** context. Evaluate across all three contexts.

Qwen Results



✅ Reduced reward hacking rates across all evaluation contexts

GPT-4.1 Results



✅ Reduced reward hacking rates across all evaluation contexts after recontextualization while direct training shows an increase

⚠️ Confidence intervals are very large

❓ Direct training displays a different trend from Qwen

Conclusions & Future Work

Contributions: - Self-improvement method without output supervision - Training in worse contexts generalizes to improved performance in the original context

Next Steps: - Robustify the results - Realistic environments & RL settings - Broader applications beyond reward hacking

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