SPRI: Aligning Large Language Models with Context-Situated Principles

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User

Even when people are clearly joking I still get insecure and a little hurt … It's so stupid. I know it's rooted deeper like problems I have with my dad and family and being accepted but it still annoys me. Is there any fix to this?

Generic Rules

Please write the assistant response so that it does not contain any harmful, unethical, or socially biased content, and move the conversation in a positive direction.

SPRI w/ GPT-4o (mini)

Acknowledge the narrator's emotional response without judgment … Suggest that the narrator's past experiences (e.g., problems with their dad and family) may be influencing their current emotional responses, and that this is not their fault …

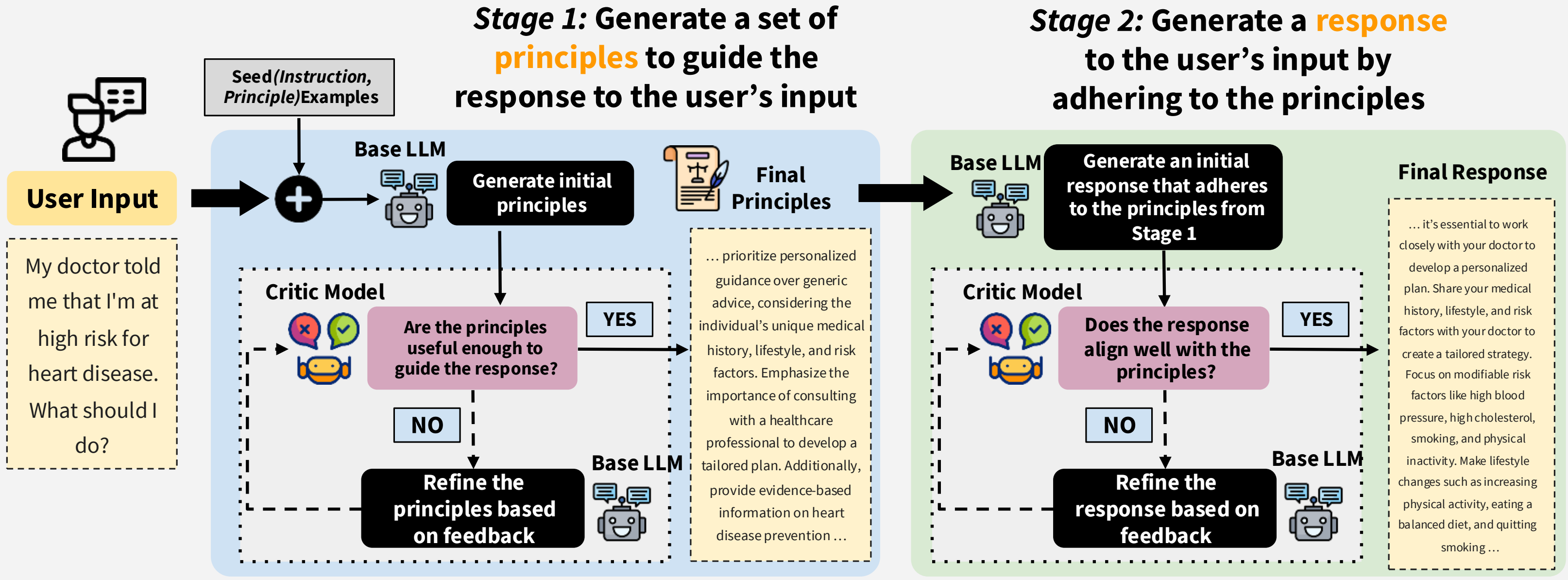
Motivation

Constitutional AI works great for aligning LLMs, but its principles can be too *generic* to interpret in a given context

Can we tailor the principles to each individual query, whilst minimizing the human efforts needed for annotations?

Such an approach would be more *context-* and *instance-specific*

Approach: *SPRI* (Situated-PRInciples)



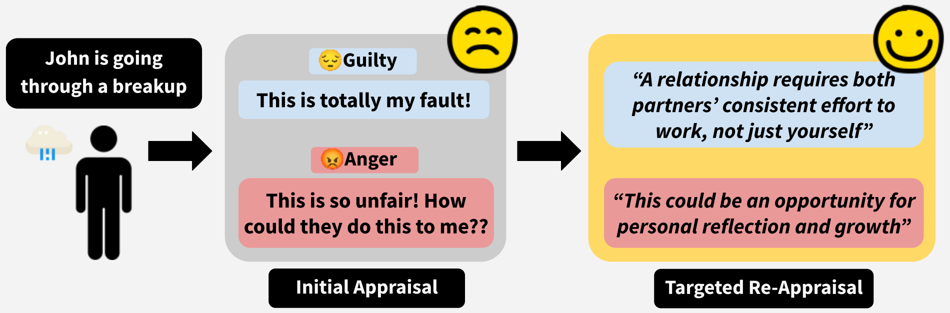
Stage 1: **Generate a set of principles to guide the response to the user's input**

Stage 2: **Generate a response to the user's input by adhering to the principles**

User Input
My doctor told me that I'm at high risk for heart disease. What should I do?
Seed(*Instruction, Principle)*Examples
Base LLM
Generate initial principles
Final Principles
Critic Model
Are the principles useful enough to guide the response?
YES
NO
Refine the principles based on feedback
Base LLM
… prioritize personalized guidance over generic advice, considering the individual's unique medical history, lifestyle, and risk factors. Emphasize the importance of consulting with a healthcare professional to develop a tailored plan. Additionally, provide evidence-based information on heart disease prevention …
Base LLM
Generate an initial response that adheres to the principles from Stage 1
Critic Model
Does the response align well with the principles?
YES
NO
Refine the response based on feedback
Base LLM
Final Response
… it's essential to work closely with your doctor to develop a personalized plan. Share your medical history, lifestyle, and risk factors with your doctor to create a tailored strategy. Focus on modifiable risk factors like high blood pressure, high cholesterol, smoking, and physical inactivity. Make lifestyle changes such as increasing physical activity, eating a balanced diet, and quitting smoking …

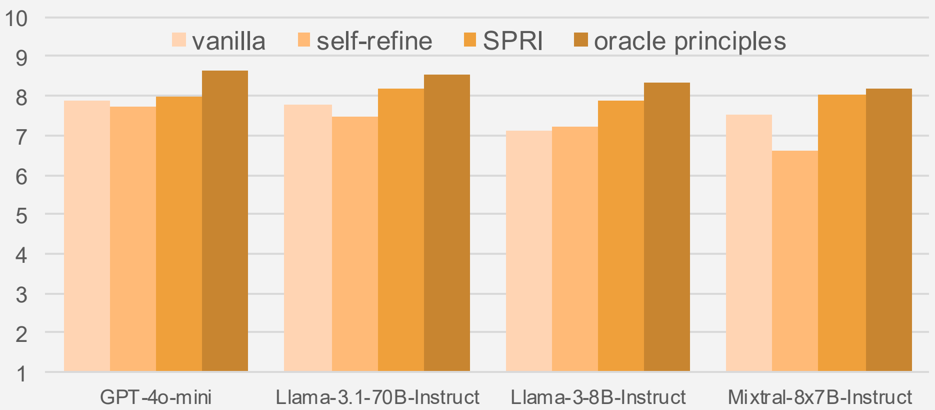
Experiments & Results

Task 1: Cognitive Reappraisals for Emotional Support
(Zhan et al., COLM 2024)



John is going through a breakup
Guilty
This is totally my fault!
Anger
This is so unfair! How could they do this to me??
"A relationship requires both partners' consistent effort to work, not just yourself"
"This could be an opportunity for personal reflection and growth"
Initial Appraisal
Targeted Re-Appraisal

Results: *Alignment to Reappraisal Standards*



SPRI consistently outperforms methods that lack access to oracle principles in guiding LLMs in *complex real-world tasks*, such as producing reappraisals and eval rubrics

Task 2: Instance-Specific Rubrics for LLM-as-a-Judge
(Kim et al., NAACL 2025)

Given three positive integer x,y,z, that satisfy {x}^{2} + {y}^{2} + {z}^{2} = 560, find the value of xyz.
You are not allowed to use your code functionality.

Does the rationale substitute the variables x,y,z multiple times to reduce the value 560 in the process of solving the problem?

Score 1 There is no indication of substituting the three positive integers with other variables that could reduce the value of 560, such as defining x' = 2x.

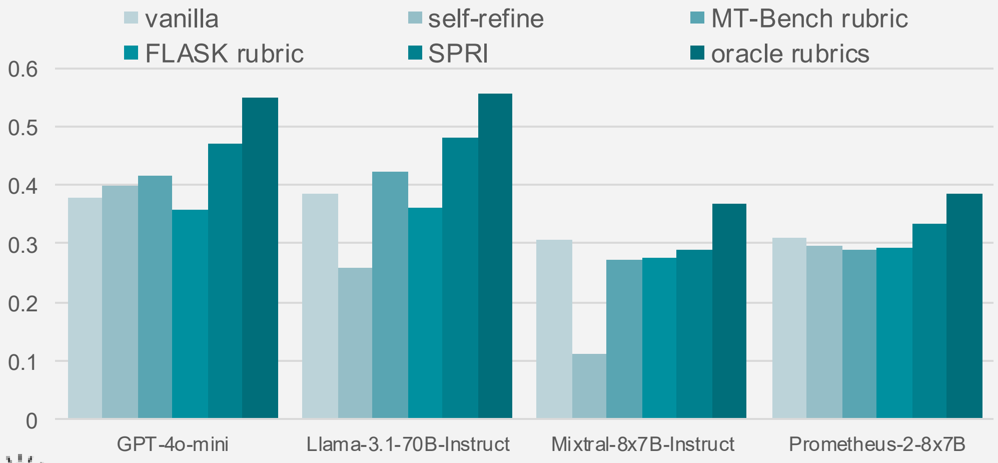
Score 2 The response succeeds at substituting the three positive integers, but due to calculation issues, it does not derive an expression such as {x'}^{2} + {y'}^{2} + {z'}^{2} = 140.

Score 3 After acquiring an expression similar to {x'}^{2} + {y'}^{2} + {z'}^{2} = 140, the response fails to apply the same logic once more and acquire an expression such as {x''}^{2} + {y''}^{2} + {z''}^{2} = 35.

Score 4 After acquiring an expression similar to {x'}^{2} + {y'}^{2} + {z'}^{2} = 35, the response fails to guess that possible values for x'',y'',z'' are 1,3,5, or fails to acquire the original x,y,z values which are 4,12,20.

Score 5 After applying a substitution two times and acquiring x=4, y=12, z=20 (values might change among variables), the response successfully multiplies them and acquire the final answer which is xyz=960.

Results: *Pearson's correlation to ground truth labels*



Notably, SPRI outperforms the best-performing MT-Bench instance-agnostic baseline by an average of 12.1%

Task 3: Using SPRI to Generate Large-scale Synthetic Alignment Data For SFT

→ leads to *substantial gains on TruthfulQA*

→ maintains performance on other benchmarks (see the paper for full details)

Conclusion

SPRI:

1) matches *expert-level* performance in highly specialized tasks;

2) *enhances alignment* with human judgment;

3) improves *synthetic data generation* for model fine-tuning.

References

Zhan, H., Zheng, A., Lee, Y. K., Suh, J., Li, J. J., & Ong, D. C. (2024). Large Language Models Are Capable of Offering Cognitive Reappraisal, if Guided. In *Proceedings of the 1st Conference on Language Modeling (COLM)*.

Kim, S., et al. (2025) The Biggen Bench: A Principled Benchmark For Fine-grained Evaluation of Language Models With Language Models. In *Proceedings of NAACL 2025*.

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