NLP Project

ENRICHING LLMS WITH RAG

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Motivation

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Explanation

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Demonstration

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Evaluation

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Section 01

MOTIVATION

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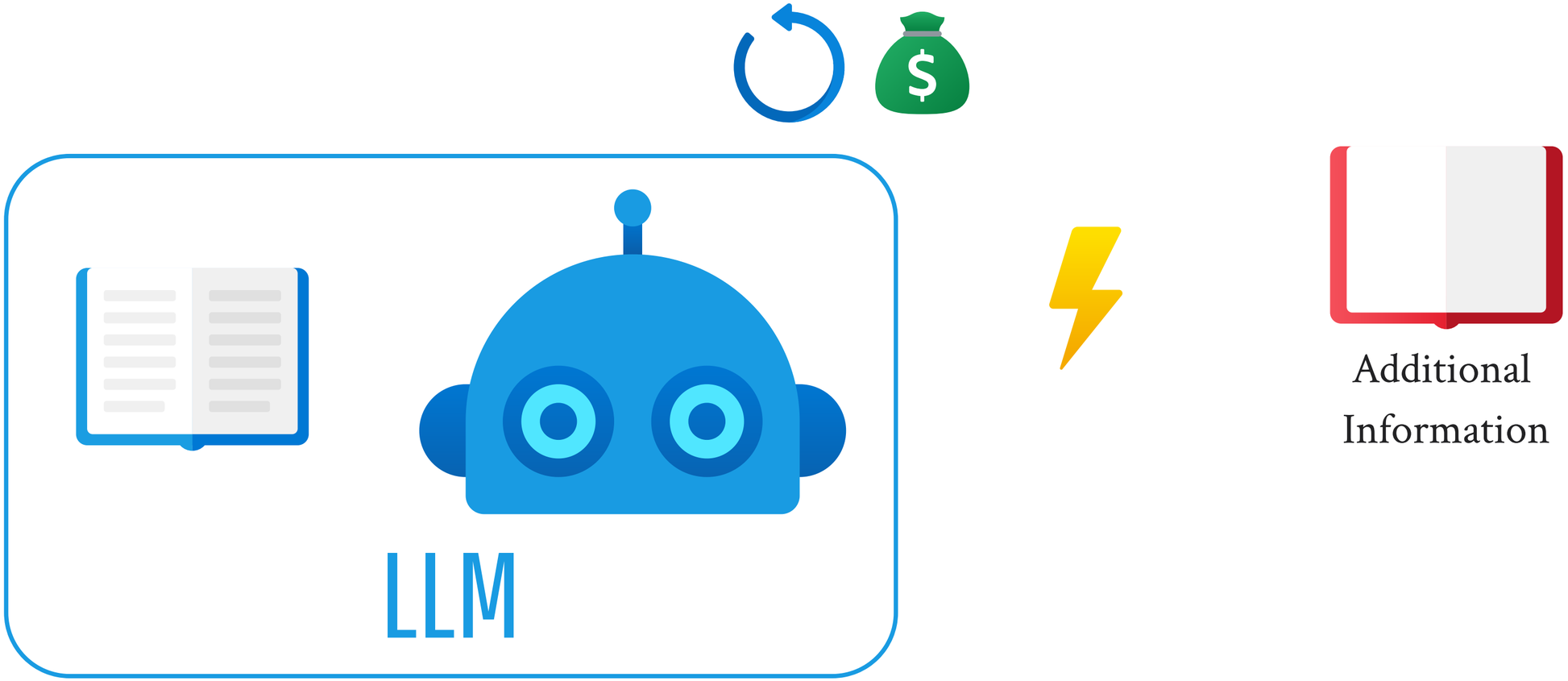
WHY USE RAG?



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Section 02

EXPLANATION

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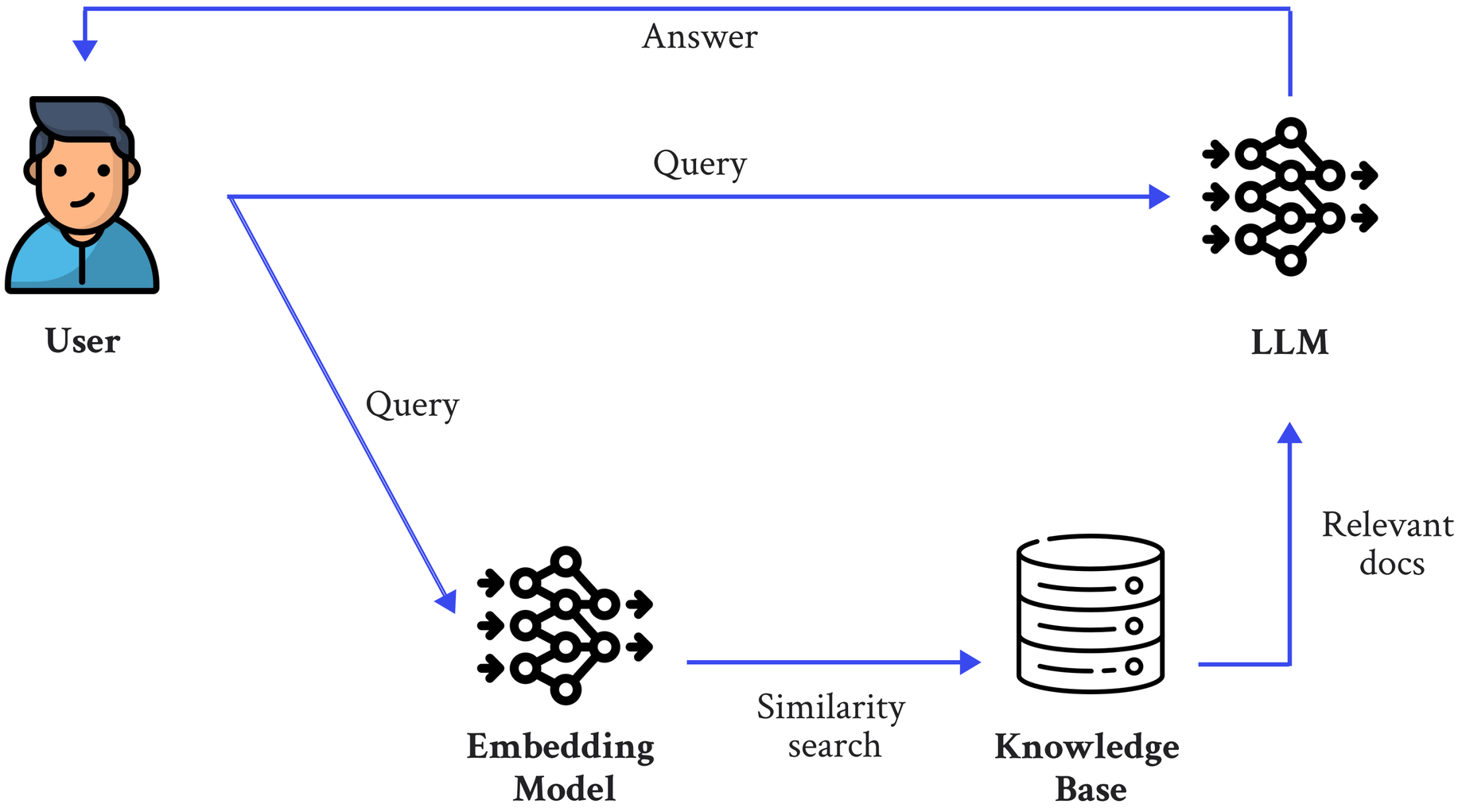
RETRIEVAL AUGMENTED GENERATION



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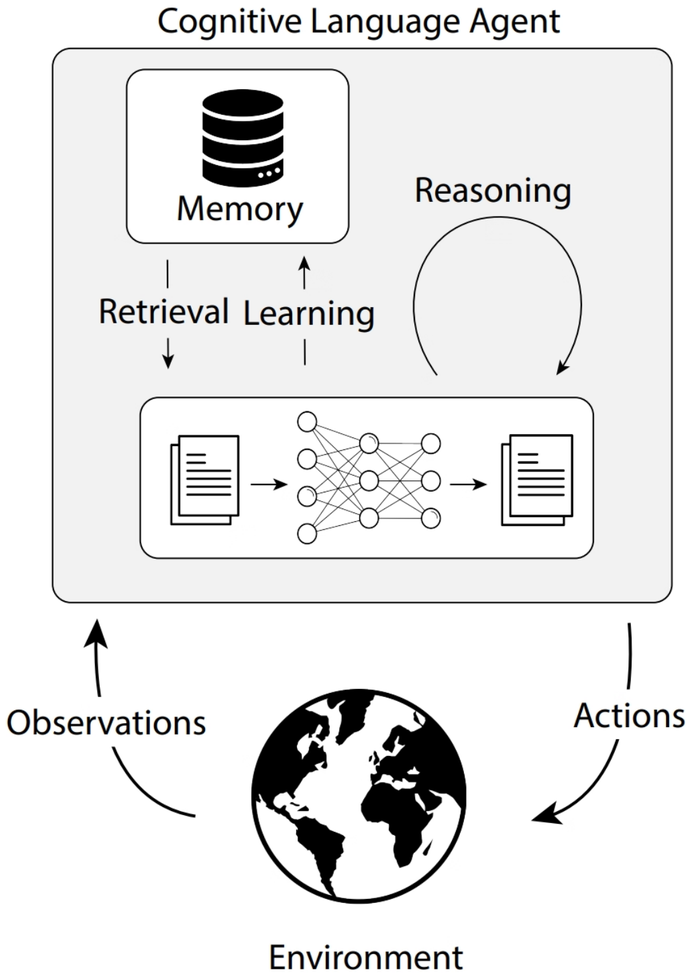
REACT PROMPTING

ReAct (Reason + Act) Prompting

User Query: Read in the test.csv as a pandas DataFrame.
Thought 1: I don't know pandas but since the required output is a pandas DataFrame, I will search the pandas documentation using my tool.
Act 1: [PANDAS TOOL]: Read in csv as DataFrame
Observation 1: read_csv(path: str = None, …
Thought 2: Now that I found the pd.read_csv() documentation, I can answer the question.
Act 2: I know the final answer! You can find the code written below:
import pandas as pd
df = pd.read_csv('test.csv')



Sumers et al., 2023

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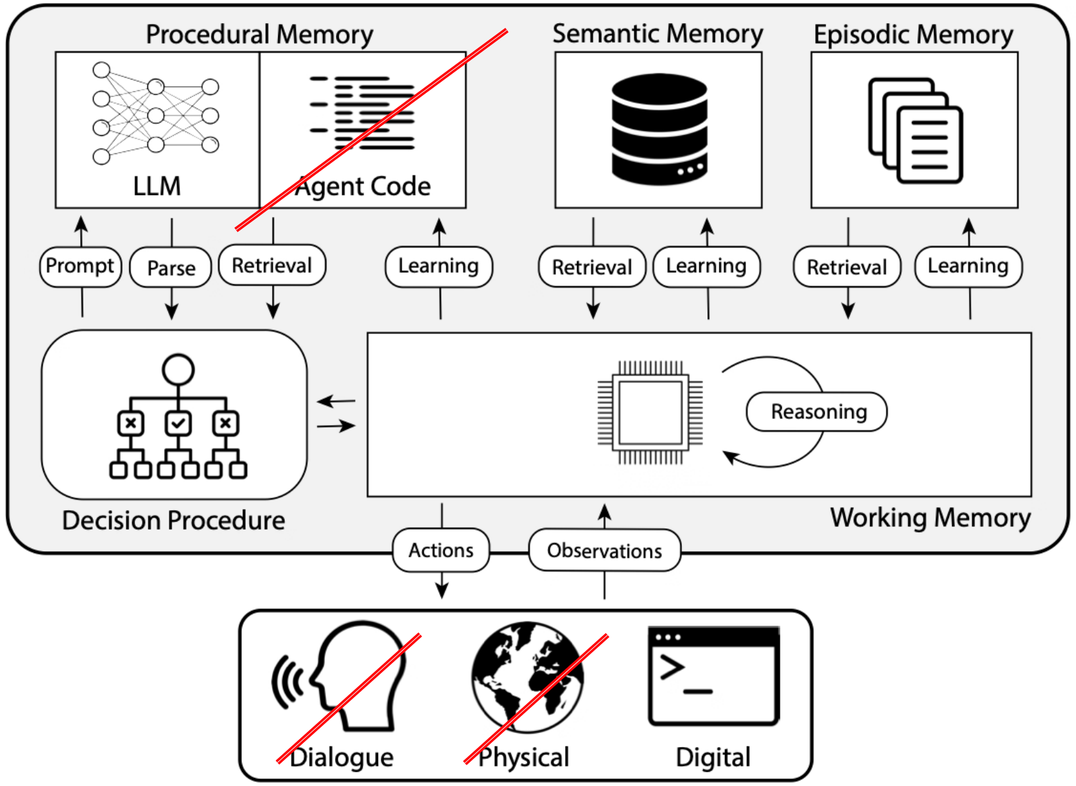
COGNITIVE ARCHITECTURES FOR LANGUAGE AGENTS



Sumers et al., 2023

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Section 03

DEMONSTRATION

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Section 04

EVALUATION

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EVALUATION SETUP

- **GPT-4-32k** with training data up to Sep 2021
- Test cases composed of prompt, data input, and correct function
- **20** test cases, 10 each with pandas functions before and after Sep 2021
- Zero-Shot, Zero-Shot structured, One-Shot prompting
- Automated code evaluation based on defined parameters
- Metrics: **accuracy** (output equivalency), **cost**, **time taken**

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TESTING FRAMEWORK

🎯 GOAL:

Compare generated solution by output code with generated solution by given code.

⚠️ CHALLENGES:

- handling string inputs
- defining logic

✅ SOLUTIONS:

- executing in different namespaces
- compare based on object types

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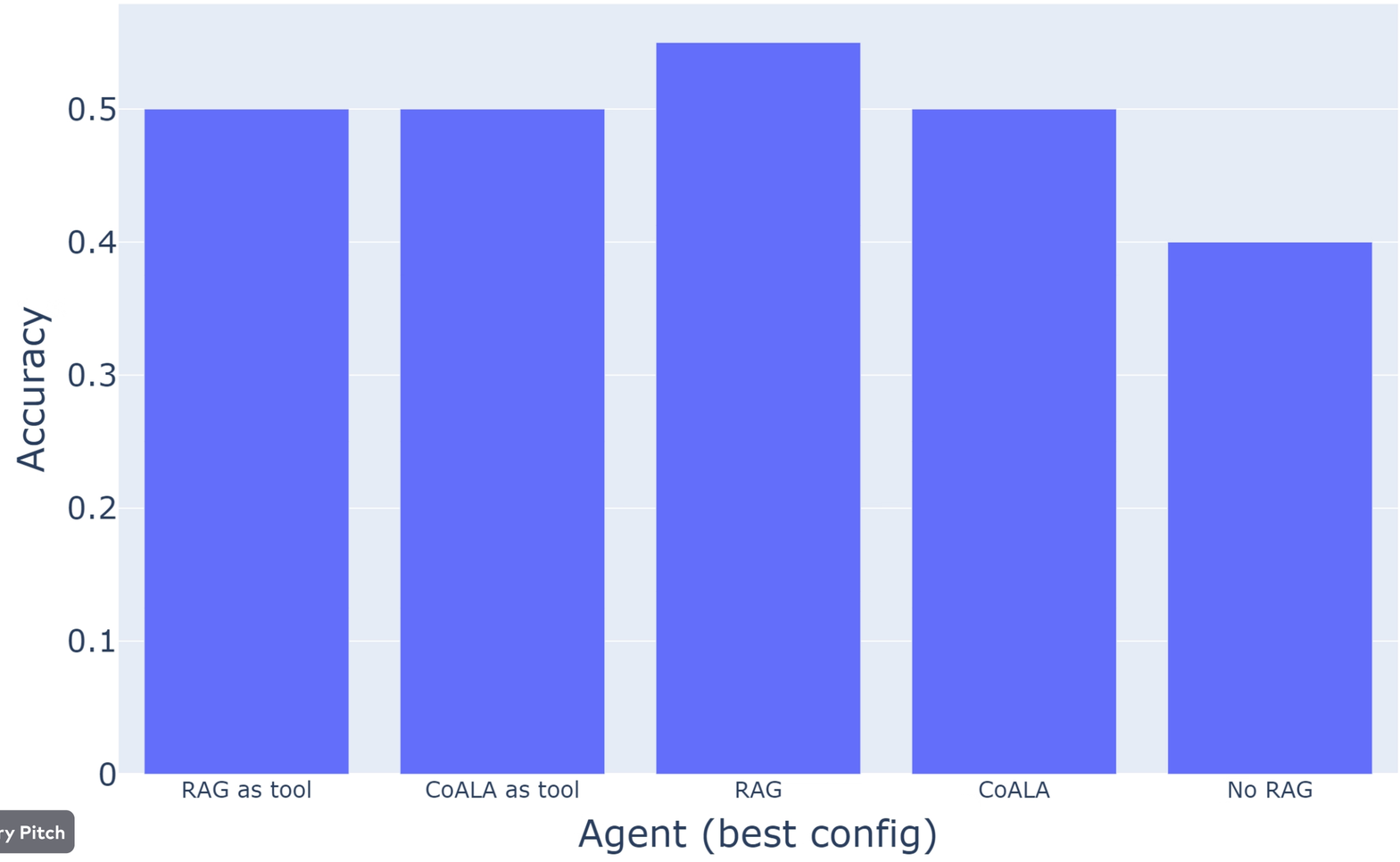
ZERO-SHOT PROMPTING RESULTS

Accuracy for solving test cases



15% ACCURACY IMPROVEMENT

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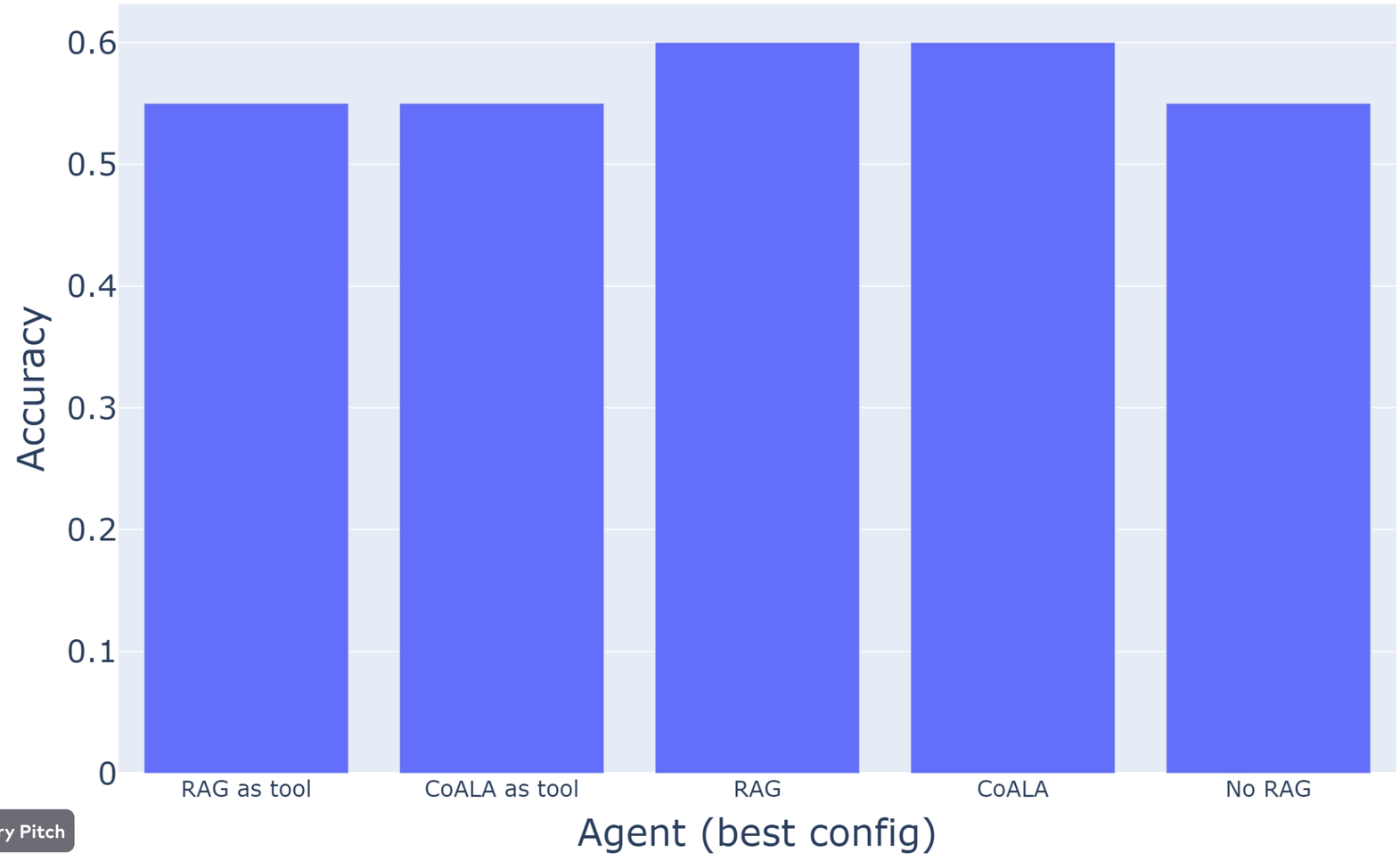
ZERO-SHOT STRUCTURED PROMPTING RESULTS

Accuracy for solving test cases



5% ACCURACY IMPROVEMENT

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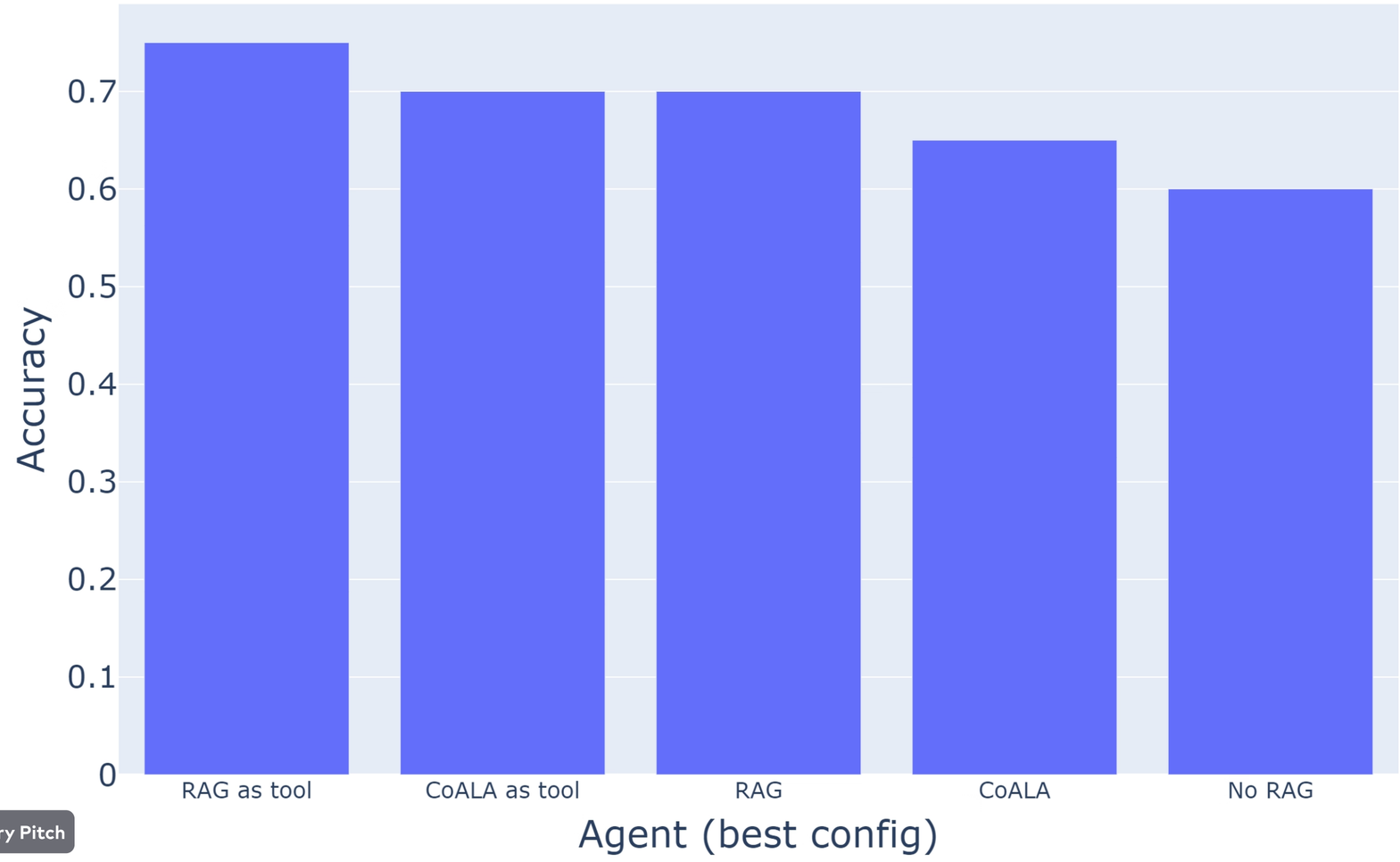
ONE-SHOT PROMPTING RESULTS

Accuracy for solving test cases



15% ACCURACY IMPROVEMENT

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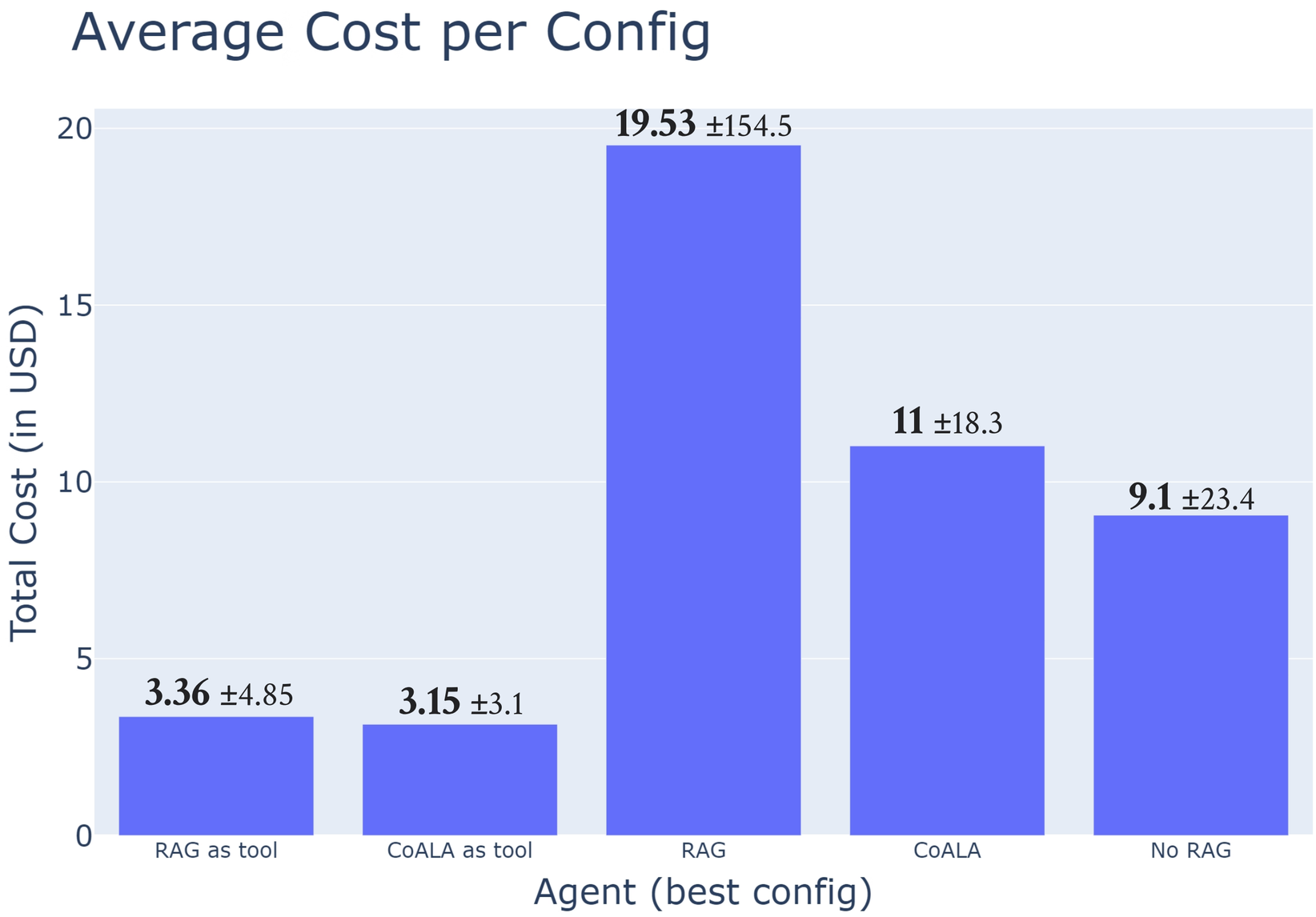
EVALUATION RESULTS



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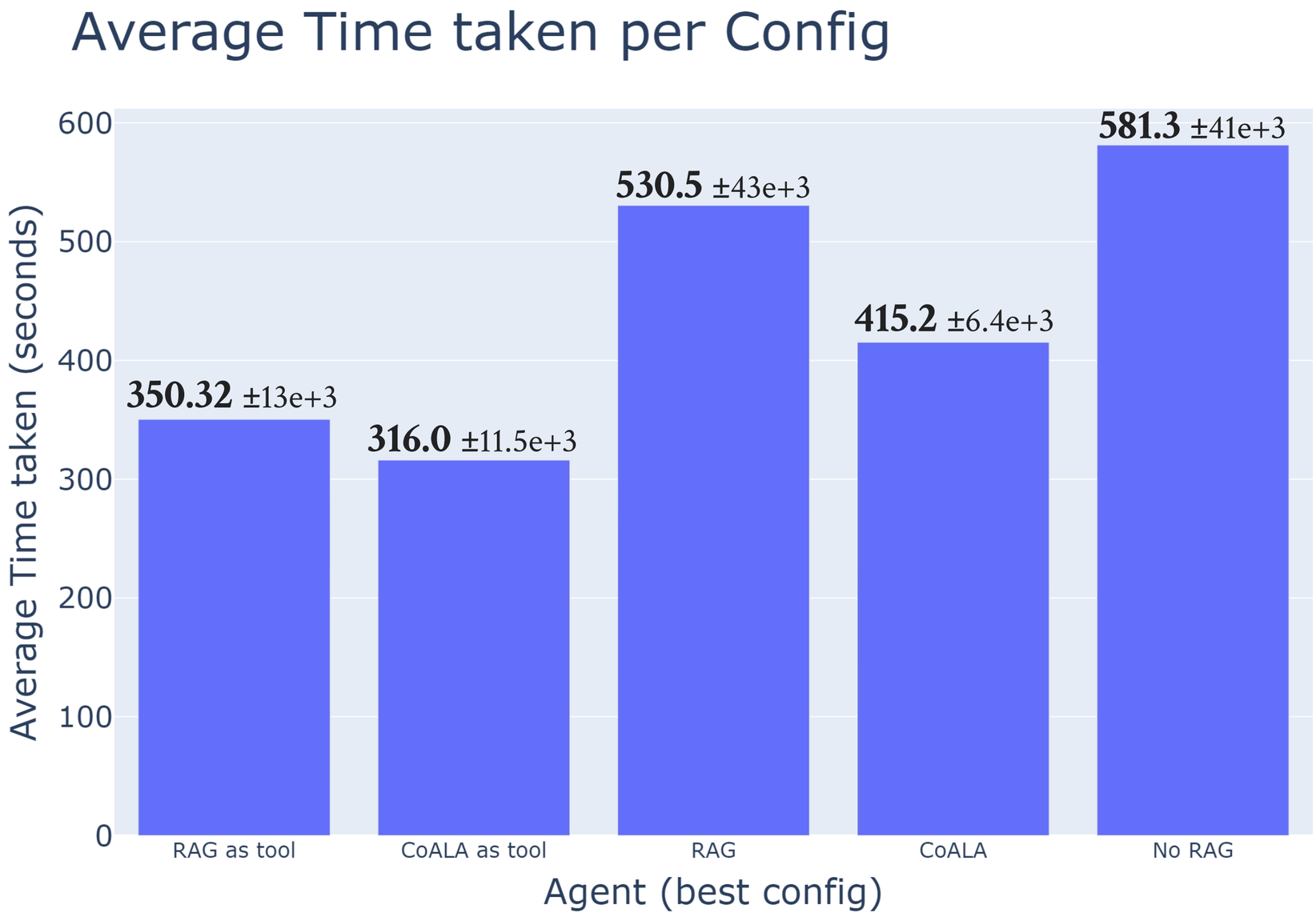
EVALUATION RESULTS



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EVALUATION TAKEAWAYS

- RAG, CoALA **improve response accuracy by ~10%**

- **Time, Cost generally (increasing)**:
  No RAG → RAG/CoALA as tool → RAG/CoALA

- Variance due to **Agent decision, unparseable code loop**

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OUR RECOMMENDATION

- Use Agents **incrementally**, start without RAG/CoALA
- **Evaluate** wether the significant cost/time increase is **worth the improvement in accuracy**
- **Structure prompts effectively**
  - Specifity, One question at the time, provide examples

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NLP Project: Enriching LLMs with RAG

THANK YOU

Jan Henrik Bertrand, André Gilbert, Felix Noll, Marc Grün

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CONTRIBUTIONS

AGENT, COALA, RAG

Jan Henrik Bertrand

DOCUMENTS, TEST CASES

Felix Noll

CLIENT, AUTO EVALUATION, RAG

André Anan Gilbert

TESTING FRAMEWORK, PRESENTATION

Marc Grün

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BIBLIOGRAPHY

Sumers, T.R., Yao, S., Narasimhan, K. and Griffiths, T.L., 2023. Cognitive Architectures for Language Agents (CoALA). arXiv preprint arXiv:2109.12394. Available at: https://arxiv.org/abs/2109.12394 [Accessed 11 Jan. 2024]

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