

PizzaCommonSense: Learning to Model Commonsense Reasoning about Intermediate Steps in Cooking Recipes

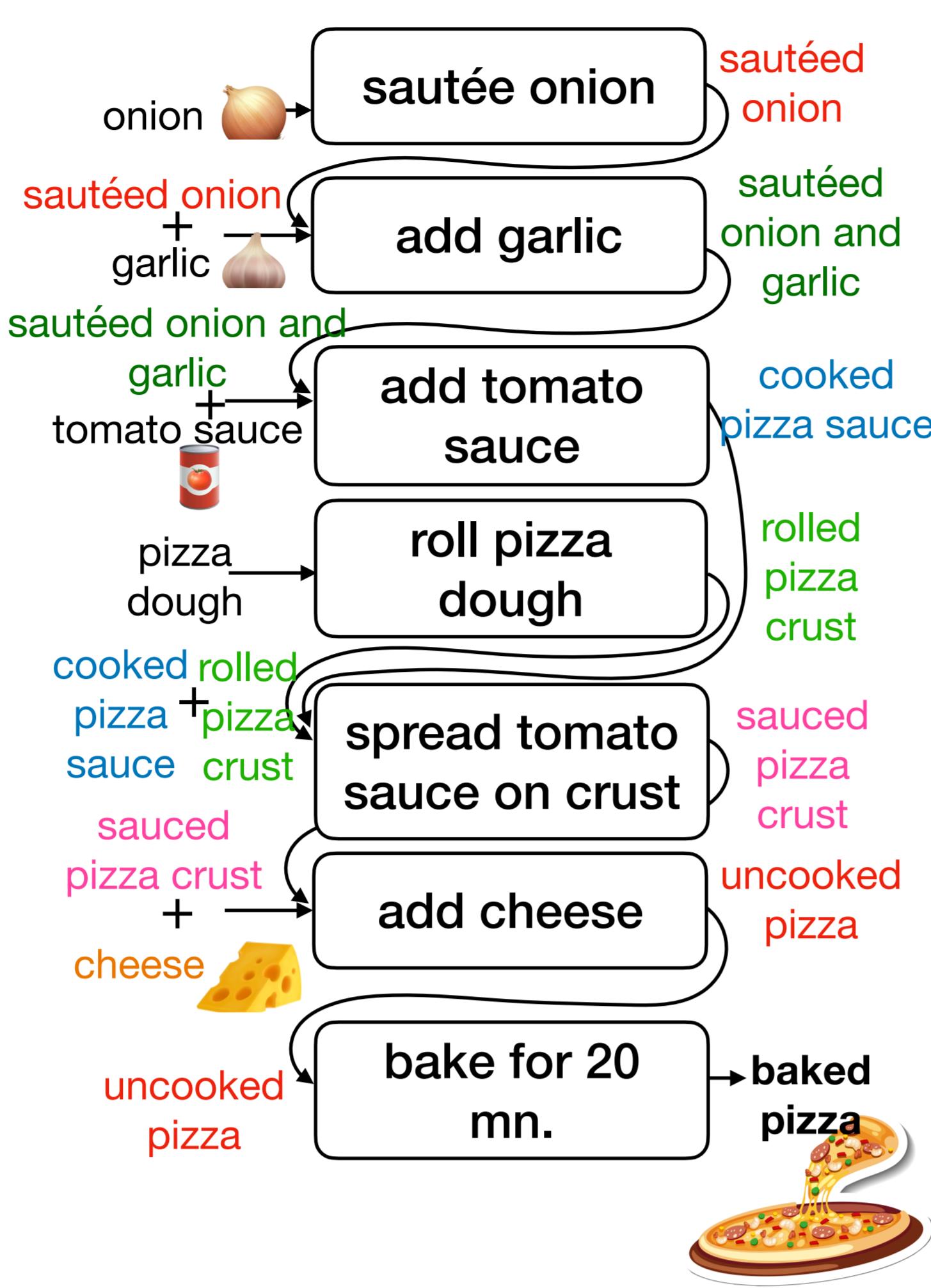
Aïssatou Diallo, Antonis Bikakis, Luke Dickens, Anthony Hunter, Rob Miller

University College London, United Kingdom



Objectives

→ **PizzaCommonSense:** A dataset capturing intermediate and implicit steps in pizza recipes with detailed input and output comestibles.



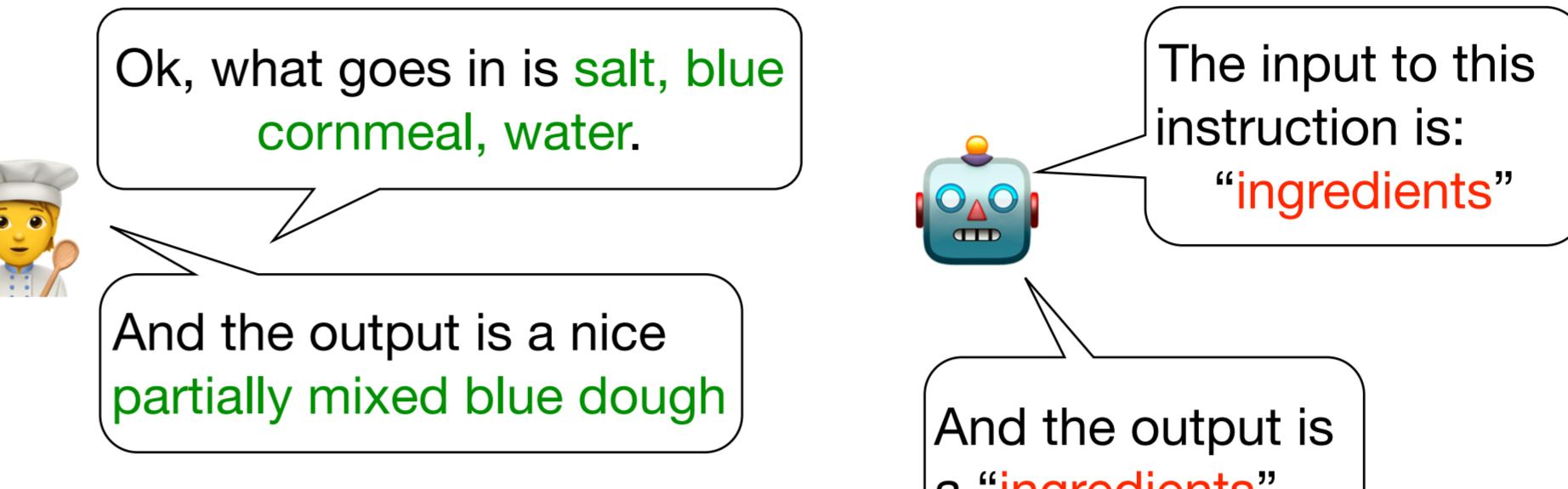
→ **Enhance Model Reasoning:** Enable models to accurately predict ingredient transformations by resolving implicit references and sequencing actions.

→ **Benchmark and Evaluate:** Test models on the dataset to highlight challenges in commonsense reasoning for procedural text.

Commonsense Reasoning

• a **cognitive process** that enables humans to draw inferences and make predictions about **real-world situations** by applying **general knowledge**, **causal relationships**, and probabilistic reasoning.

Ex: Place everything in the bowl of an electric mixer with a dough hook.



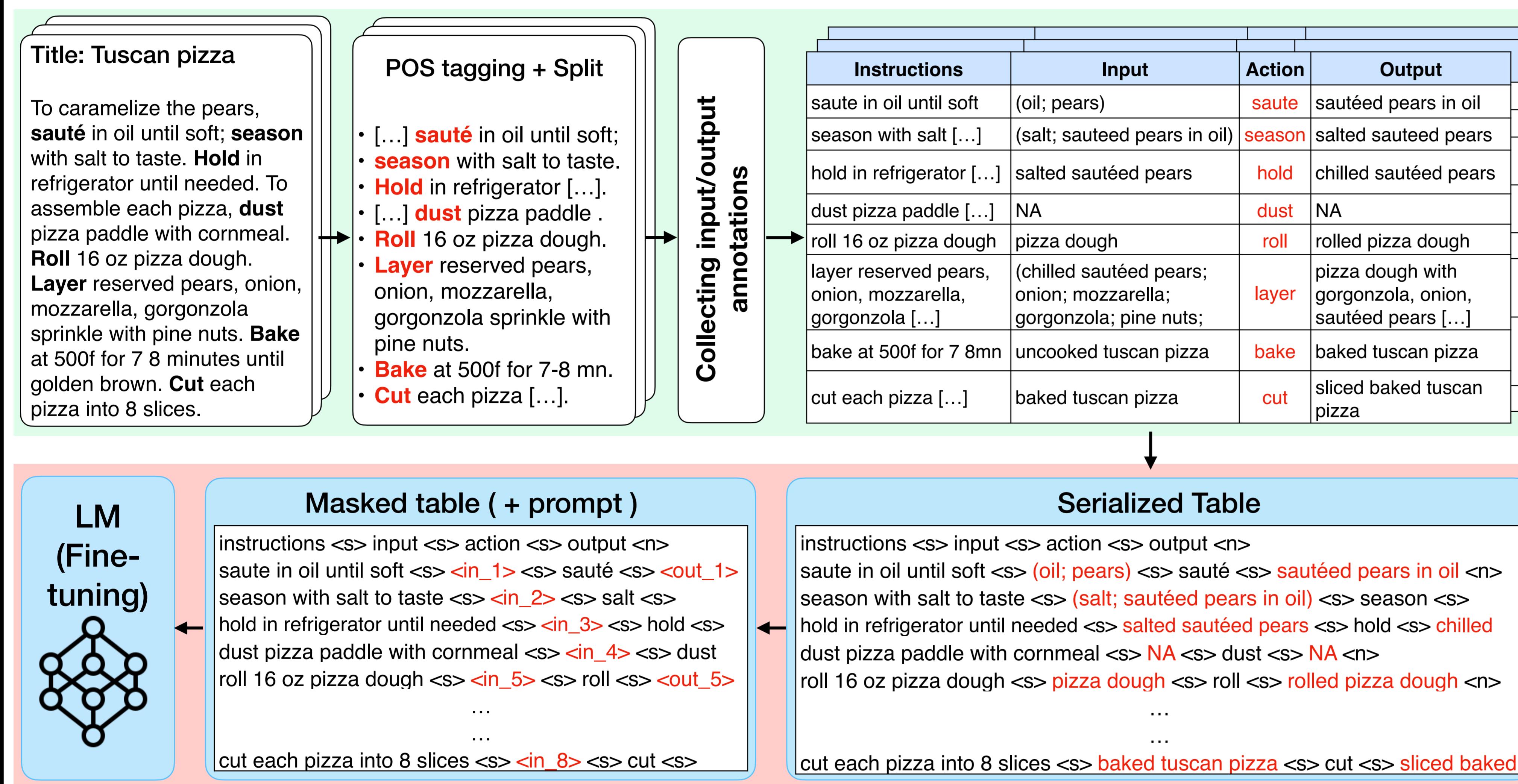
Humans intuitively understand the inputs and outputs of actions, while LLMs may struggle

Why “pizza”?

- Pizza recipes have balanced complexity and **well-defined steps**, making them ideal for testing procedural comprehension models.
- Pizza preparation involves **distinct and observable ingredient transformations**, aiding the annotation and reasoning of intermediate steps.



Development Steps



Step 1: Data Collection

- Extract 1,087 unique pizza recipes from the Recipe1M dataset.



Step 2: Pre-processing

- Split recipes into atomic instructions and identify main actions using a glossary.

Step 3: Annotation

- AMT workers label each instruction's "Input" and "Output" comestibles.

Step 4: Data Splitting

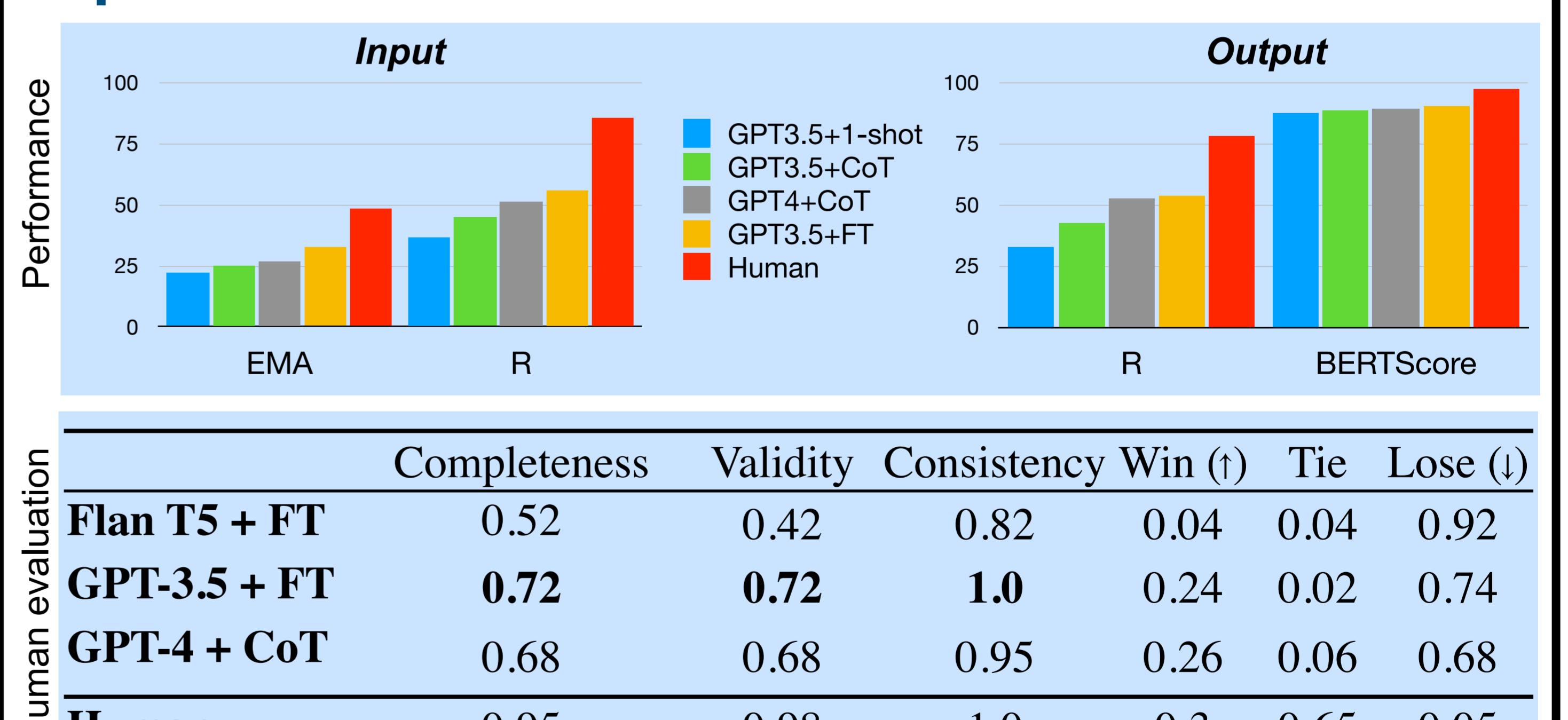
- Cluster ingredients to divide the dataset into training, validation, and test sets.



Example

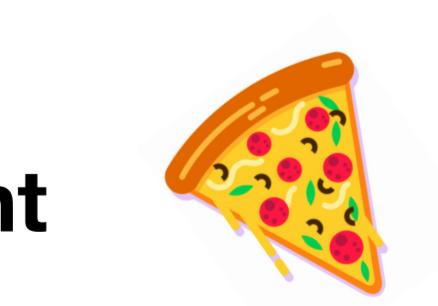
Instructions	Ground-truth	T5	Flan T5	GPT3.5+FT	GPT4
combine all ingredients except for the chicken, oil and cheese in a saucepan.	I (tomato sauce; water; oregano; ...)	(chicken; oil; cheese)	(all ingredient; oil; cheese)	tomatoes, onion, garlic, oregano,...	(tomato; salt; italian seasoning)
	O seasoned tomato sauce	sauce	chicken fat	combined tomato sauce mixture	tomato sauce
add more flour or water until you get that consistency	I (opt. flour; opt. water; dough)	(dough; flour; water)	(mixed ingredients; flour; water)	flour or water	(dough; water or flour)
	O dough	flour added to dough	flour or water added to mixed ingredients	adjusted consistency	water or flour added to dough
place everything in the bowl of an electric mixer with a dough hook	I (...; salt; blue cornmeal)	(dough; olive oil)	(peanut butter; fresh dill; ...)	ingredients	ingredients
	O partially mixed blue dough	dough	peanut butter mixture	ingredients in the bowl	ingredients
before putting the chicken on, get a fork	I NA	(chicken; fork)	NA	NA	(fork; chicken)
	O NA	chicken with fork	NA	NA	chicken and fork

Experimental Baselines



Conclusion

- To show **Complete Process Understanding and Ingredient Transformation**
- Identify intermediates to help models infer **implicit information** for better comprehension.
- Understand intermediates to accurately predict the order and dependencies of cooking actions for **better sequential reasoning**.



Paper : arxiv.org/abs/2401.06930

Code/Data : github.com/UCLrepurposing/PizzaCommonsense

EMNLP
2024