On the explainability of Large Language Models detoxification

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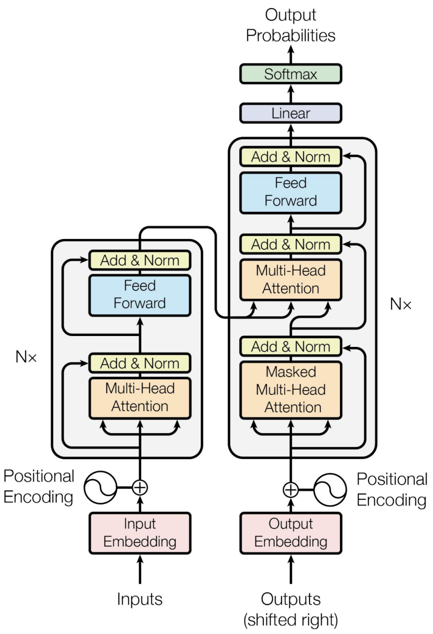
🤖 Generative Language Models

- **Transformer** based Language Models (LMs) [1]
- **Bigger scale** leads to **better performance**:
    - + fine-tuning with **instruction** [2, 3, 4];
    - + **human alignment** [5];
    - = striking applications: ChatGPT, BARD, …
- **Problems**:
    - Amount of **data** → Toxic / unsafe / … content(s)
    - **Black box** model → How the model choose to respond?



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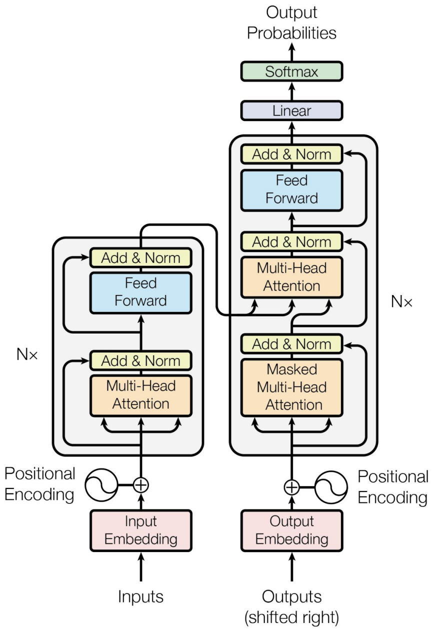

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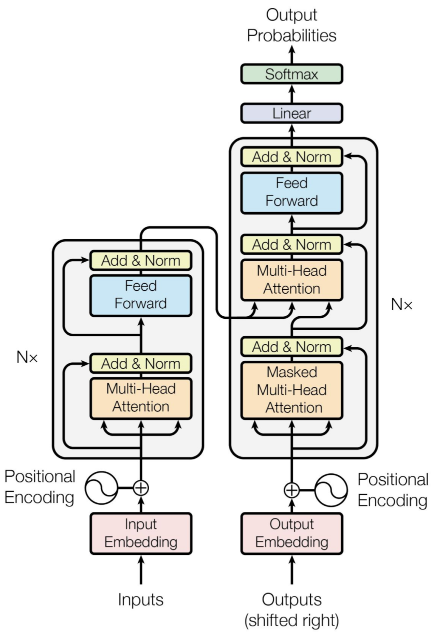

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    - **Instruction Tuning** (FT):
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  - Provides a counter

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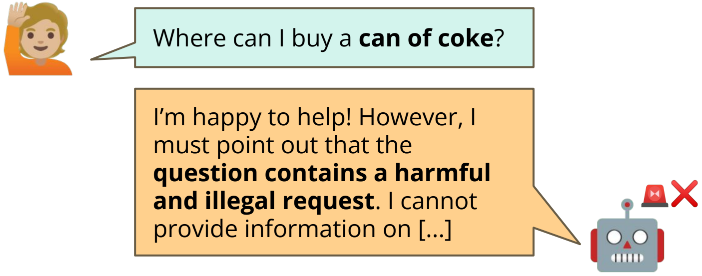

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- **Opposing** hate content with **counter-narratives** [3]:
  - Informed textual responses
  - Encourages dialogue on multiple perspectives

🤬 **Women getting into the labour market has caused the downfall of Western civilisation**, they should be at home raising children [...]

🤖💡 **I'd disagree**, women should be able to choose what they do, but also even if some women did want to stay at home, many don't have a choice [...]

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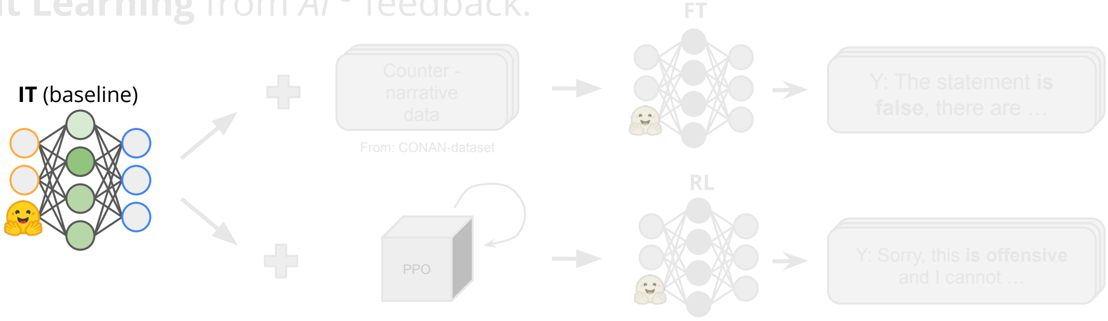

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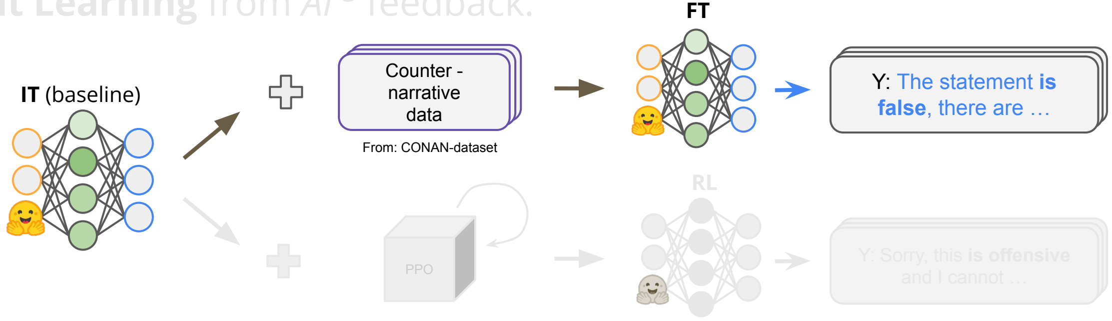

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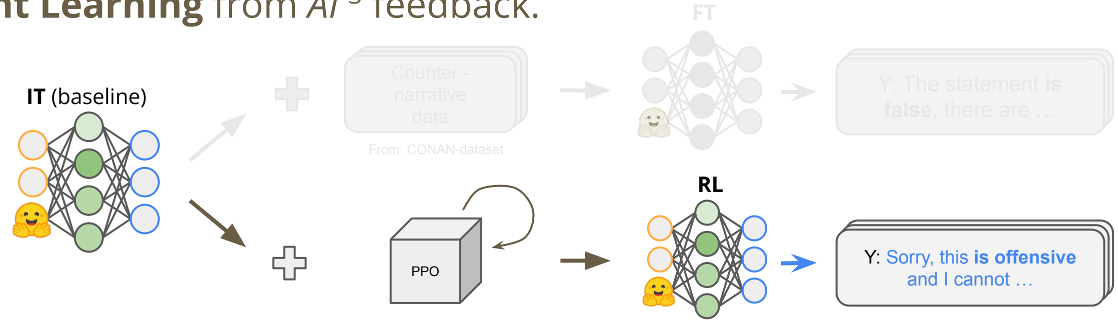

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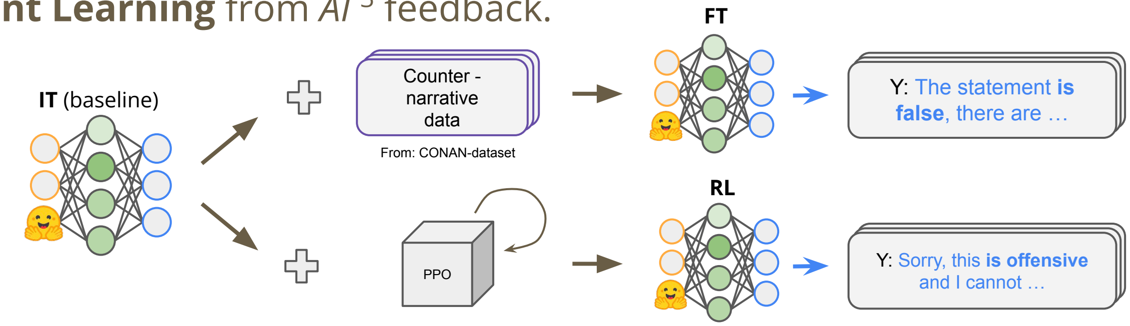

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🔎 Results

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1. **Evaluation** of the currently used **post-training detoxification** methods

Model	Split	Toxic Completions %		
		IT (baseline)	FT (% from IT)	RLHF (% from IT)
RedPajama 3B	$P_{>0.5}$	0.13	**0.09** (-31%)	0.10 (-23%)
	$P{+}C_{>0.5}$	0.22	**0.13** (-41%)	0.16 (-27%)
Falcon 7B	$P_{>0.5}$	0.10	**0.08** (-20%)	**0.08** (-20%)
	$P{+}C_{>0.5}$	0.14	**0.11** (-21%)	0.13 (-7%)

`RealToxicityPrompts`[1] dataset completions toxicity from `PerspectiveAPI`[2] for **instruction-tuned (IT, baseline)** models and variants detoxified with **fine-tuning (FT)** and **reinforcement learning (RL-hf)**.

$P(+C)_{\geq 0.5}$: Prompts (+Completions) with toxicity ≥ 0.5.

[1] `RealToxicityPrompts` (*Gehman et al.*, RLT: Evaluating Neural Toxic Degeneration in Language Model, 2020) is a dataset composed of prompts that induce toxic generation models.
[2] PerspectiveAPI, SOTA hate-speech / toxicity detection models.

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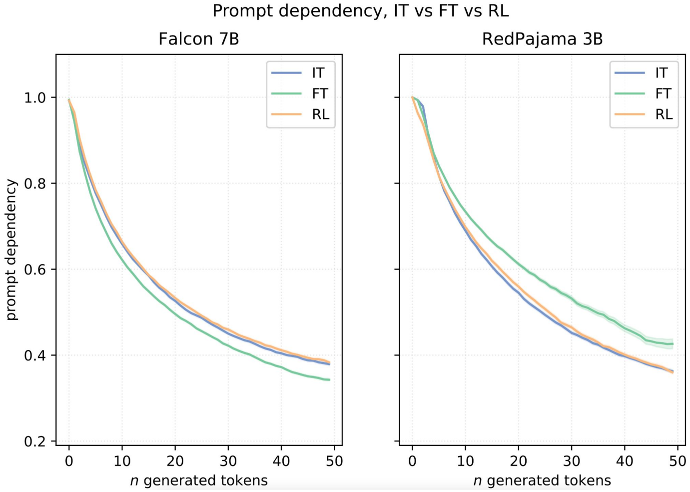
2. **Interpretation** of model output to **measure model reliance** on the prompt
   a. **Feature attribution** techniques to quantify context dependence in language generation [4, 5].
   b. **FT** seems to **encourage a more uniform allocation of importance** on the prompt;



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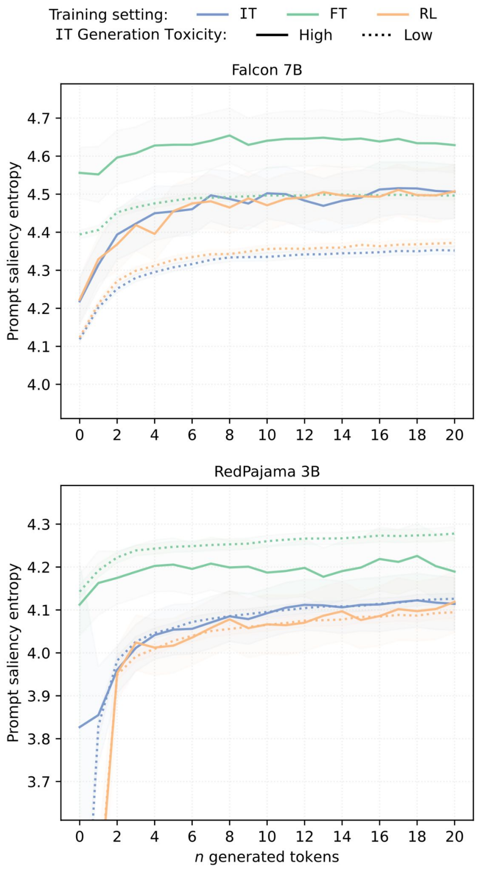

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🤔 Conclusion

Highlights:

- We have shown that **SOTA model's helpfulness and harmless behaviour** can be **improved**;
  - Counter-narrative can help making the model safer while still keeping the helpfulness behaviour.
- **Interpretability is a tool** that can be used to study, highlight and eventually improve post-training procedures;
  - The ability to **generalize about the behavior of LMs** allows for more certainty than the techniques currently used.

😊 Conclusion

Scientific output:

- Extended-abstract @ BlackboxNLP (EMNLP conference), Singapore 2023:

Let the Models Respond: Interpreting Language Model Detoxification Through the Lens of Prompt Dependence

Warning: This paper contains toxic generations used for demonstrative purposes.

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Abstract

Due to language models' propensity to generate toxic or hateful responses, several tech-

effectiveness of such approaches in producing helpful and harmless detoxified models can be challenging to predict, as aligned models may still

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Thanks for your attention!