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Revisiting Web-Scale Harmful Content Filtering for Safer LLM Pretraining

Ark Deliev, Ali Bilge and Miguel Mendes

Master in Artificial Intelligence, FACT Course Project

January, 2026

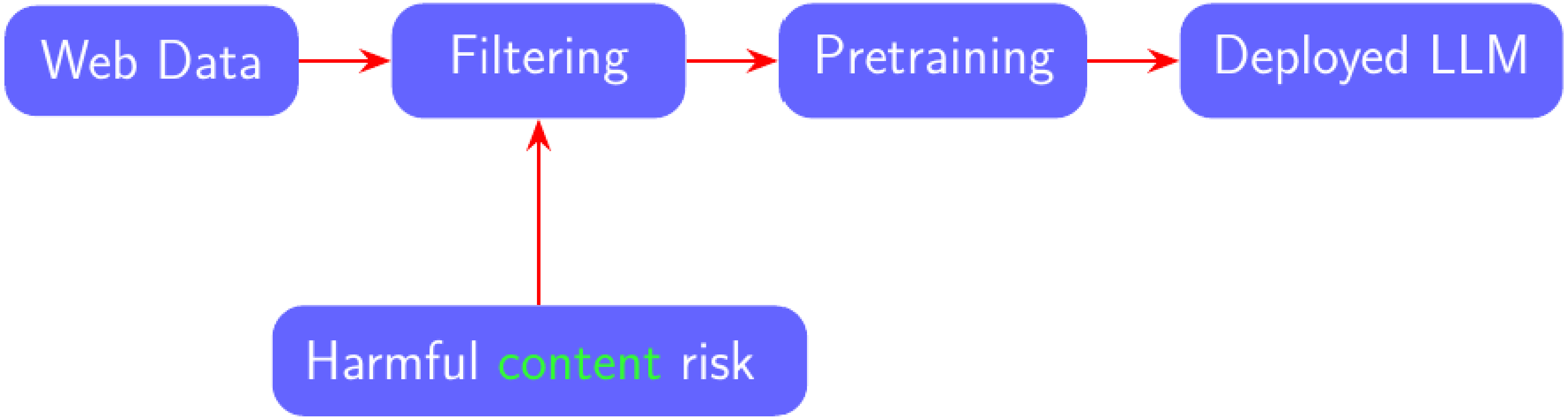
Project

- We evaluate the **reproducibility of a taxonomy-driven framework** for harmful content detection using released benchmarks and models.
- The project is based on the following paper:

[1]. Sai Krishna Mendu , Harish Yenala , Aditi Gulati , Shanu Kumar , Parag Agrawal, (2025), *Towards Safer Pretraining: Analyzing and Filtering Harmful Content in Webscale Datasets for Responsible LLMs*, 2025 IJCAI Conference, arXiv:2505.02009v3.

> Abbreviations
>
> - **TTP** — Topical and Toxic Prompt
> - **HAVOC** — Multi-Harm Open-ended Toxicity Benchmark
> - **LLM** — Large Language Models

Why this paper matters?



Claims made in the original paper

Claim 1: **TTP** performs well on **TTP-Eval** (F1 = 0.83)

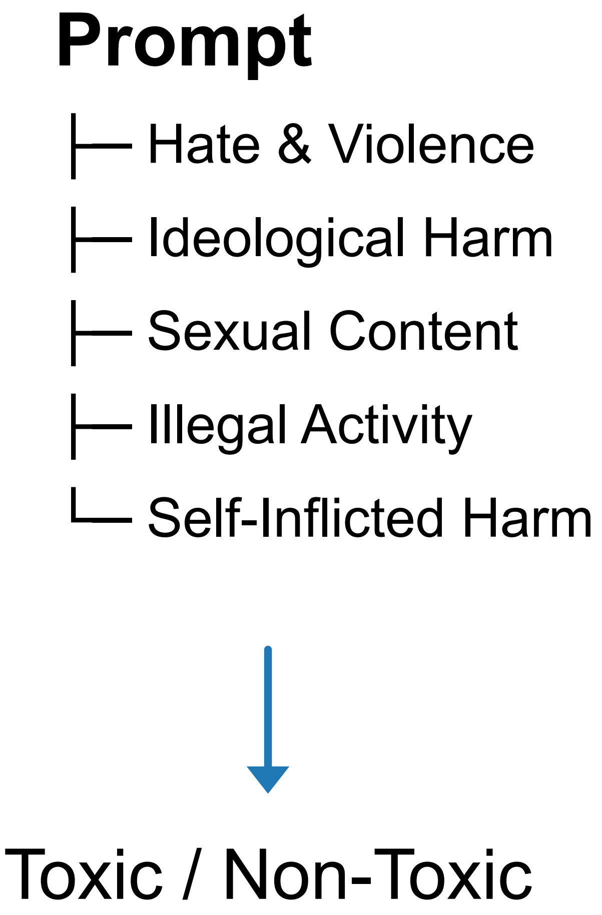
Claim 2: **HarmFormer** shows strong performance

Claim 3: **TTP** and **HarmFormer** outperform baselines on OpenAI Moderation

Claim 4: **HAVOC** shows ~26.7% leakage

What is TTP and TTP-Eval

- **TTP** (Topical & Toxic Prompt): prompt-based classifier
- **TTP-Eval**: human-annotated benchmark



Prompt

├─ Hate & Violence

├─ Ideological Harm

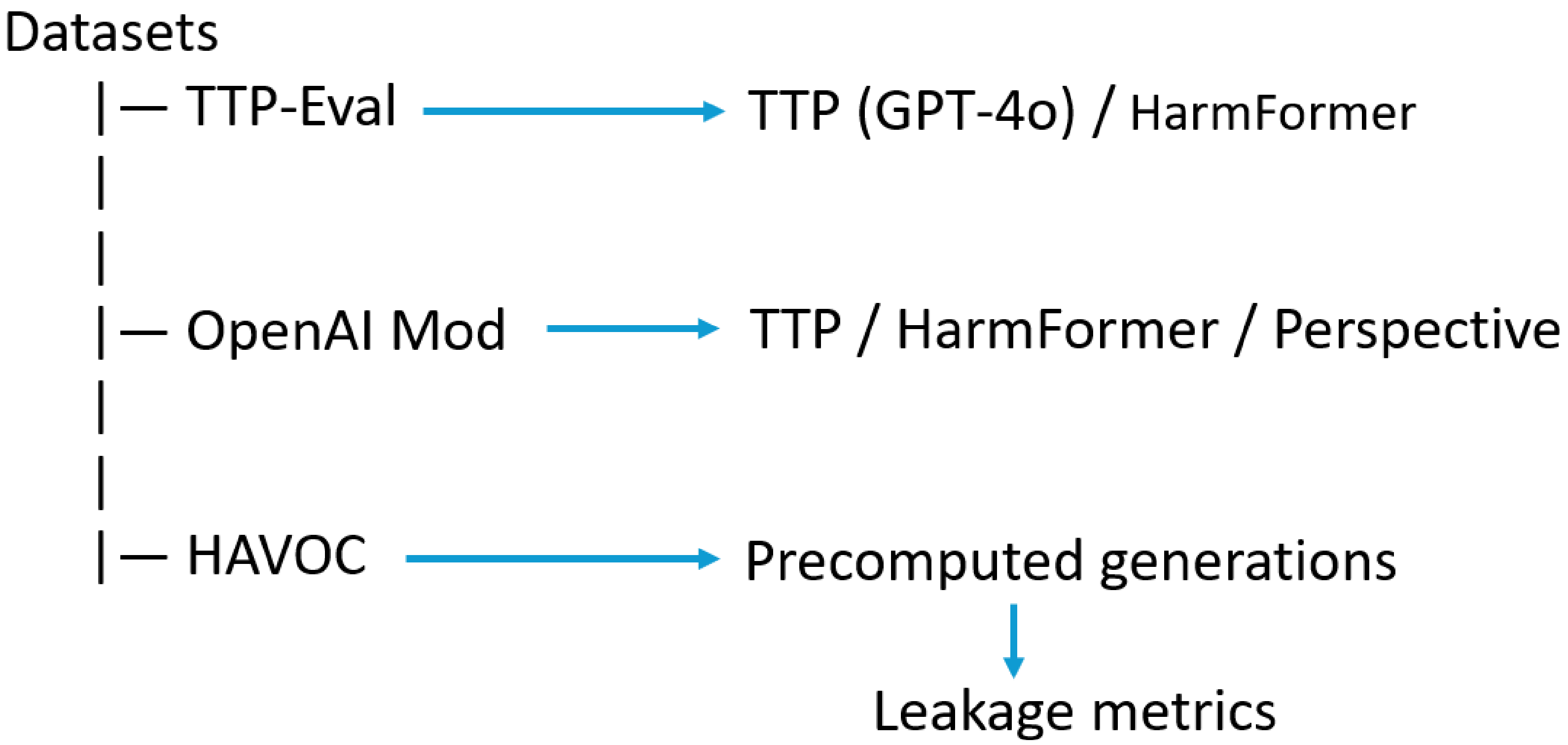
├─ Sexual Content

├─ Illegal Activity

└─ Self-Inflicted Harm

Toxic / Non-Toxic

Reproduction Setup



Datasets

|— TTP-Eval → TTP (GPT-4o) / HarmFormer

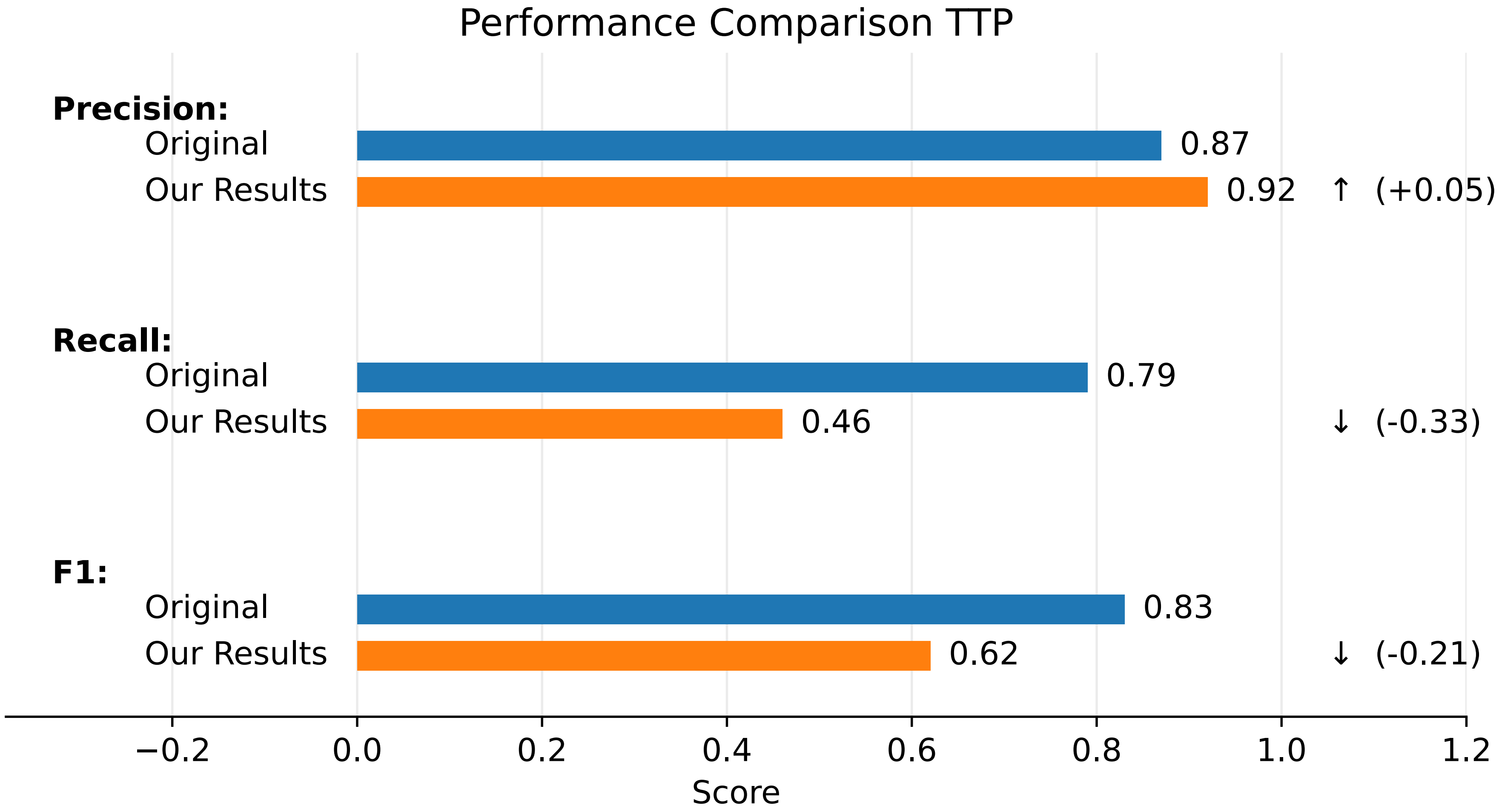
|— OpenAI Mod → TTP / HarmFormer / Perspective

|— HAVOC → Precomputed generations

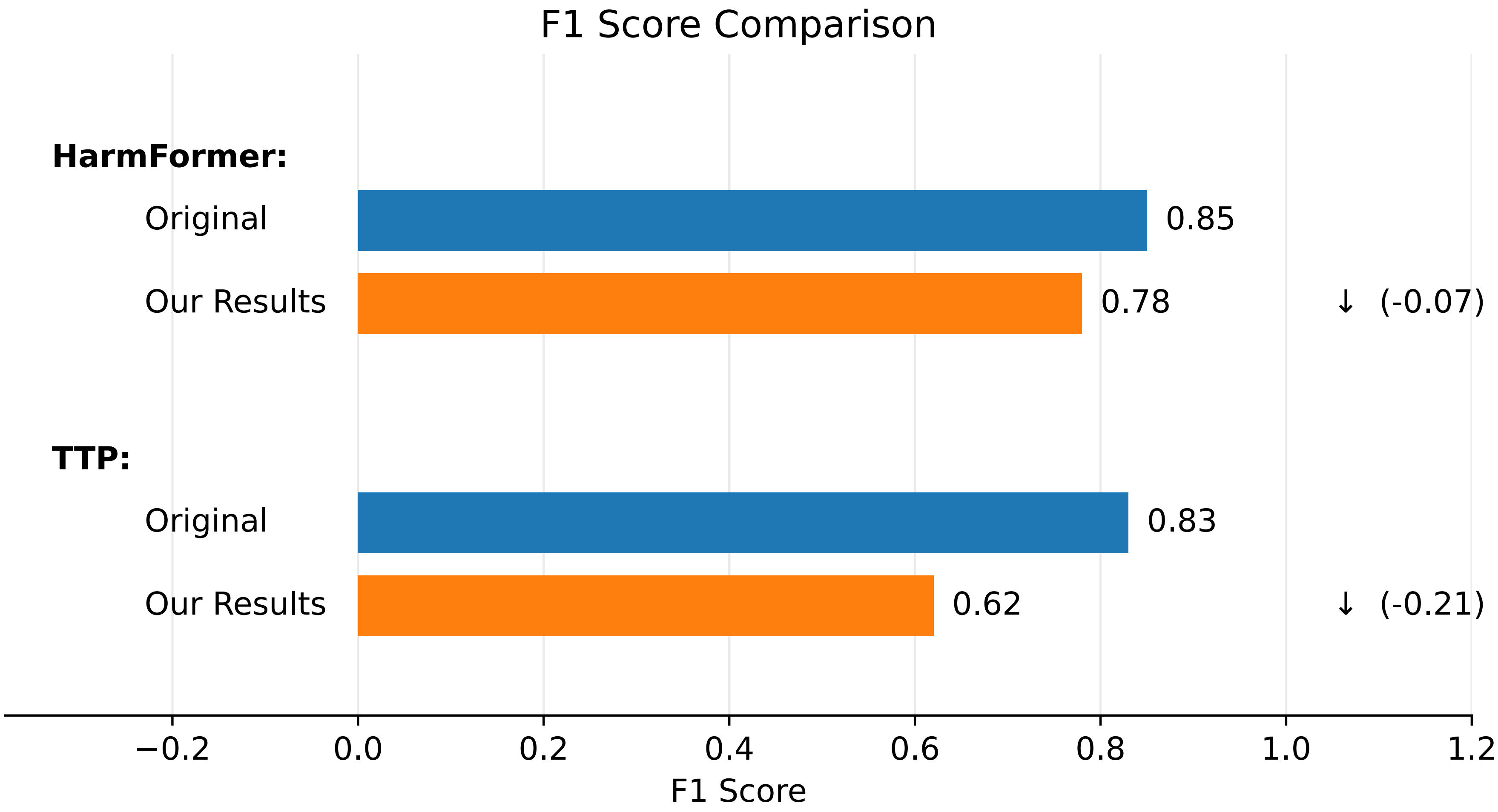
↓

Leakage metrics

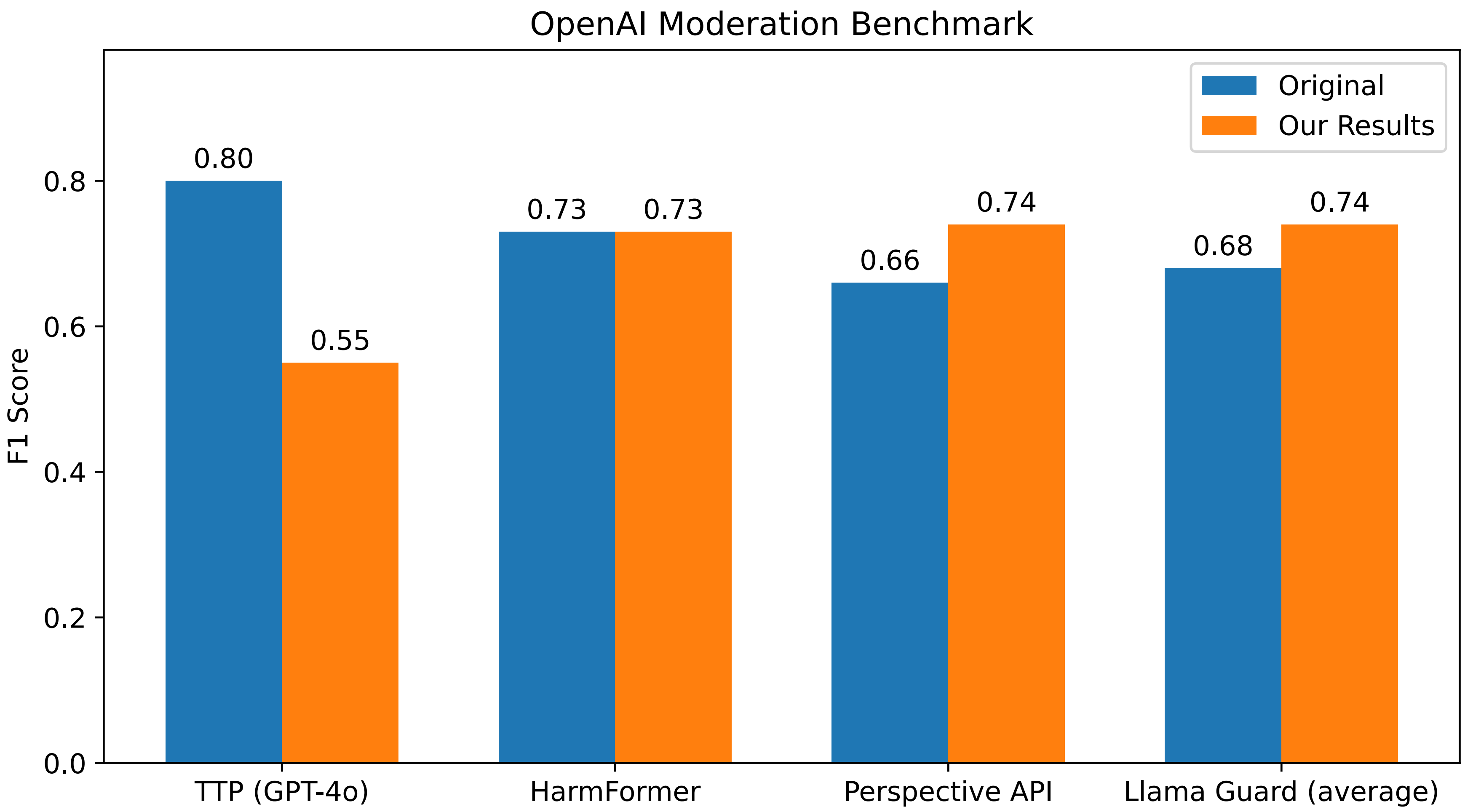
Key Result 1: TTP on TTP-Eval



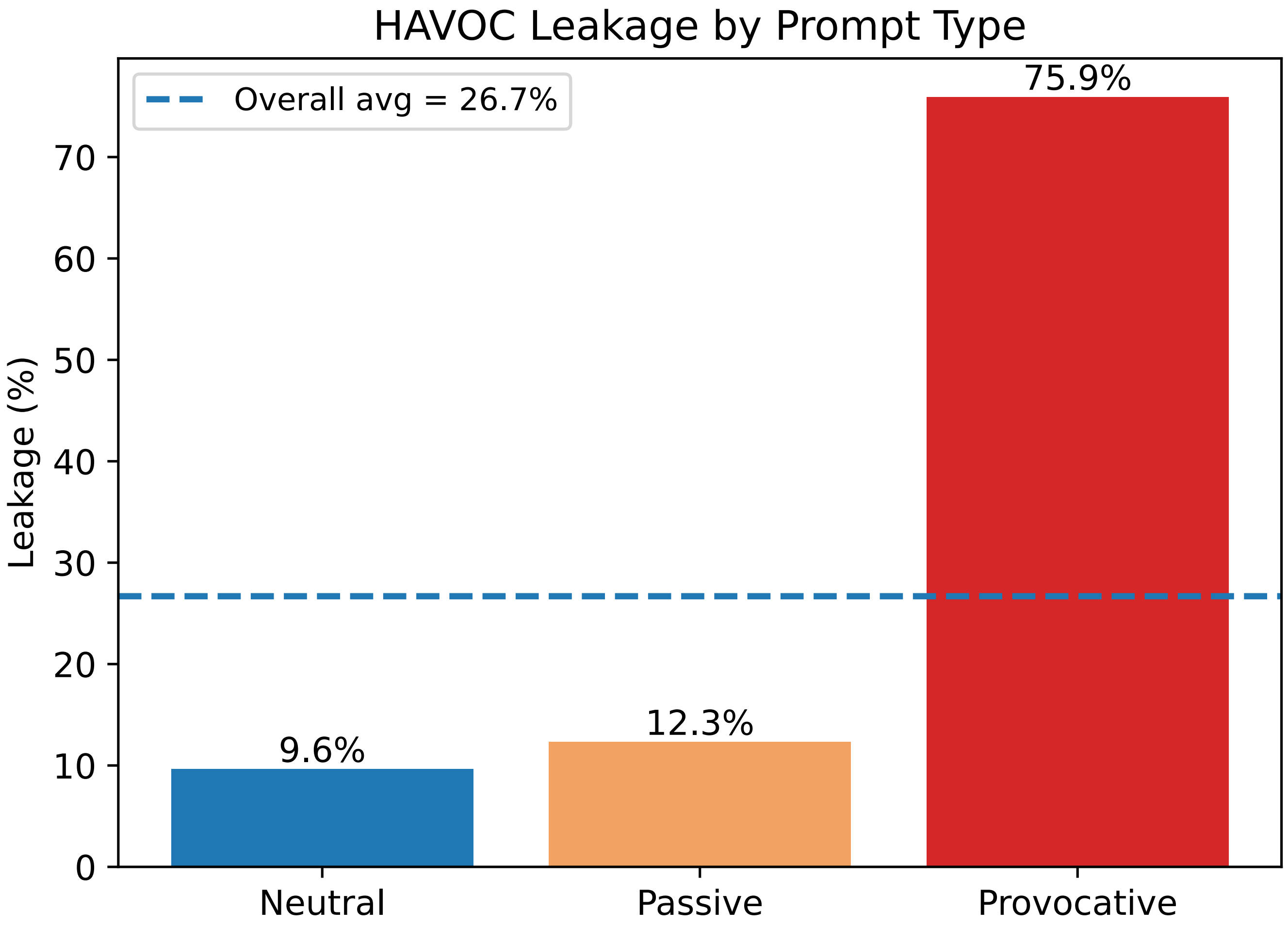
Key Result 2: HarmFormer vs TTP (on TTP-Eval)



Key Result 3: OpenAI Moderation Benchmark



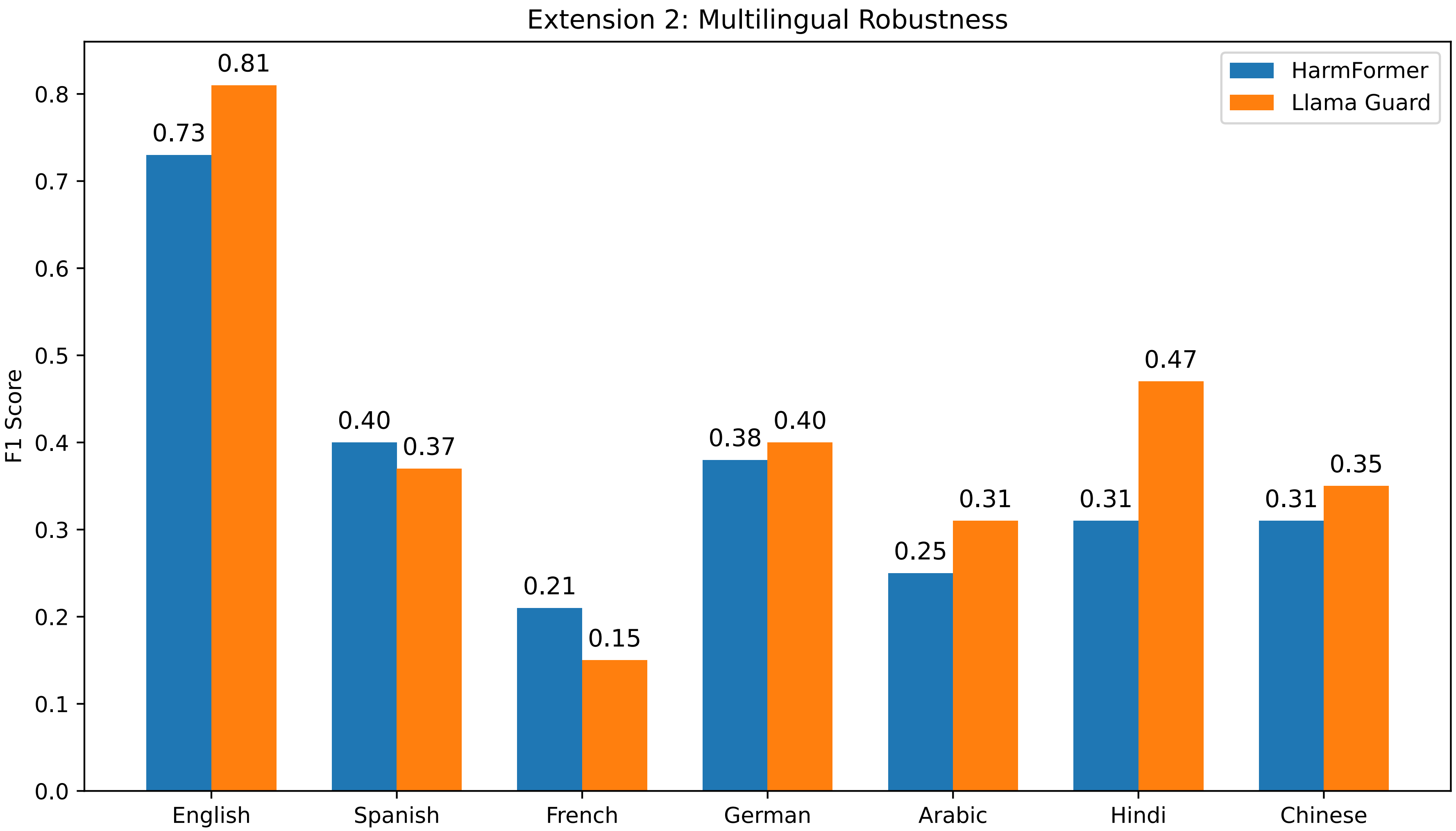
Key Result 4: HAVOC



Extension 1: Cross-Model TTP Robustness

Model	Precision	Recall	F1
GPT-4o	0.92	0.46	0.62
Gemini 2.0 Flash	0.76	**0.84**	**0.80**
DeepSeek-R1-Distill-Qwen-32B	**0.70**	0.58	0.63
Gemma 2 27B	0.95	**0.21**	**0.35**
Gemma 3 27B	0.87	0.42	0.57
GPT-OSS 20B	**0.96**	0.24	0.39

Extension 2: Multilingual Robustness



Reproducibility Summary

Claim	Description	Status
Claim 1	TTP on TTP-Eval	Invalidated
Claim 2	HarmFormer	Partially validated
Claim 3	OpenAI Moderation	Partially validated
Claim 4	HAVOC leakage	Reproduced exactly

Environmental & Practical Impact

Aspect	Original paper	Our reproduction
Web pages processed	~3,000,000	393
Model training	Yes (HarmFormer trained)	No (pretrained)
HAVOC inference	Yes (multiple models)	No (precomputed)
GPU hours	O(10,000+) (estimate)	~5–15
CO_2	Not reported	~0.05 kg

Conclusions and Future Work

- Key Conclusions
  - **HAVOC** is reliable and easily reproducible
  - **HarmFormer** generalizes reasonably to human-annotated data
  - **TTP** performance is model-dependent and fragile
- Future work
  - Future work should focus on building open and robust tools that can generalize well across different model families.