

LLM's prompt optimization via linguistic features

Noemi Quintili - noemi.quintili@gmail.com

National Research Council of Italy (ICAR-CNR)
Dr. Raffaele Guarasci - raffaella.guarasci@icar.cnr.it



Abstract

Large Language Models (LLMs) have revolutionized the field of Natural Language Processing (NLP), but their effectiveness heavily depends on the quality of the input prompts. This research will explore how prompt optimization based on linguistic features (**syntax, semantics, pragmatics**) can improve LLM performance in specific tasks. The objective is to identify prompt strategies that avoid linguistic bias and stereotypes, with a particular focus on the Italian language.

Introduction

The **Italian language** presents a unique syntactic and morphological complexity, with significant implications for LLMs. Furthermore, the availability of Italian-language data is limited compared to English, affecting **output quality**. This research focuses on how the linguistic features of Italian influence the responses generated by LLMs and how prompt optimization can **mitigate ethical issues and biases**.



Research methodology Previous consideration

This study involves the analysis of Italian text corpora alongside specifically designed prompts to assess their impact on LLM-generated outputs. Various LLMs will be tested with different types of prompts to evaluate their responses.

The assessment is conducted using multiple evaluation metrics, including accuracy, coherence and readability.

Additionally, a qualitative analysis will be performed to examine the outputs with regard to stereotypes and gender biases, aiming to identify areas where linguistic and ethical improvements can be made.

- Italian's **morphological complexity** influences LLMs' ability to generate accurate outputs.
- Available **Italian-language data is limited**, leading to potential overrepresentation of certain linguistic variants.
- **Gender stereotypes** are still present in language models and can be amplified by prompts.

Conclusion:

This study highlights the importance of adapting prompt optimization strategies to the specific characteristics of the Italian language. The rich morphology, syntactic flexibility, and cultural nuances of Italian present unique challenges that current multilingual models fail to fully address. Addressing linguistic biases and dataset limitations through human-centered AI methodologies is essential to improving AI-generated responses.

Literature Review:

- Ervas, F., Cocco, R., (2021) *Idola sermonis: Il potere cognitivo degli stereotipi nel linguaggio implicito*. Melterni.
- Mizrahi, M., Kaplan, G., et al. (2024) "State of what art? a call for multi-prompt llm evaluation." *Transactions of the Association for Computational Linguistics*. Volume 12" 933-949. MIT Press.
- Murugadoss, B., Poelitz, C., et al. (2024) "Evaluating the Evaluator: Measuring LLMs' Adherence to Task Evaluation Instructions." arXiv:2408.08781.
- Ruzzetti, S., Onorati, D., et al. (2023) "Investigating Gender Bias in Large Language Models for the Italian Language." Ceur-ws.
- Waldis, A., Perlitz, Y., et al. (2024) "Holmes: Benchmark the Linguistic Competence of Language Models." arXiv:2404.18923.
- Zhang, Z., Liu, Y., et al. (2023) "MELA: Multilingual Evaluation of Linguistic Acceptability." arXiv:2311.09033.

Acknowledgements. The HCAIM (the Human-Centred AI Master's Programme) Project is Co-Financed by the Connecting Europe Facility of the European Union Under Grant N°CEF-TC-2020-1 Digital Skills 2020- EU-IA-0068. This Poster Was Created As Part of the Blended IP Event Organized Under Erasmus + Programme of the European Union.

