IN SEARCH OF THE INVISIBLE

GPT in An Investigation of Hidden Semantic Information

Katarzyna Wiśniewska, PhD
University of Eastern Finland
University of Rijeka

Benedikt Perak, Dr. Sc.
University of Rijeka

The surge of interest in artificial intelligence (AI) stems from the remarkable fluency demonstrated by Large Language Models (LLMs) in language comprehension. Our study focuses on uncovering hidden semantic information, particularly how OpenAI's Generative Pre-trained Transformer (GPT) 4.0 model excels in this area. Informed by documented obstacles in neural machine translation (MT) (Koehn and Knowles, 2017; Wan et al., 2022), challenges in text-generation models (Wang et al., 2023), recent advancements in leveraging LLMs for natural language processing (NLP) tasks (Riemenschneider and Frank, 2023) and human-like translation strategies (He et al., 2024), our aim to evaluate GPT's proficiency in discerning and articulating semantic nuances, comparing its performance with human judgement.

Employing a comparative analysis framework, our study scrutinises a selection of translated sentences from literary and audiovisual texts that have been extensively studied within the framework of Talmy's (2000) force dynamics by Wiśniewska (2022 and 2023). This conceptual framework illuminates how language expresses causality and dynamic relationships between entities, often using the metaphor of physical forces acting on objects. For instance, in the sentence *She persuaded him to go*, the force exerted by *she* leads to the action of *him* going.

Methodologically, our approach is multifaceted, integrating quantitative measures with qualitative analysis to assess the fidelity of translations in capturing hidden semantic information. Custom prompts are employed to elicit translation and self-evaluation of GPT output as metadata. We explore relationships between English, Finnish, and Polish, with a focus on verb phrases and sentences embedded with force dynamics meanings. Evaluation encompasses idiomatic correctness and language conventions, providing technical details alongside a nuanced discussion of semantics in JSON format.

Anticipated findings indicate that while GPT demonstrates remarkable proficiency in rendering surface-level meanings, its ability to identify and articulate hidden semantic information varies based on linguistic context, complexity, and the specificity of prompts. Human translation evaluators display a more nuanced

understanding, leveraging linguistic intuition to analyse translations rich in hidden meanings.

This study contributes to the growing body of research on AI-assisted translation by shedding light on the capabilities and limitations of LLMs in uncovering implied semantic information. By elucidating the interplay between human translators, AI, and MT systems, this research advances our understanding of translation studies in the digital age of NLP. Drawing on insights from studies such as Alzahrani et al. (2024), it emphasises the importance of rigorous methodology and careful consideration of evaluation metrics in assessing the performance of translation models.

References:

Alzahrani, N., Alyahya, H. A., Alnumay, Y., Alrashed, S., Alsubaie, S., Almushaykeh, Y., Mirza, F., Aloitaibi, N., Altwairesh, N., Alowisheq, A., Bari, M. S., and Khan, H. (2024). “When benchmarks are targets: Revealing the sensitivity of Large Language Model leaderboards.” ArXiv. Preprint. arXiv.2402.01781v1. February 1, 2024 [access: 11/03/2024].

He, Z., Lian, T., Jiao, W., Zhang, Z., Yang, Y., Wang, R., Tu, Z., Shi, S., and Wang X. (2024). “Exploring human-like translation strategy with Large Language Models.” In: *Transactions of the Association for Computational Linguistics*. pp. 229–246.

Koehn, P. and Knowles, R. (2017). “Six challenges for neural machine translation.” In: *Proceedings of the First* Workshop on *Neural Machine Translation*. Vancouver, Canada. August 4, 2017. Association for Computational Linguistics, pp. 28–39.

Riemenschneider, F. and Frank, A. (2023). “Exploring Large Language Models for classical philology.” ArXiv. Preprint. arXiv:2305.13698. May 23, 2023 [access: 10/04/2024].

Talmy, L. (2000). *Toward a Cognitive Semantics: Vol. 1. Concept Structuring Systems*. Cambridge: The MIT Press.

Wan, Y., Yang, B., Wong, D. F., Chao, L. S., Yao, L., Zhang, H., and Chen, B. (2022). “Challenges of neural machine translation for short texts”. In: *Computational Linguistics*, 48 (2). pp. 321–342.

Wang, S., Sun, X., Li, X., Ouyang, R., Wu, F., Zhang, T., Li, J., and Wang, G. (2023). “GPT-NER: Named entity recognition via Large Language Models.” ArXiv. Preprint. arXiv:2304.10428. October 7, 2023 [access: 10/04/2024].

Wiśniewska, K. (2022). *Description of Force Dynamics and Cognitive Retention in Literary and Audiovisual Translation*. Unpublished manuscript. PhD thesis. University of Eastern Finland, Joensuu, Finland.

Wiśniewska, K. (2023). *Understanding Cognitive Retention in Translation: An Exploration of a Descriptive Tool Focusing on Cognitive Semantics of Force Dynamics*. Manuscript submitted for publication.