

Peer Review

Review of: "Quantifying Hot Topic Dynamics in Scientific Literature: An Information-Theoretical Approach"

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Referee Report

"Quantifying Hot Topic Dynamics in Scientific Literature: An Information-Theoretical Approach" by A. Chumachenko.

The manuscript presents a novel and interesting approach to measuring conceptual change in scientific literature over time, using Normalized Variation of Information (NVI) as a metric for semantic drift. The method is original, computationally efficient, and interpretable. The paper is well-written and thoughtfully illustrated, with strong potential contributions to scientometrics and computational social sciences, especially international relations.

The paper is a significant contribution to the study of semantic evolution and information-theoretic text analysis. With minor revisions addressing the points below, it would be suitable for publication in Qeios.

1. The figure captions in the supplementary materials are too detailed and read more like extended methodological discussions. While the depth of explanation is appreciated, such commentary would be more appropriately placed in the text.
1. The manuscript briefly mentions large language models (LLMs) but does not sufficiently address their relevance. Given their growing role in semantic modeling and topic tracking, it would be helpful to discuss in the Introduction how LLM-based embeddings compare to or complement the NVI approach, and whether they could enrich or validate the results.
3. The manuscript would benefit from some terminological clarifications. Terms such as "conceptual hub," "velocity matrix," and "distance threshold" are central to the method and should be briefly

redefined or clarified where they first appear.

4. To better situate the contribution within recent developments in topic modeling and semantic shift analysis, the authors are encouraged to cite the following relevant works:

- Wang, Y., Du, M., & Tian, Y. (2024). *Semantic-Augmented Latent Topic Modeling with LLM-in-the-Loop*. arXiv:2507.08498. <https://arxiv.org/abs/2507.08498>
- Cascha van Wanrooi, Omendra Kumar Manhar, Jie Yang (2024). *Topic Modeling for Small Data using Generative LLMs*. BNAIC/BeNeLearn 2024. <https://bnaic2024.sites.uu.nl/wp-content/uploads/sites/986/2024/10/Topic-Modeling-for-Small-Data-using-Generative-LLMs.pdf>
- Montanelli, S., & Periti, F. (2023). *A Survey on Contextualised Semantic Shift Detection*. arXiv:2304.01666. <https://arxiv.org/abs/2304.01666>

Declarations

Potential competing interests: No potential competing interests to declare.