Marianne Reboul

June 6th 2024

{Multilingual Intertext Detection}

in Ancient Languages

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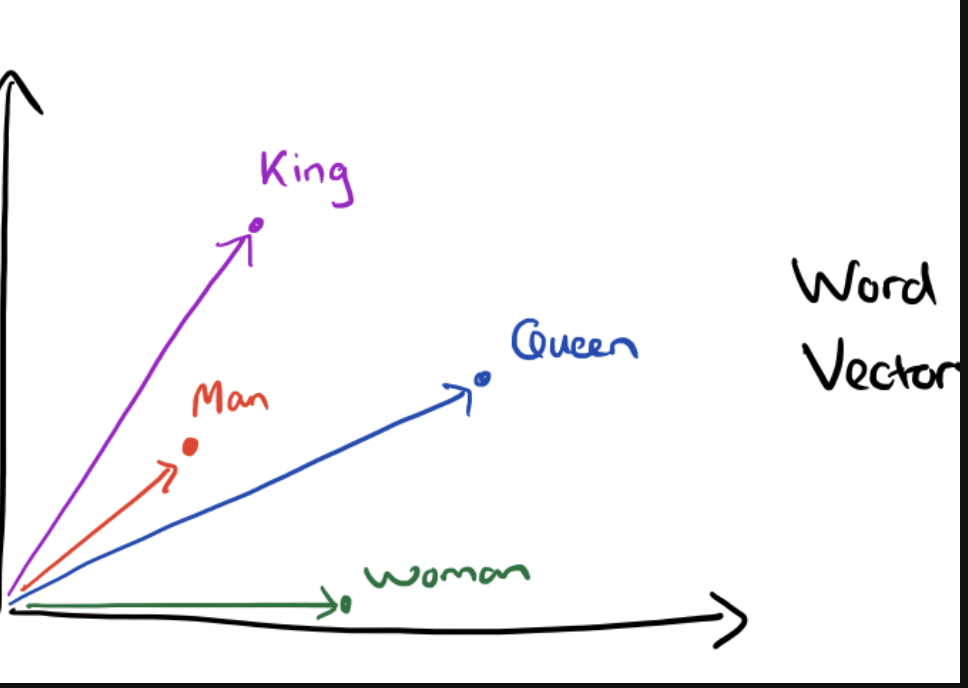
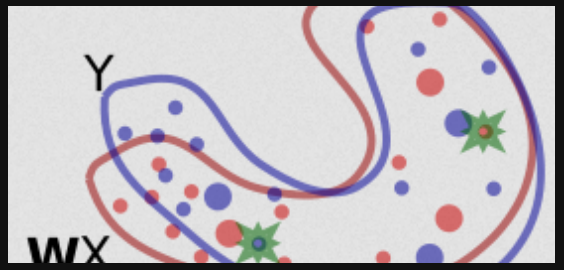
ihrim

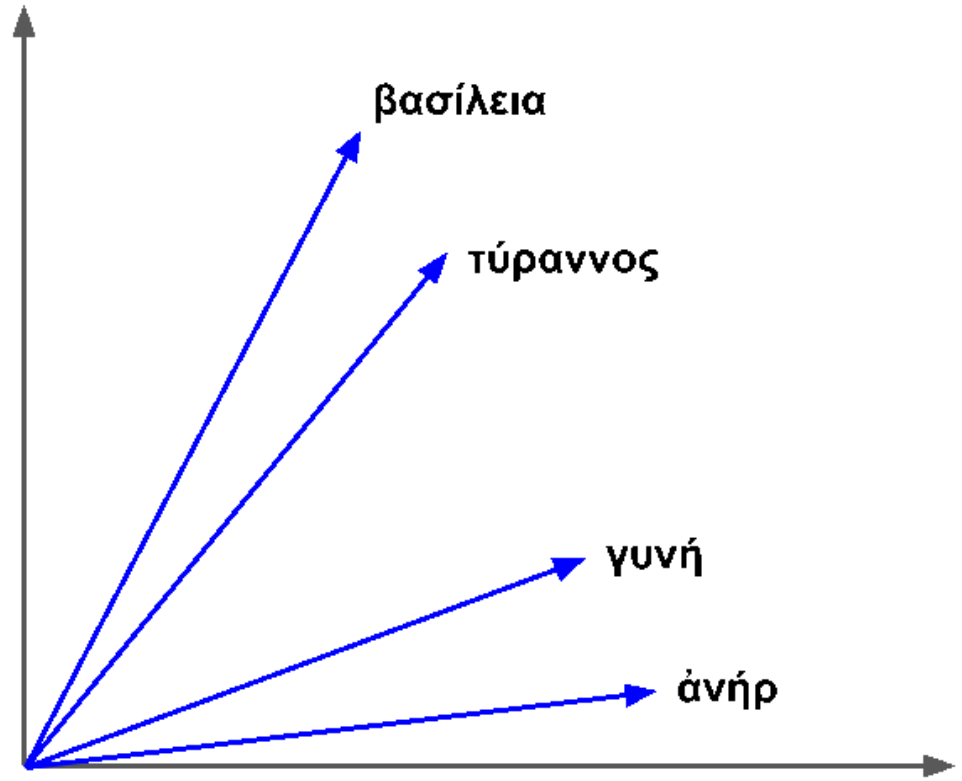




Basic concepts

static word vectors, contextual vectors, ...

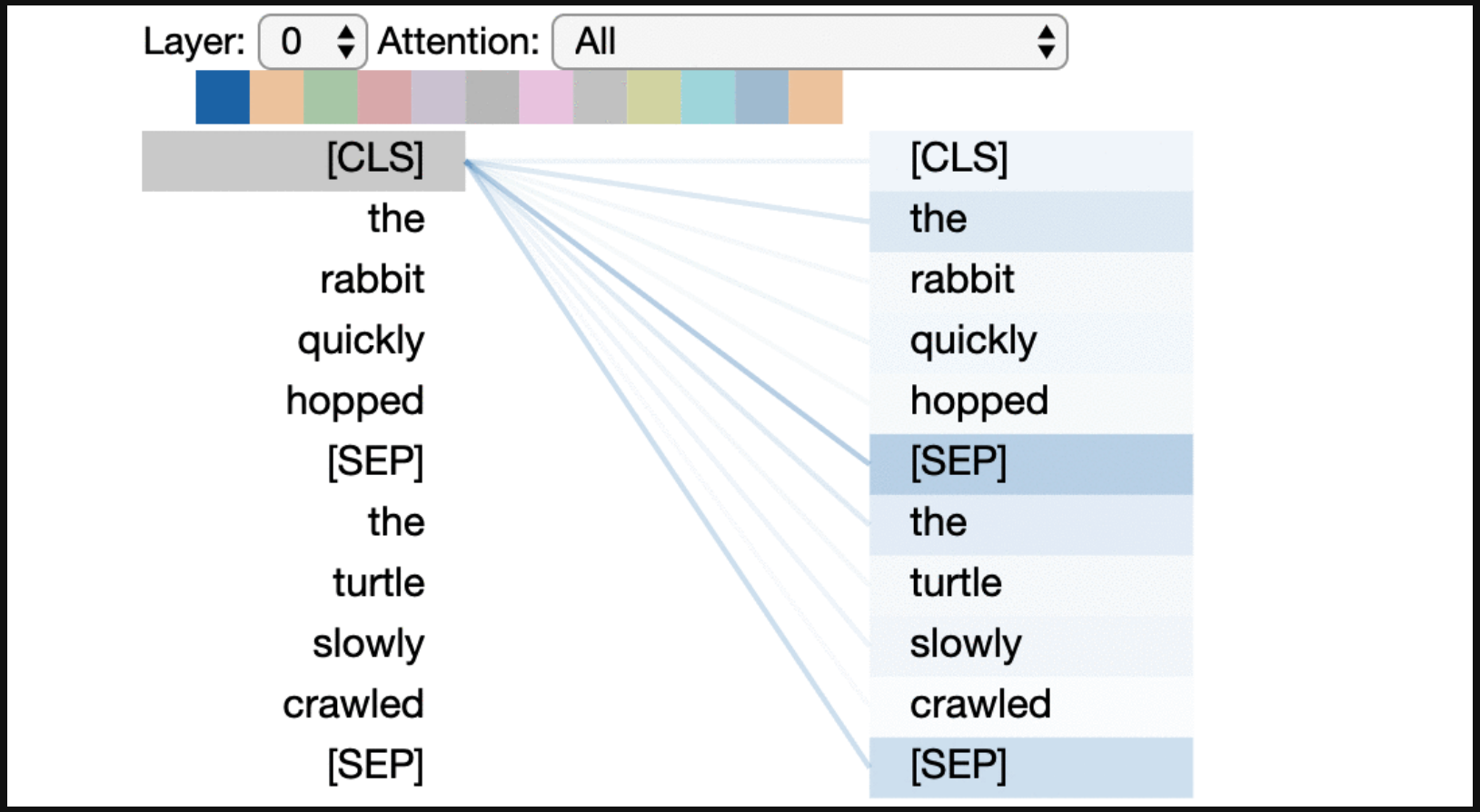
Word vectors



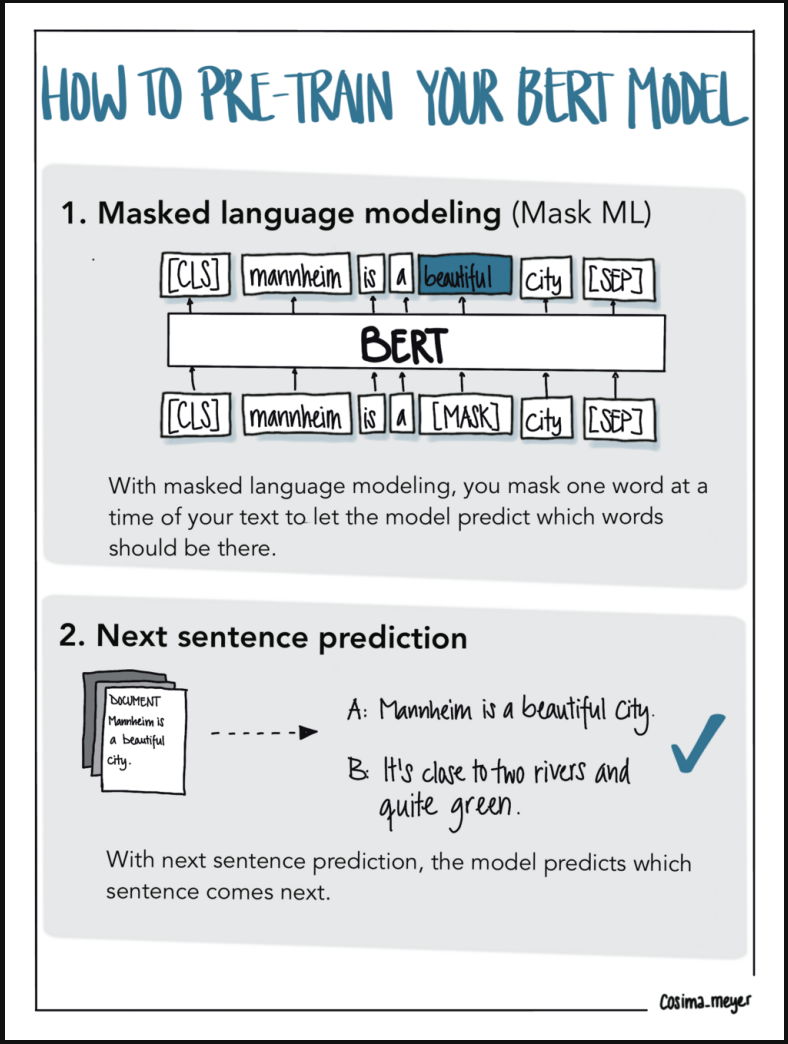
Example on a medium corpus (Balzac)

https://projector.tensorflow.org/

What's a large language model (LLM) ?



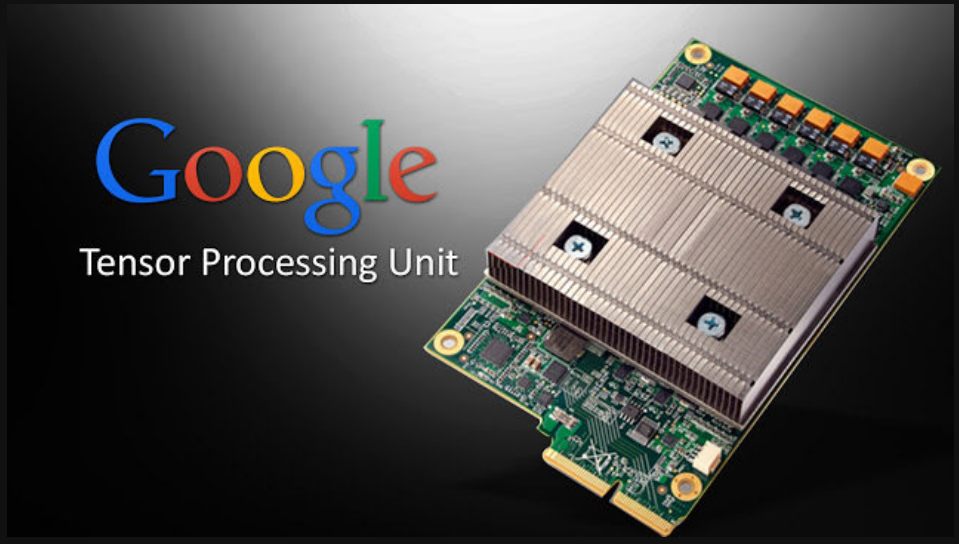
Training



https://www.mzes.uni-mannheim.de/socialsciencedatalab/article/bert-explainable-ai/#bert

Problems ?

You may need some serious hardware.

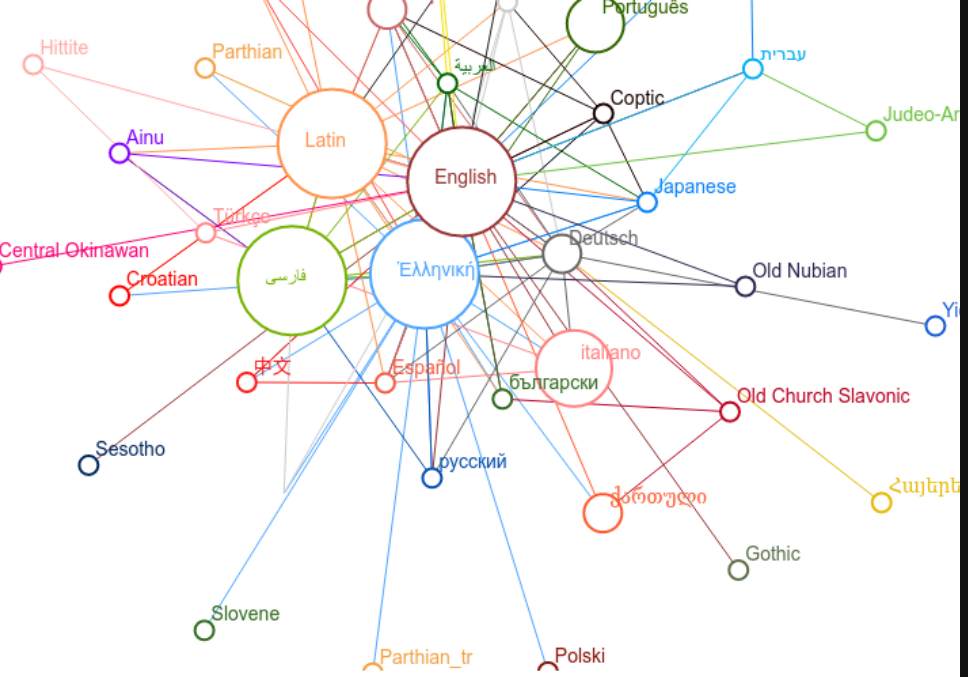


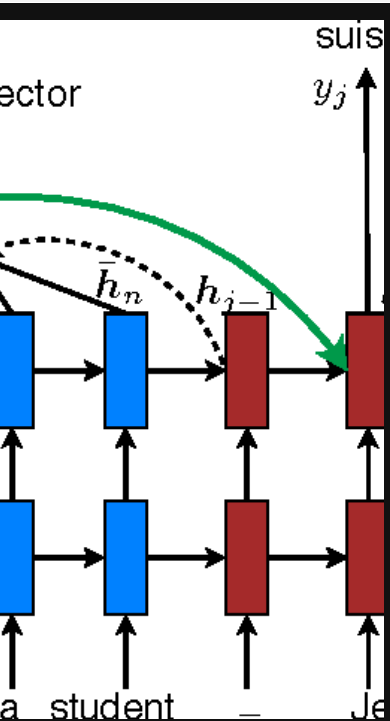
Problems ?

But the main obstacle is :

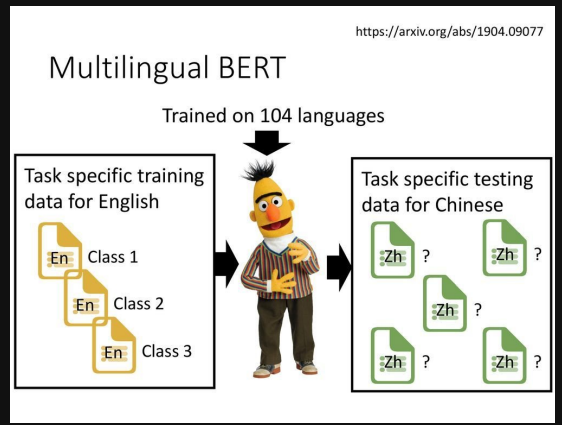
- very few data

- very few representative data (apart from the classical period)





Ἀχιλλῆος	d ' Achille
Δαρδανίδαο ἥγε λαβὼν δ'	pris
ἐρινεὸν	à un figuier sauvage
φεύγοντι	qui s ' échappe
Λυκάονι	Lycaon
τόν	qu
ποτ'	naguère
αὐτὸς	lui - même
πατρὸς	de père
ἀλωῆς	verger



multilingual LLMs

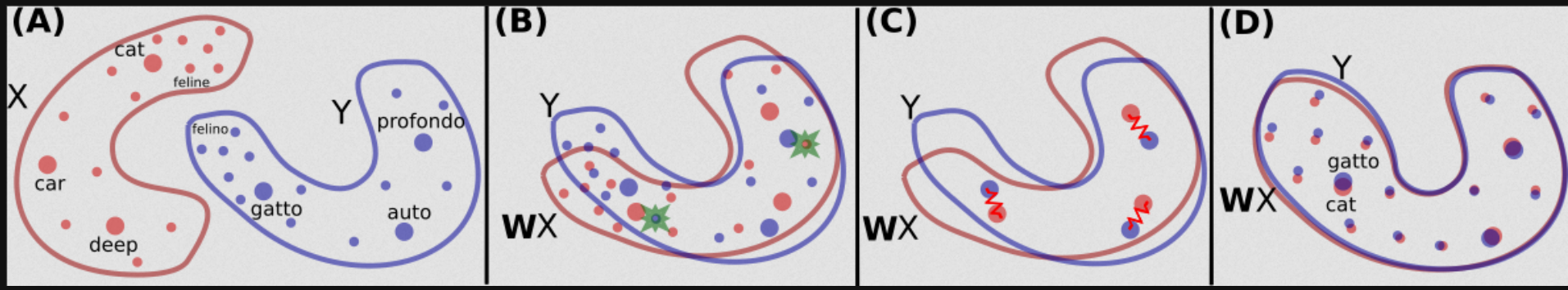
Even bigger problems

Why is it so complex ?

wmt19_translate/de-fr

- **Description** de la configuration : ensemble de données de tâche de traduction de-en WMT 2019.
- **Taille du téléchargement** : `9.71 GiB`

Solution 1 : mapping monolingual spaces



SOLUTION_2

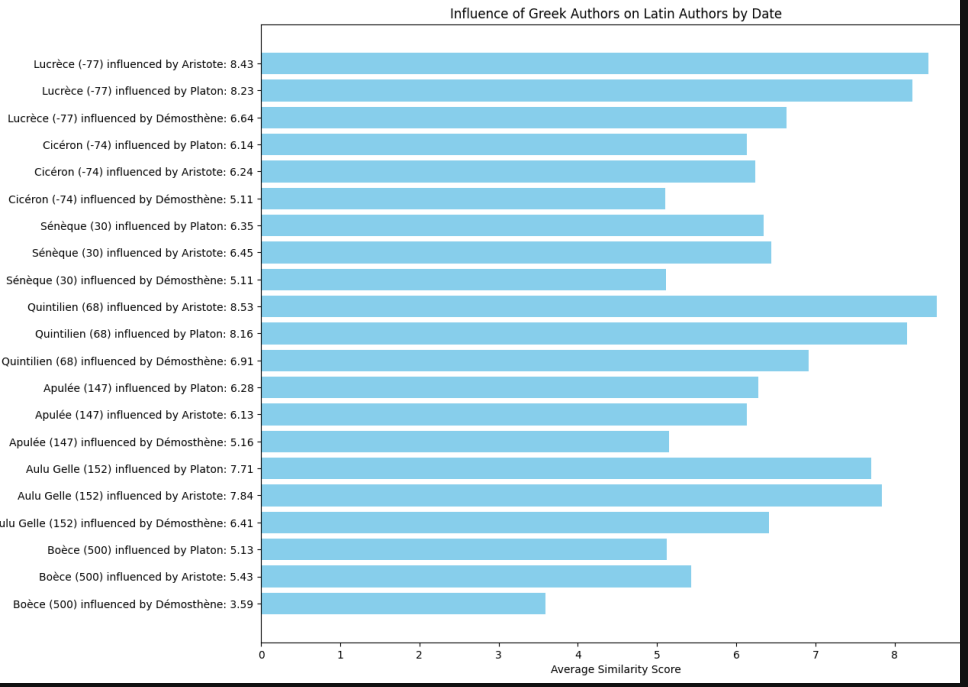
Token similarity with Multilingual BERT

```
greek_word = "λόγος"
greek_embedding = greek_filtered_embeddings[greek_word]

top_latin_words_with_scores = find_most_similar(greek_embedding, latin_filtered_embeddings)

for word, score in top_latin_words_with_scores:
    print(f"{word}: {score:.4f}")
```

```
oratio: 0.9894
τῷ: 0.9892
narratio: 0.9885
καὶ: 0.9878
liber: 0.9877
finis: 0.9877
scribo: 0.9877
loquor: 0.9875
ratio: 0.9875
argumentum: 0.9872
```




```
_grecs = [
halès", "tlg1705", -624, -546),
ythagore", "tlg0632", -570, -495),
éraclite", "tlg0626", -535, -475),
arménide", "tlg1562", -515, -450),
lcidamas", "tlg0610", -450, -400),
ntisthène", "tlg0591", -445, -365),
laton", "tlg0059", -427, -347),
émocrite", "tlg1304", -460, -370),
ristote", "tlg0086", -384, -322),
iogène de Sinope", "tlg1325", -413, -32
orgias de Léontium", "tlg0593", -480, -
émosthène", "tlg0014", -384, -322),
pictète", "tlg0557", 50, 135)

_latins = [
icéron", "phi0474", -106, -43),
ucrèce", "phi0550", -99, -55),
arron", "phi0684", -116, -27),
énèque", "phi1017", -4, 65),
énèque", "stoa0255", -4, 65),
énèque", "phi1014", -4, 65),
uintilien", "phi1002", 35, 100),
pulée", "phi1212", 124, 170),
ulu Gelle", "phi1254", 125, 180),
oèce", "stoa0058", 477, 524),
usonius Rufus", "tlg0628", 20, 101),
arc Aurèle", "tlg0562", 121, 180)
```

```
ile: tlg0086.tlg025.perseus-grc2.xml, Latin File: phi0550.phi001.perseus-la
 Phrase: δῆλον δὲ καὶ ἐκ τῶν τοιούτων λόγων·
 Phrase: id quod iam supra tibi paulo ostendimus ante.
arity Score: 0.9494874477386475

 Phrase: περὶ μὲν οὖν τούτων δεδήλωται καὶ πρότερον·
 Phrase: quo magis inceptum pergam pertexere dictis.
arity Score: 0.9490494132041931

 Phrase: ἔστι δὲ ἀπορία καὶ ἑτέρα περὶ αὐτῶν.
 Phrase: quae tibi posterius largo sermone probabo.
arity Score: 0.948077917098999

 Phrase: περὶ ὧν οὐδὲν ἧττον συμβαίνει τὰ αὐτὰ ἀπορεῖν.
 Phrase: id licet hinc quamvis hebeti cognoscere corde.
arity Score: 0.9477147459983826
```

8.12008

utation and Language

m victorem cepit. Detecting Latin Allusions to Ancie

Anette Frank

ivotal role in Classical Philology, with Latin authors frequently referencing Ancient Greek texts
xtual references has been constrained to monolingual approaches, seeking parallels solely wit
lingual Sentence-RoBERTa model tailored for Classical Philology, which excels at cross-lingua
ences across Ancient Greek, Latin, and English. We generate new training data by automatical
esent a case study, demonstrating SPhilBERTa's capability to facilitate automated detection of
https URL.

lication at the First Workshop on Ancient Language Processing (ALP) 2023; 9 pages, 5 tables
guage (cs.CL)

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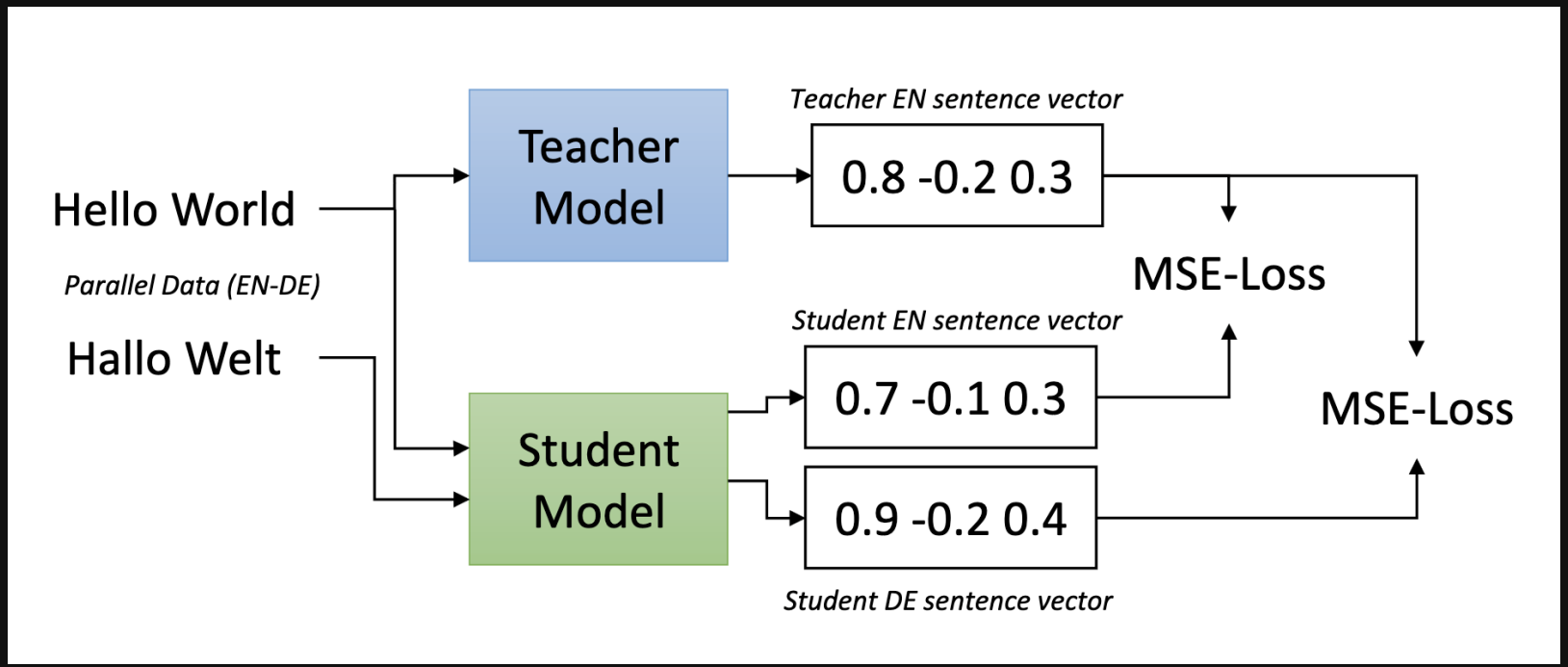
50/arXiv.2308.12008

MULTILINGUAL

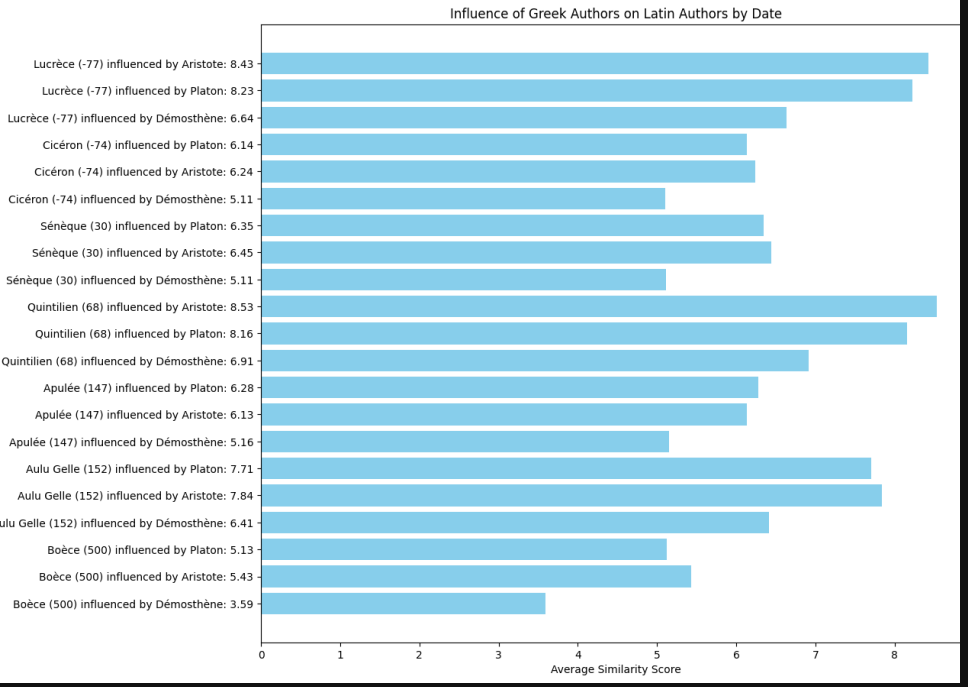
Experiment

Can we quantify proximity between philosophers ?

Model selection : sPhilberta



Nils Reimers and Iryna Gurevych. 2020. Making Monolingual Sentence Embeddings Multilingual using Knowledge Distillation. In *Proceedings of the 2020 Conference on Empirical Methods in Natural Language Processing (EMNLP)*, pages 4512–4525, Online. Association for Computational Linguistics.

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MULTILINGUAL

Steps

from topoi to original ideas

Step 1 : corpus selection

Global open source data (First1KGreek, Perseus)

Thales
Pythagoras
Heraclitus
Parmenides
Alcidamas
Antisthenes
Plato
Democritus
Aristotles
Diogenes of sinope
Gorgias
Demosthenes
Epictetus

~ 50 000 unique sentences

Cicero
Lucretius
Varro
Seneca
Quintilian
Apuleius
Aulus Gellius
Boetius
Musonius Rufus
Marcus Aurelius

~ 100 000 unique sentences

Step 2 : topoi versus peculiarities

Thales

Pythagoras

Heraclitus

Parmenides

Alcidamas

Antisthenes

Plato

Democritus

Aristotles

Diogenes of sinope

Gorgias

Demosthenes

Epictetus

~ 50 000 unique sentences

χ^2

Docs	Word 1	Word 2	Word 3	Author
Doc1	3	0	1	A
Doc2	0	4	1	B

$$Eij=(Ni.\times N.j)/N$$

Ni. : all words in class *i*.

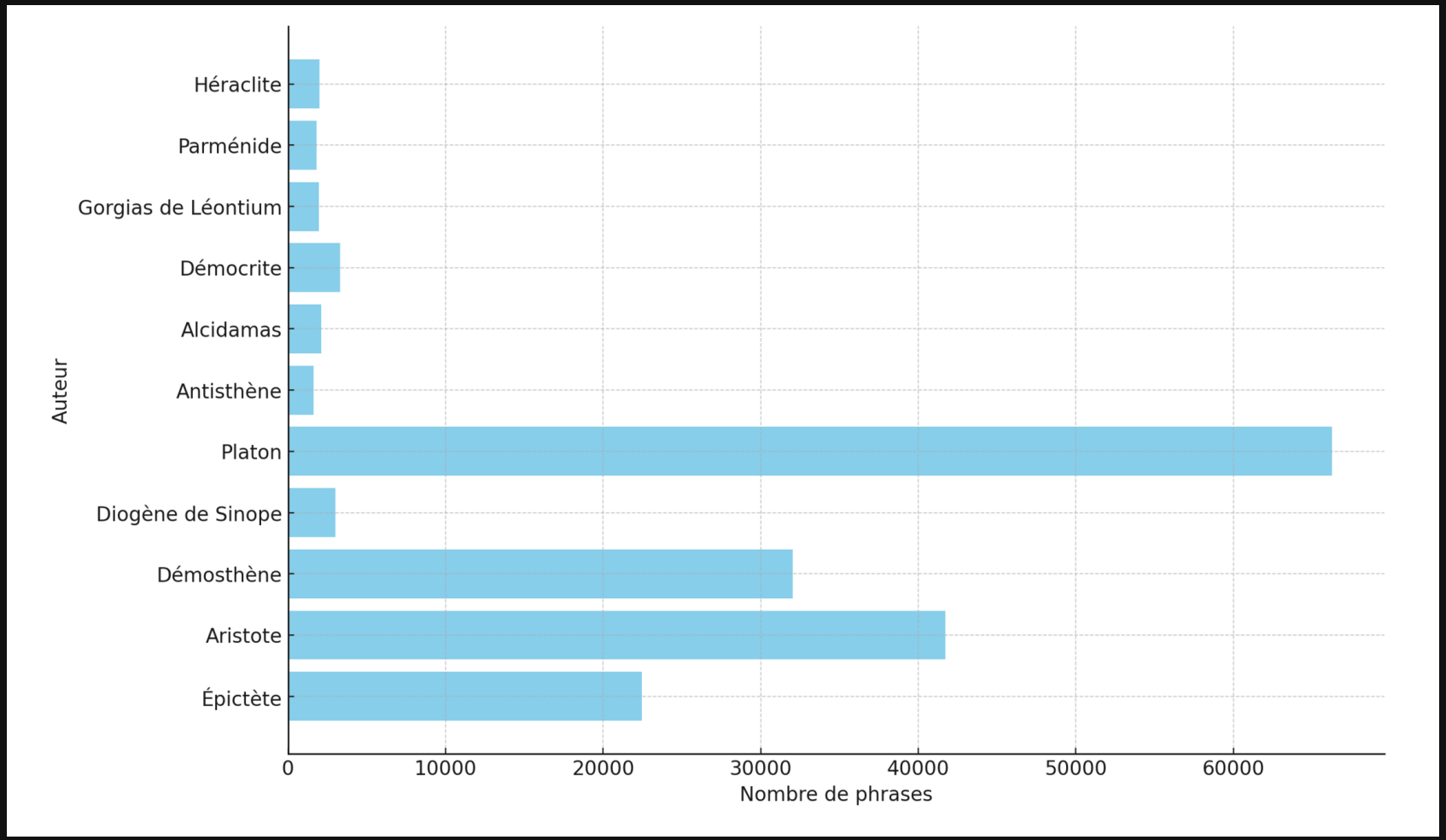
N.j: all words *j* in all classes.

N : all words in all classes.

- Word 1 pour Auteur A : $E=(4*3)/9=1.33.$
- Word 1 pour Auteur B : $E=(5*3)/9=1.67.$

- $\chi^2 = \frac{(3-1.33)^2}{1.33} + \frac{(0-1.67)^2}{1.67} = \frac{2.77}{1.33} + \frac{2.79}{1.67} = 2.08 + 1.67 = 3.75$
- $\chi^2 = \frac{(0-1.78)^2}{1.78} + \frac{(4-2.22)^2}{2.22} = \frac{3.17}{1.78} + \frac{3.17}{2.22} = 1.78 + 1.43 = 3.21$
- $\chi^2 = \frac{(1-0.89)^2}{0.89} + \frac{(1-1.11)^2}{1.11} = \frac{0.0121}{0.89} + \frac{0.0121}{1.11} = 0.014 + 0.011 = 0.025$

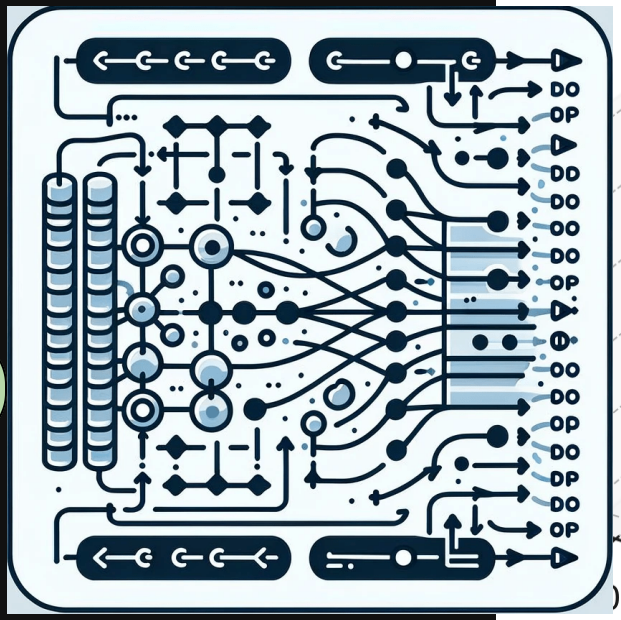
Step 3 : filtering corpus

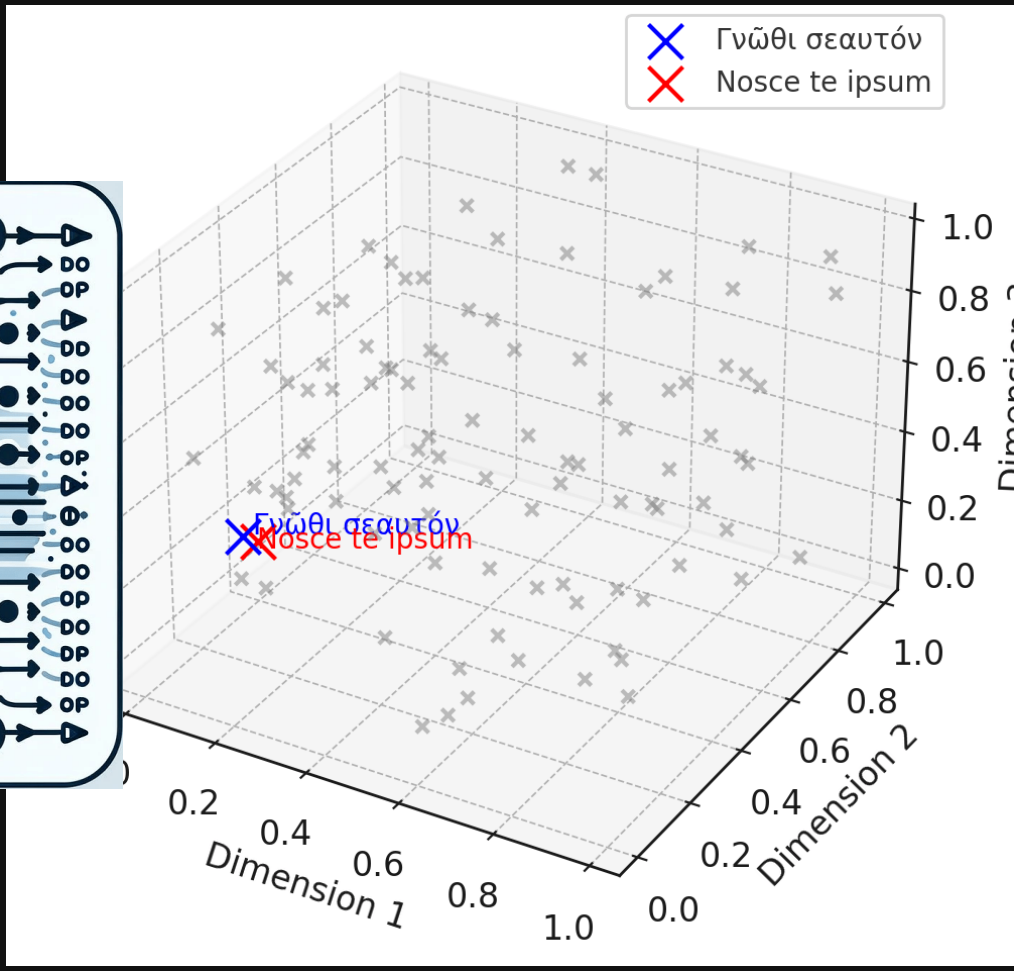


Step 4 : encoding

latin sentence

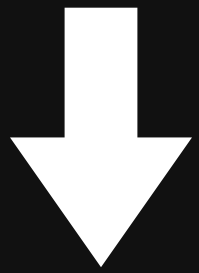
greek sentence





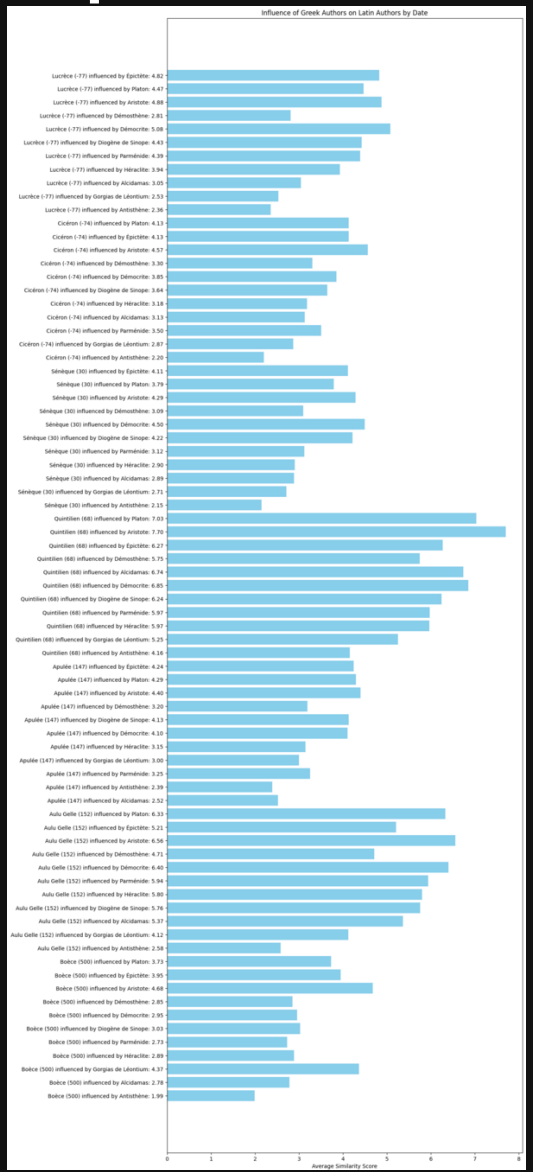
Step 4 : raw results and re-calculated

```
Distribution des similarités filtrées par auteur grec :
Auteur : tlg0014, Nombre de similarités : 1251200
Auteur : tlg0086, Nombre de similarités : 1669362
Auteur : tlg0557, Nombre de similarités : 824366
Auteur : tlg0059, Nombre de similarités : 3359990
Auteur : tlg1562, Nombre de similarités : 15828
Auteur : tlg0626, Nombre de similarités : 14775
Auteur : tlg1304, Nombre de similarités : 56673
Auteur : tlg0610, Nombre de similarités : 23685
Auteur : tlg1325, Nombre de similarités : 38615
Auteur : tlg0593, Nombre de similarités : 13377
Auteur : tlg0591, Nombre de similarités : 3633
```



Similarity means / number of sentences per author (total)

Step 5 : final results



Main results :

Aristotle, although with less sentences, is much more represented in latin authors on the whole period

Plato remains one of the main inspirations through time

Some of the smallest authors (in terms of frequency) are still represented, mostly in earlier latin authors

Epictetes is definitely influenced by contemporary latin authors

Quintilian seems to be the author where global similarities are the most referenced

Contact

Thank you for your attention

Github link for experiment

marianne.reboul@ens-lyon.fr

github : OdysseusPolymetis

Useful references

Yousef, T., Palladino, C., Shamsian, F., d'Orange Ferreira, A., & Ferreira dos Reis, M. (2022). An automatic model and Gold Standard for translation alignment of Ancient Greek. In Proceedings of the Language Resources and Evaluation Conference (pp. 5894–5905). European Language Resources Association. Marseille, France. Retrieved from https://aclanthology.org/2022.lrec-1.634

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Riemenschneider, F., & Frank, A. (2023). Graecia capta ferum victorem cepit. Detecting Latin Allusions to Ancient Greek Literature. In *Proceedings of the First Workshop on Ancient Language Processing*. Association for Computational Linguistics. Varna, Bulgaria. Retrieved from https://arxiv.org/abs/2308.12008

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Contact

Thank you for your attention

Colab link for experiment

marianne.reboul@ens-lyon.fr

github : OdysseusPolymetis

Bibliographie

Yousef, T., Palladino, C., & Jänicke, S. (2022). Transformer-based named entity recognition for ancient greek.

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Riemenschneider, F., & Frank, A. (2023). Exploring large language models for classical philology. *arXiv preprint arXiv:2305.13698*.

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