

Leveraging NLP, LLMs and Network Community Detection for Enhanced Narrative Extraction in the UK Migration Debate



TEODOR D. YANKOV

Oxford Internet Institute

University of Oxford

MSc Social Data Science



The UK Migration Debate



- ▶ Over the past decade, migration has become a **central** and **contentious** issue in the UK.
- ▶ Policymakers, journalists and civil society actors need to disentangle migration narratives.
- ▶ Narratives exist in a **vast**, **dynamic** and **decentralised** information space, as big (unstructured) data.
- ▶ This calls for scalable computational methods for narrative extraction (NE).

What methods exist currently?



NLP



Topic modelling

Opportunity:

well-established algorithms,
sets foundations for CNE

Gap: not scalable, info loss,
low output interpretability



Networks



Community detection

Opportunity: community
detection better and more
efficient than clustering.

Gap: semantic blindness, no
granular applications yet.



LLMs



Topic representation

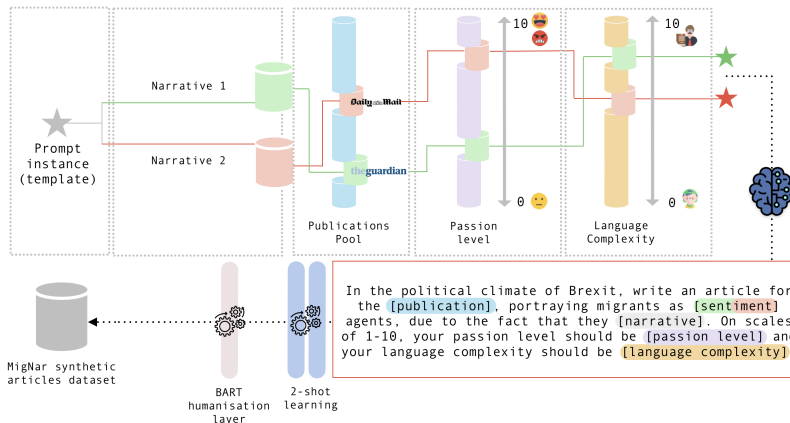
Opportunity: interpretable
representations, lowers
overhead.

Gap: very new, needs
prompt engineering.

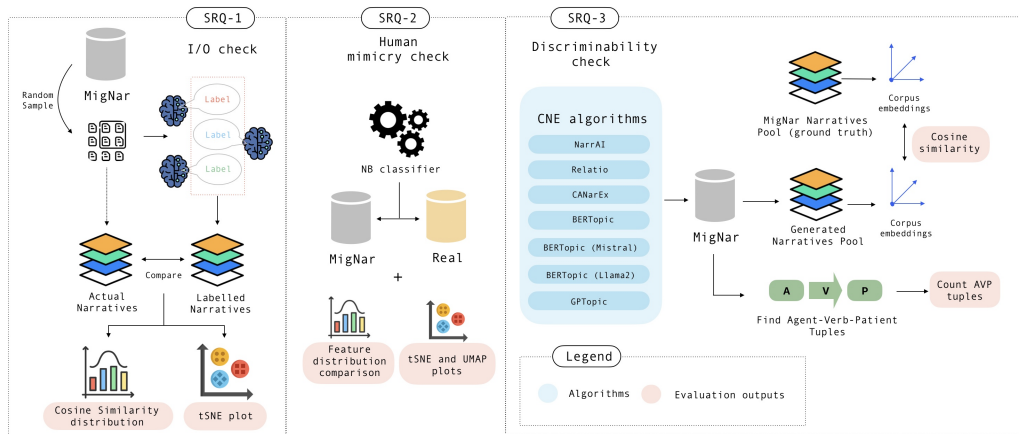
Challenges

- ▶ **Gap:** Most methods stuck on *topic* representations, we need *narrative* representations. Those that focus on narratives are very intense computationally.
 - ▶ **Gap:** No algorithm exists that leverages traditional NLP methods, network methods and LLMs together.
 - ▶ **Gap: no benchmark** to compare CNE algorithmic performance.
- ▶ I propose a benchmark dataset for CNE algorithmic performance evaluation and comparison → **MigNar**
 - ▶ I propose a CNE algorithm → **NarrAI**

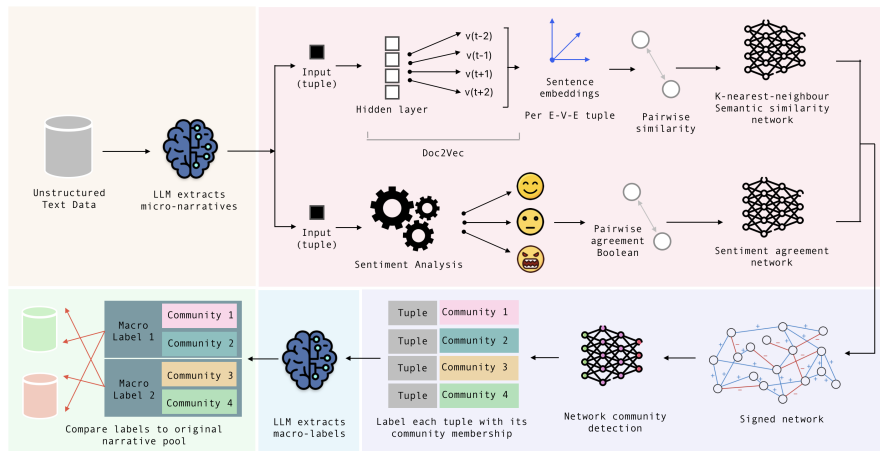
MigNar architecture



Evaluation framework



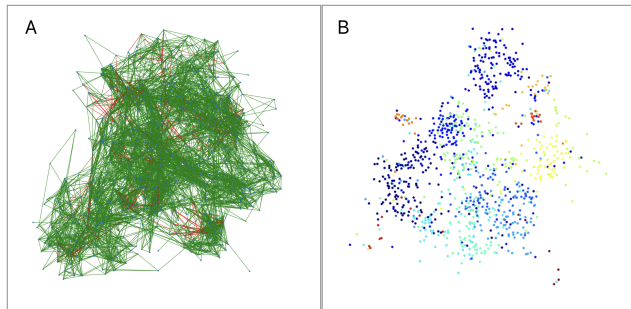
NarrAI Architecture



Tuning & Robustness checks

- ▶ Comparing results across representation LLMs - GPT 4 Turbo, GPT 3.5 Turbo, Claude 3.5 Sonnet.
- ▶ Comparing results across community detection approaches → regular Louvain (ignoring signed edges) and regular Leiden.
- ▶ Comparing results across different values of k (k -nn semantic similarity graph).
- ▶ Comparing results with different embedding algorithms: BERT, SBERT, Doc2Vec.

Results - *NarrAI*-identified *MigNar* Narratives



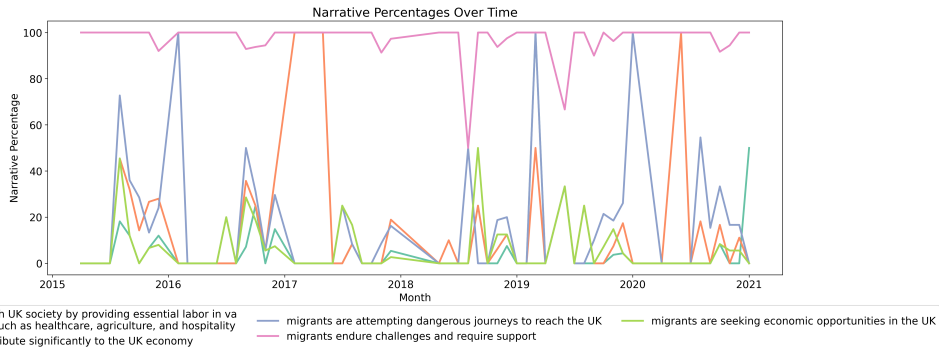
- ▶ "Migration challenges public resources and social cohesion"
- ▶ "Migrants alleviate workforce shortages and enrich UK's healthcare and public sectors"
- ▶ "Migrants significantly enrich the UK's cultural fabric"
- ▶ "Migrants receive preferential treatment"
- ▶ "Migrants are linked to crime"
- ▶ "Migration poses challenges to integration"
- ▶ "Migration strains public services"
- ▶ "Migrants fill essential roles and significantly boost the UK economy"

Results - model discriminability

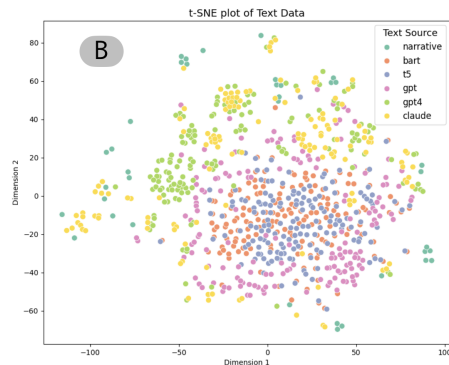
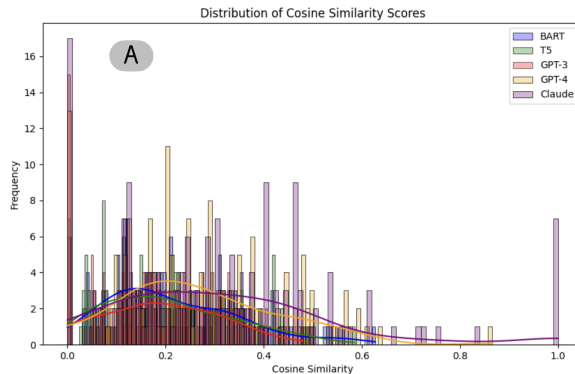
Model	CNE score	AVP score
Relatio	0.697	0.061
CANarEx	0.899	0.893
BERTopic (cTF-IDF)	0.567	0.750
BERTopic (Llama)	0.880	0.250
BERTopic (Mistral)	0.796	0.059
GPTopic	0.815	0.000
NarrAI LLM baseline	0.709	0.900
NarrAI	0.989	0.923

Table: CNE algorithms' performance on the MigNar benchmark.

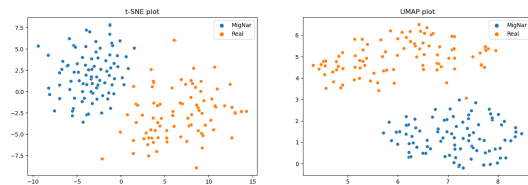
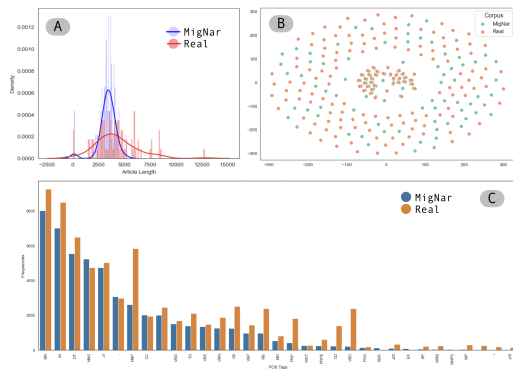
Applying NarrAI to real data



MigNar I/O Check



MigNar Human Mimicry Check



Conclusion and Future Work

- ▶ NarrAI outperforms state-of-the-art CNE in narrative recovery and narrative structuring.
- ▶ Performance consistent across robustness checks.
- ▶ MigNar benchmark successfully demonstrates theory congruent model performance differentials.
- ▶ Room for improvement in MigNar I/O and Human Mimicry capacity.
- ▶ Current clustering layer has $O(N^2)$ complexity, potential to make it more efficient.
- ▶ Potential to increase the size of the MigNar dataset, and to test out NarrAI on a more diverse and larger sample of real articles.

Thank you all! Questions?