Economic and Social Research Council

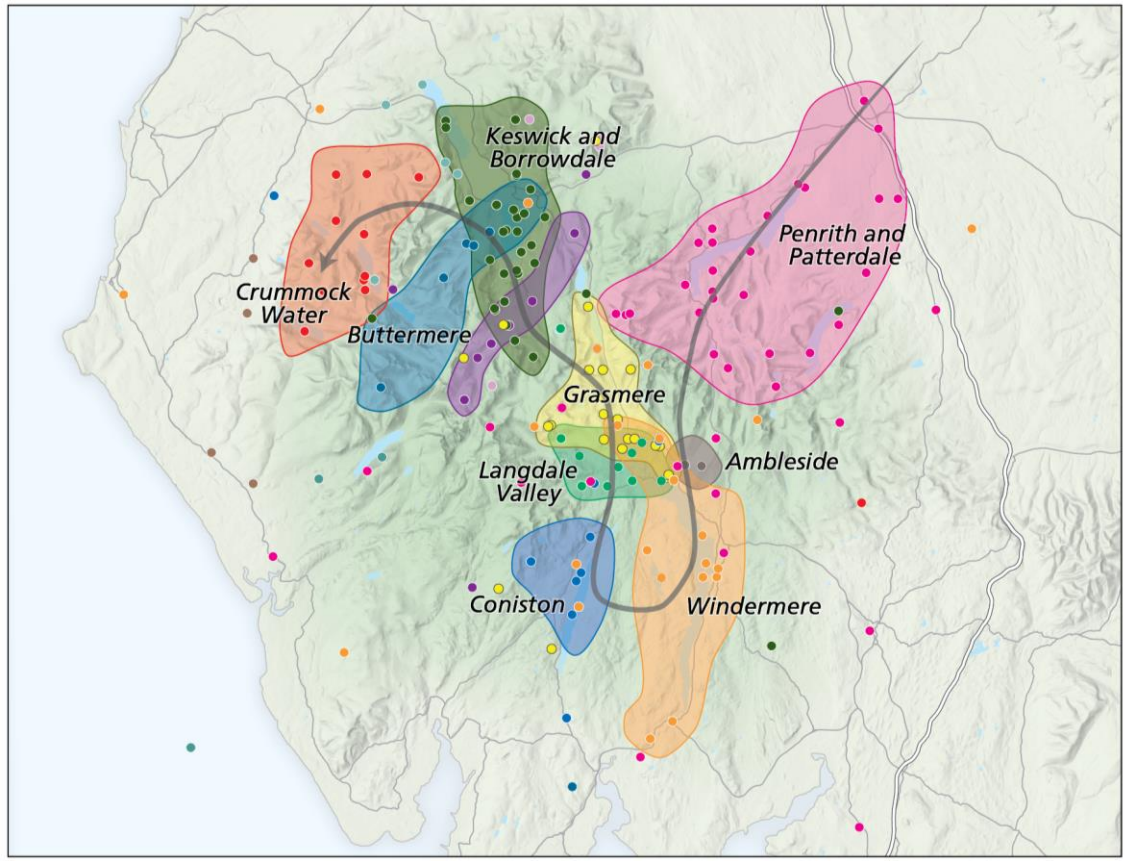
The National Science Foundation

The Spatial Narratives Project

Accessing and Interpreting Space and Time in Large Corpora

Towards an Extensible Framework for Understanding Spatial Narratives

GeoHumanities '23: 7th ACM SIGSPATIAL Int' Workshop on Geospatial Humanities, November 2023



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https://spacetimenarratives.github.io/

Our Project

- Spatial narratives help us to organize experiences and give them meaning.
- Previous approaches 'textual geographies' focus on geoparsing identifying place names and allocating them to coordinates.
- Limited to named places with coordinates, and have little concept of time.
- Often omits vague, imprecise, and ambiguous, e.g "*the camp*", or "*the hills in the distance*", and relative locations such as "*near to*", "*on the left*", "north of" or "*a few hours' journey from*".
- Leaves out experience, emotion, and memory accompanying the geography.
- We aim to gain more insight from textual data beyond the toponyms and introduce an extensible framework for extracting, analyzing, and visualizing spatial elements

Project Objective

Given a piece of writing, can we extract and build a narrative around:

- Locations:
  - Texts often use toponyms (place names) for locations often reduced to a coordinate for mapping.
- Locale:
  - Usually nouns for geographical features such as ‘house’, ‘lake’, ‘mountain’ etc. often vague or ambiguous and cannot be directly mapped in Euclidean space.
- Sense of place:
  - subjective and emotional expressions by a person that make the place a unique community or landscape.
  - Events that occur at a place will contribute to this.
  - Various forms of date, time, and other temporal references

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Corpora: CLDW and HST

Corpus of the Lake District Writing

- Comprises 80 texts and around 1.5 million
- Texts originally created between 1622 – 1900
- Containing travel literature, fiction, histories, letters, and diaries.
- Includes works by well-known Lake Poets
  - e.g. William Wordsworth and Samuel Taylor Coleridge.
- Also accounts by prominent writers such as Daniel Defoe and Celia Fiennes

Holocaust Survivor's Testimonies

- Contains 1k transcripts of survivor interviews; approx 21m words/tokens
- Each comprises a series of interviewer's questions and the survivors' answers
- Chronicles the survivors' Holocaust experience
- Duration =~ 2hrs: 20% pre-war life; 60% wartime experience; 20% post-war
- Highlights sites of incarceration or hiding serving as anchors that describe survivors' wartime trajectories.

Defining and Labelling Spatial Entities

- **PLNAME**: Any mention of a specific placename (toponym) e.g. '*Penrith*', '*Keswick*'
- **GEONOUN**: geographical feature nouns e.g. '*river*', '*road*', '*waterfall*'
- **EVENT**: descriptions of events or activities e.g. '*ride*', '*walk*', '*excursion*'
- **EMOTION**: expressions of sentiments and emotions. For example e.g. '*delightful excursions*', '*pleasant walk*', or '*horrible ravines*'
- **DATE|TIME**: references to dates e.g. '*March 1803*', '*the beginning of the century*') and time e.g. '10 o'clock', 'late in the evening')
- **PERSON**: proper names and references to people
- **DISTANCE**: expressions of distance measures '*about four miles*'

*We are also considering:
- **spatial prepositions** (*above*, *behind*, *below*, *through*, *within*)
- **locative adverbs** (*alongside*, *downtown*, *homewards*, *southward*, *up-country*)
- **movements:** mostly verbs indicating a change in location (*cross*, *walk, etc*)

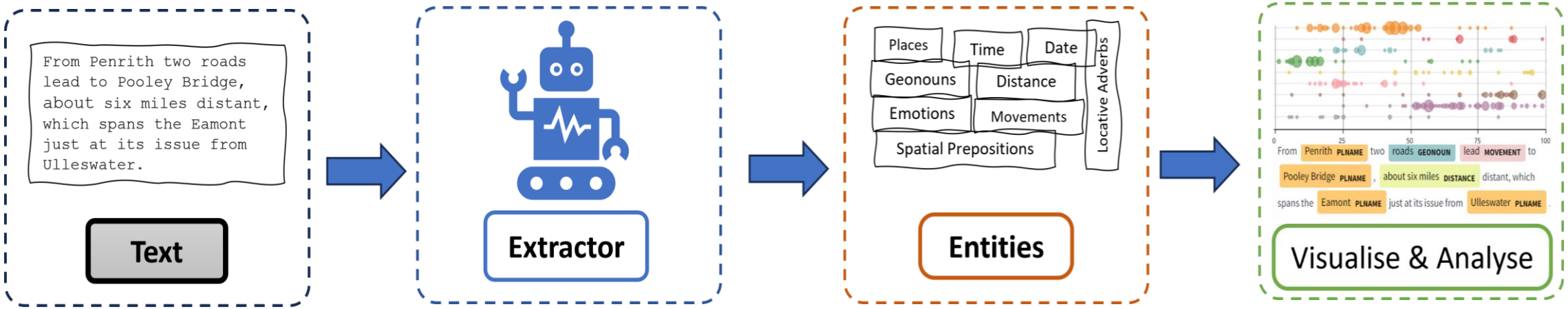
Spatial Entities - Example

Category	Description	Example	Source
PLNAME	Place names	From Penrith two roads lead to Pooley Bridge	CLDW
GEONOUN	Geo feature nouns	Cross the bridge, and take the first road to the right.	CLDW
TIME	Temporal references	If I survive tonight, I will remember the 9th of April	HST
DATE	Date mentions	Americans will probably be here the following day.	HST
EVENT	Events or activities	You lost your brother and father in the Holocaust?	HST
MOVEMENT	Movements	Cross the bridge, and take the first road to the right.	CLDW
SPPREP	Spatial preposition	Carleton Hall is near to it on the left.	CLDW
LOCADV	Locative adverb	I wasn't here, I was sleepwalking	HST
DISTANCE	Distance measure	Lowther Castle is about four miles from this bridge.	CLDW
EMOTION	Sentiments	The march is a nightmare, completely obliterated.	HST

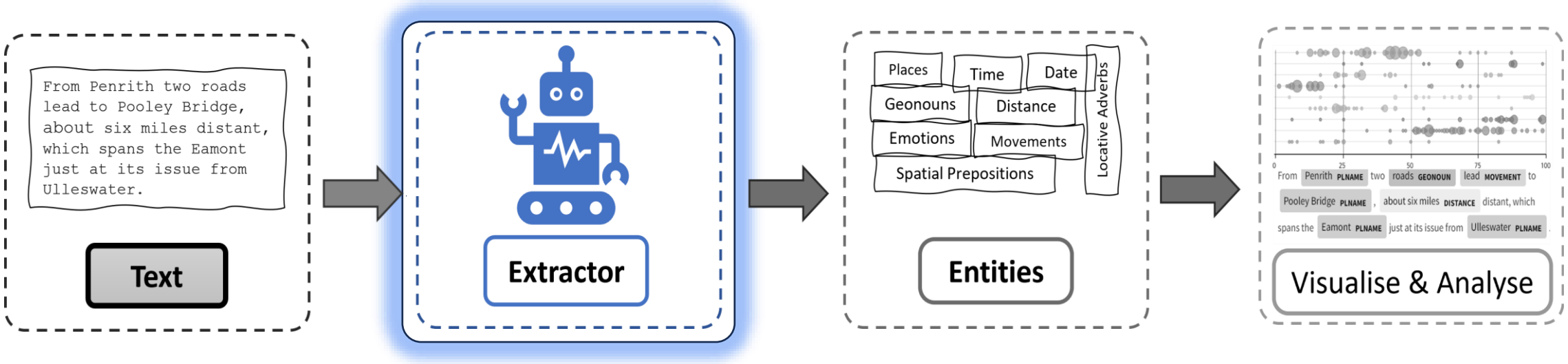
Key Tasks

Corpus annotation	Annotate the corpus to reflect the occurrence of spatial elements of interest: *toponyms, geo nouns, emotions, events, time*
Spatial entity extraction	Develop NLP techniques to appropriately identify, extract, and categorize these elements.
Spatial visualization	Add a user-friendly visualization interface to the extraction tool to look at the special entities
Analysis	Perform analysis on the extracted entities to build a narrative

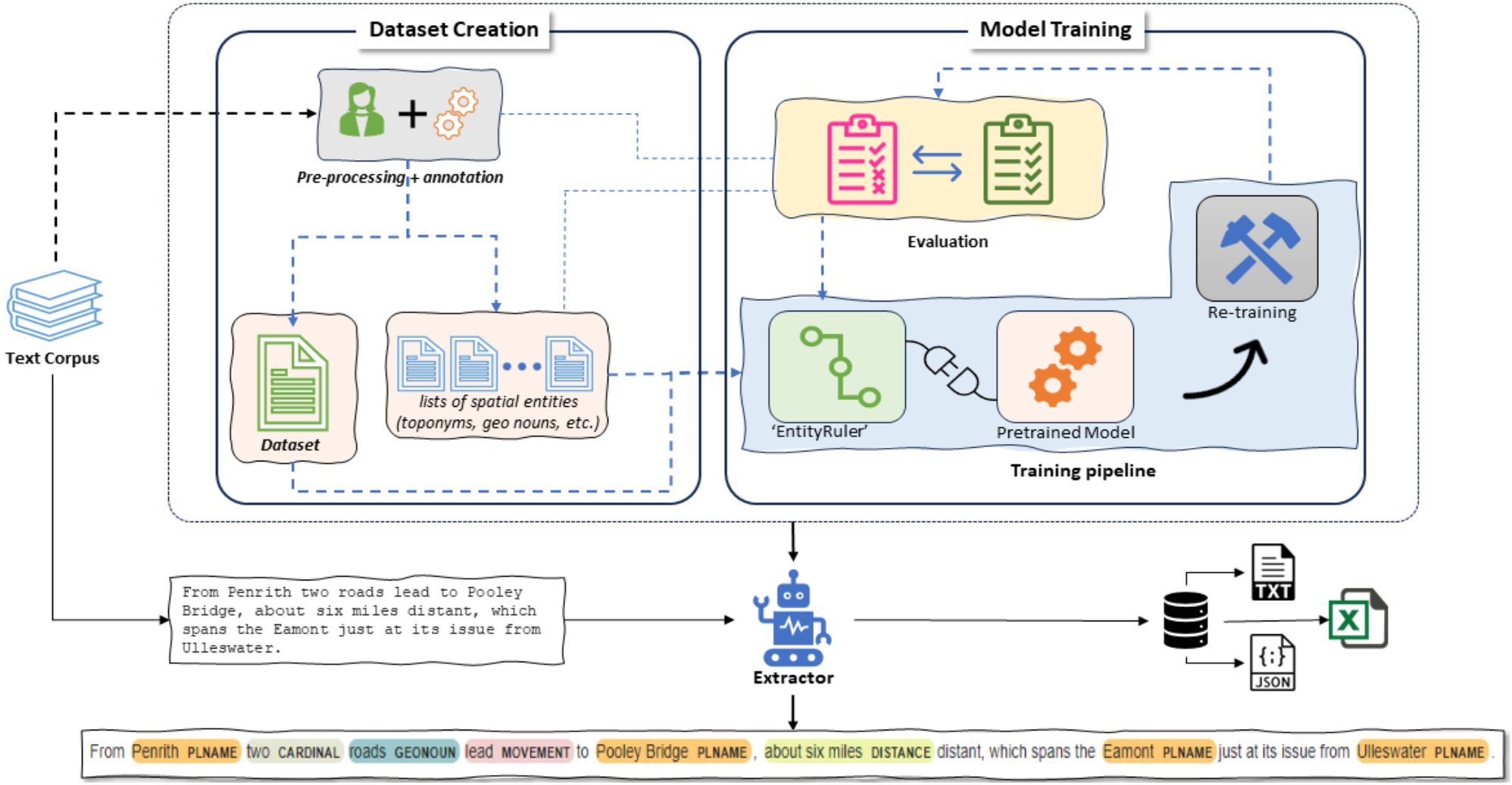
Proposed Framework



Proposed Framework



Building the Entity Extractor



Evaluation

Entity Category	CLDW			HST		
	Regex	SpaCy	**Ext**	Regex	SpaCy	**Ext**
PLNAME	85.76	87.33	**90.20**	52.34	71.61	**72.86**
GEONOUN	82.44	–	**85.78**	78.51	–	**68.33**
LOCADV	61.55	–	**63.85**	55.94	–	**57.07**
DISTANCE	67.73	73.25	**79.29**	60.75	63.60	**68.08**

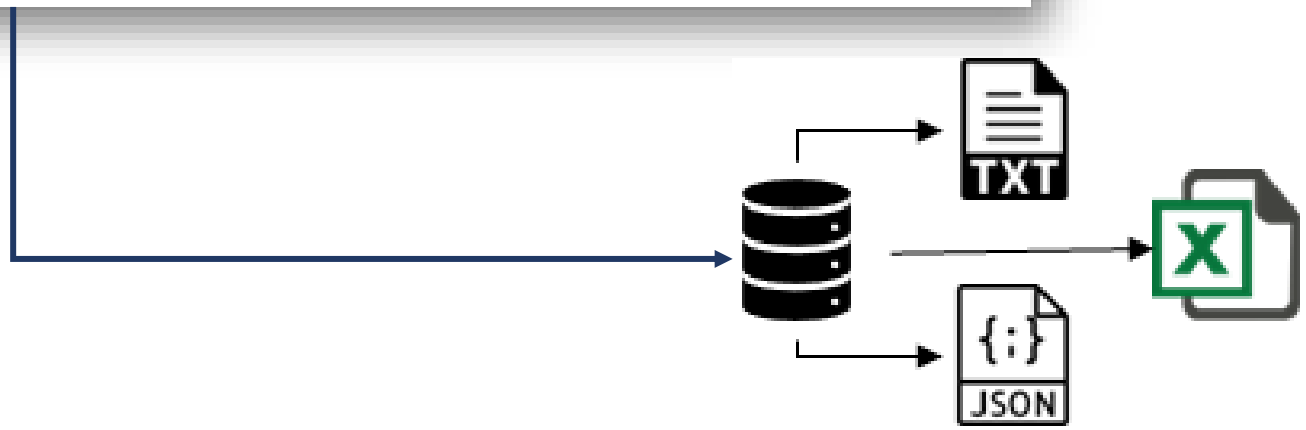
Visualisations

- **Sentence 1:** *From Penrith two roads lead to Pooley Bridge, about six miles distant, which spans the Eamont just at its issue from Ulleswater.*

From Penrith **PLNAME** two roads **GEONOUN** lead **MOVEMENT** to Pooley Bridge **PLNAME** , about six miles **DISTANCE** distant, which spans the Eamont **PLNAME** just at its issue from Ulleswater **PLNAME**

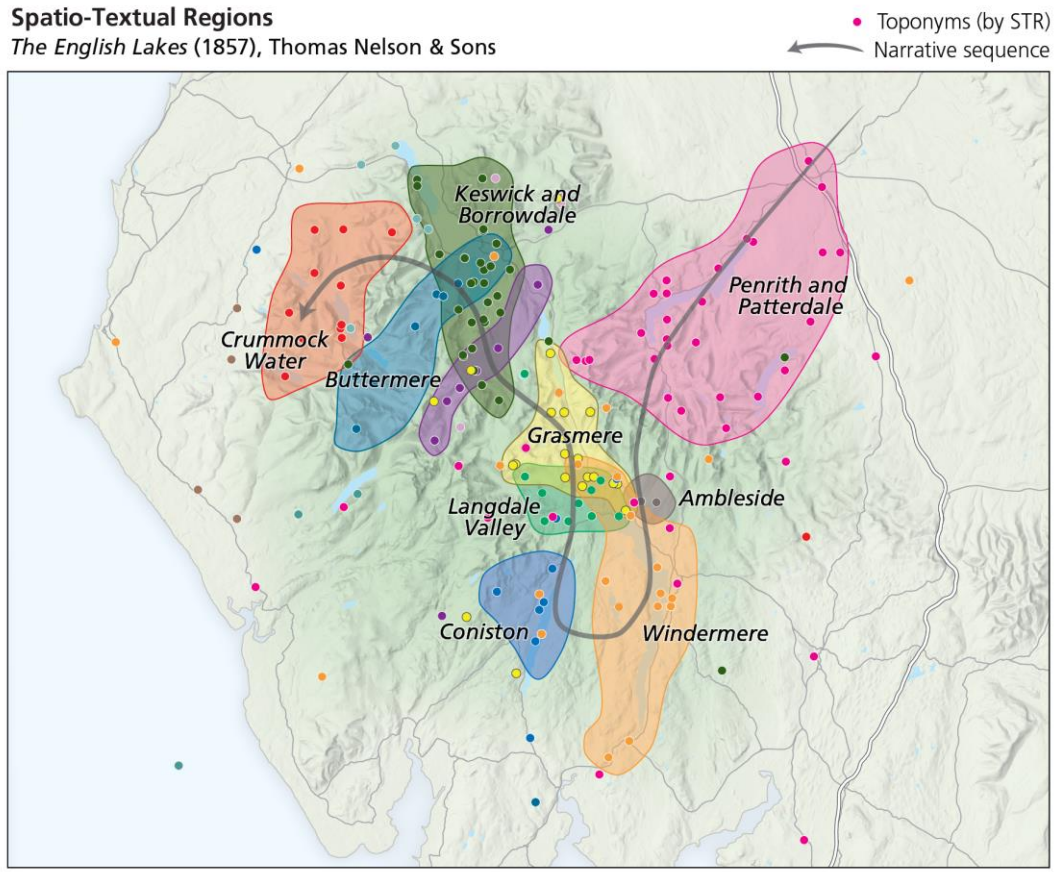
- **Sentence 2:** *Carleton Hall is near to Eamont Bridge on the left.*

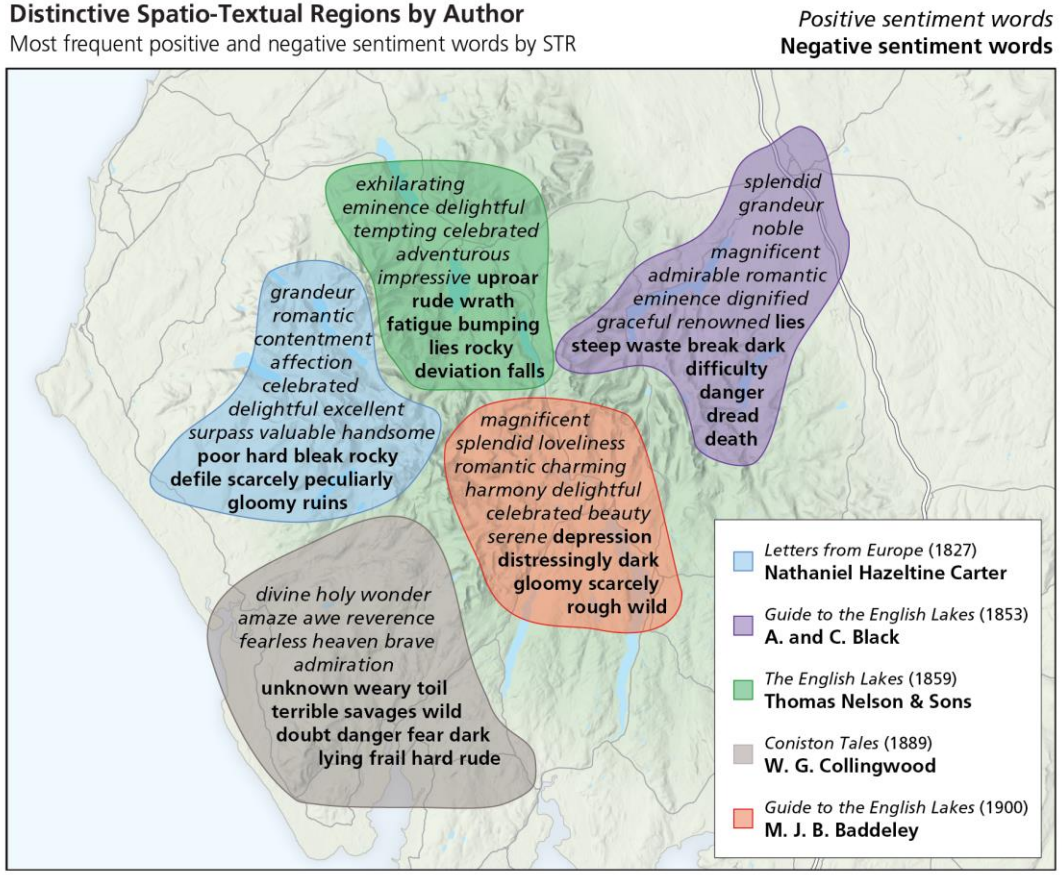
Carleton Hall **PLNAME** is near **LOCADV** to Eamont Bridge **PLNAME** on the left **LOCADV** .



Source: Ezeani, et al. Extracting Imprecise Geographical and Temporal References from Journey Narratives, Text2Story '23

Visualisations





Source: Steiner, et al, Spatio-Textual Regions: Extracting Sense of Place from Spatial Narratives PLATIAL'23

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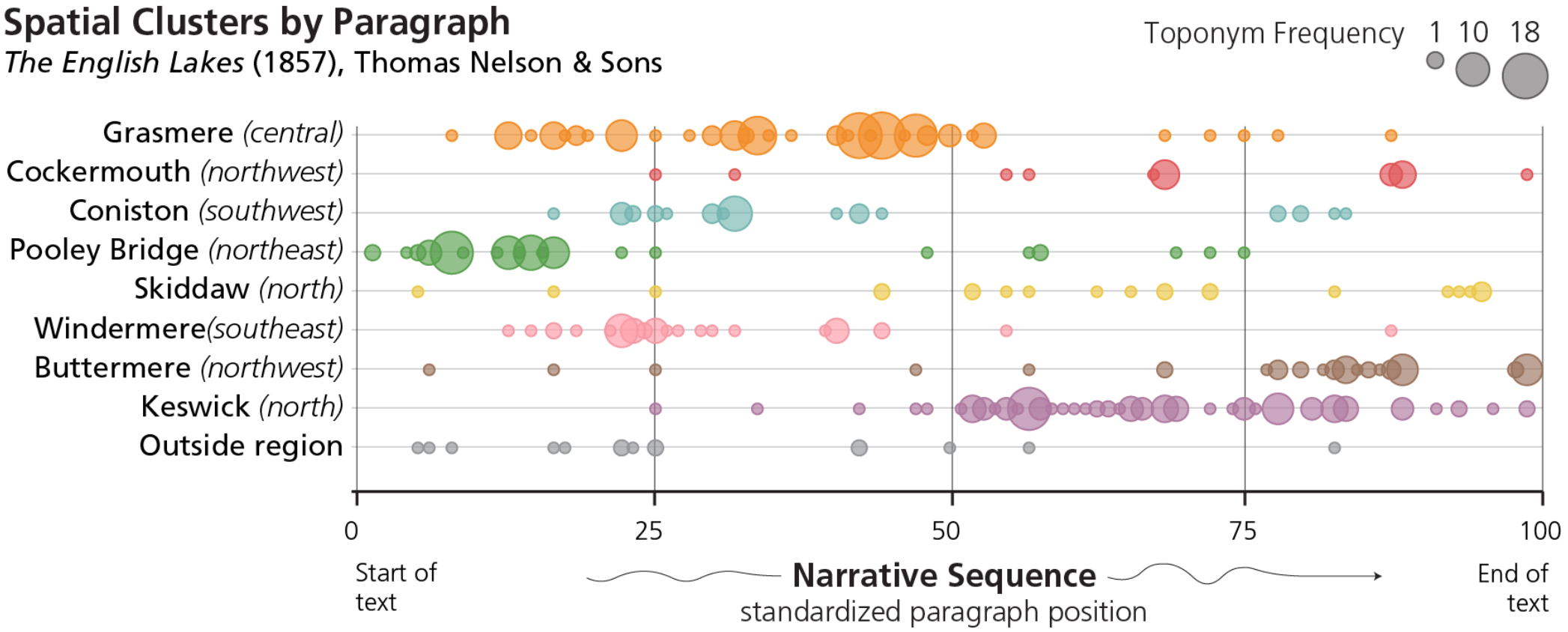

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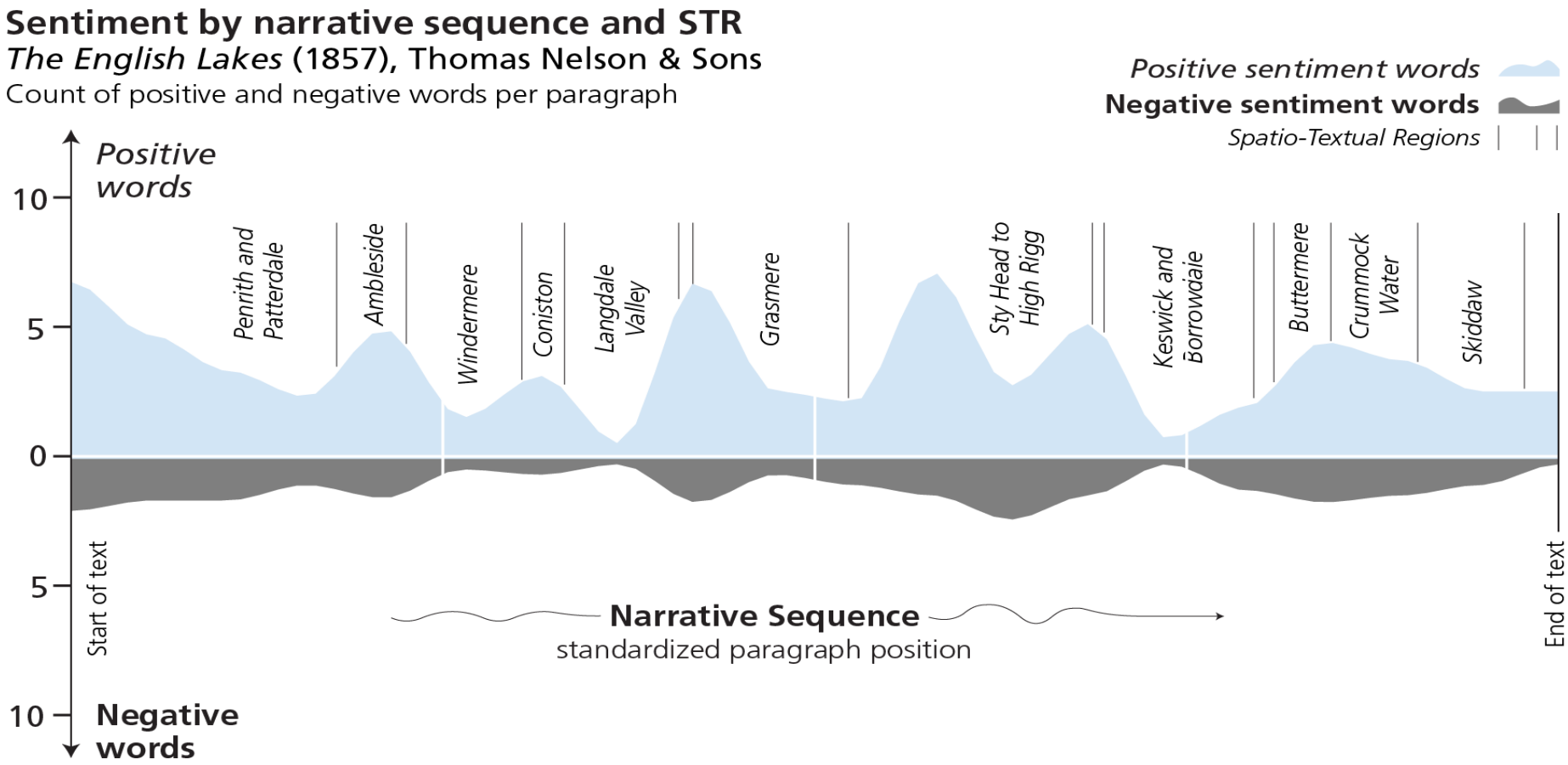

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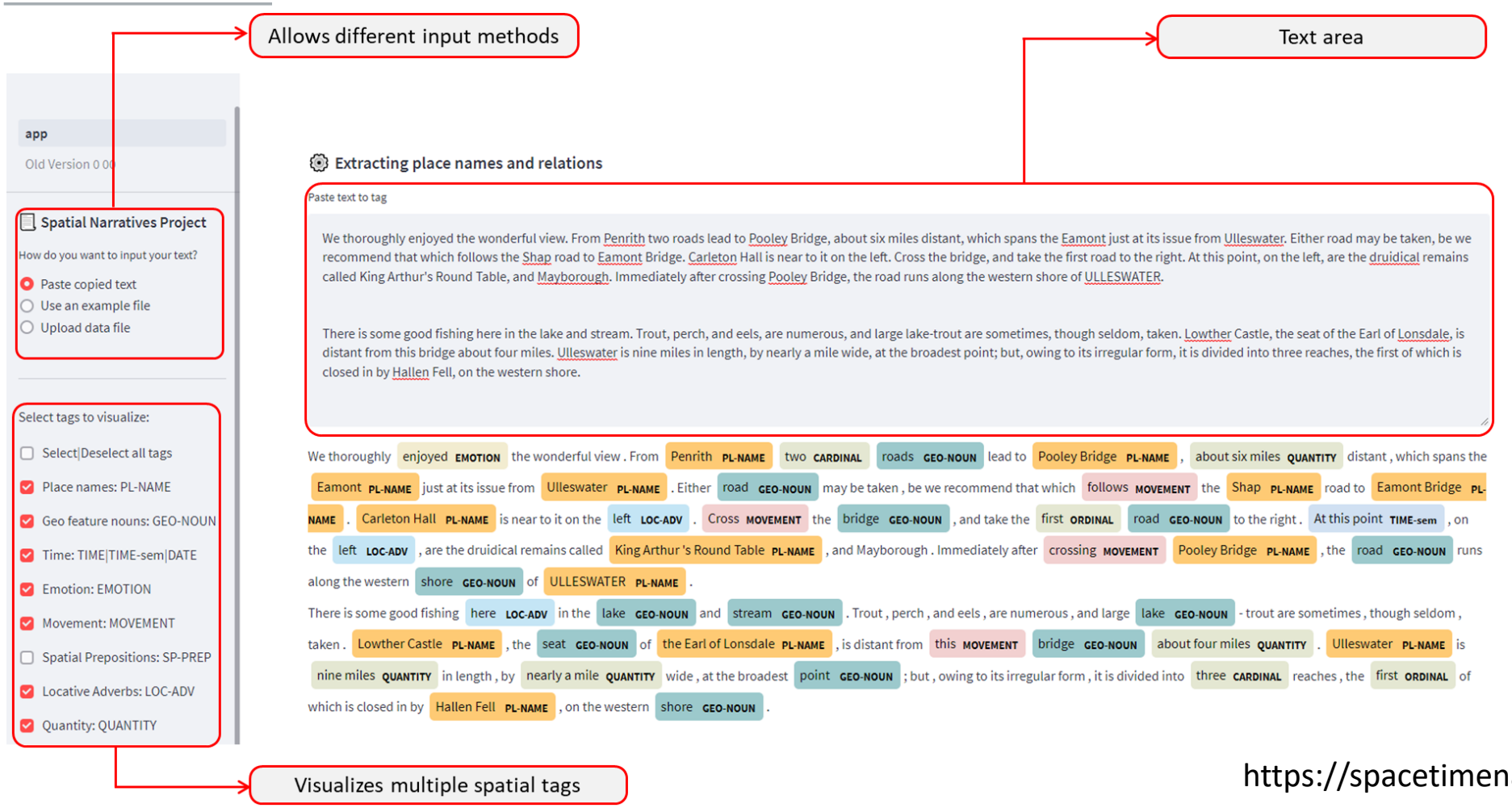
Relationships and Ontology Design

QSR-based relations	Interpretations
From Penrith two roads lead to Pooley Bridge, about six miles distant, which spans the Eamont just at its issue from Ulleswater	
`place(penrith)`	`Penrith` is a place.
`place(pb)`	`Pooley Bridge`, pb, can be a place (as here) or a bridge. For convenience, here we use the same name, pb, for both the place and the bridge, but in practice it is necessary to have separate names in the formalism, as we discuss below in section 8.
`distance(penrith, pb, about(6), miles)`	distance in miles between places
`road(road1); road(road2)`	`road1` and `road2` belong to the class `road`.
`end(road1, penrith); end(road1, pb)`	`road1` ends in `Penrith` and `Pooley Bridge`.
`end(road2, penrith); end(road2, pb)`	Also `road2` as above.
`bridge(pb); spans(pb, eamont)`	`Pooley Bridge` is also a bridge and 'spans' `Eamont`.
`river(eamont); source(eamont,ullswater)`	`Eamont` is a river and issues from `Ullswater`.
`lake(ullswater)`	`Ullswater` is a lake.

Conclusion

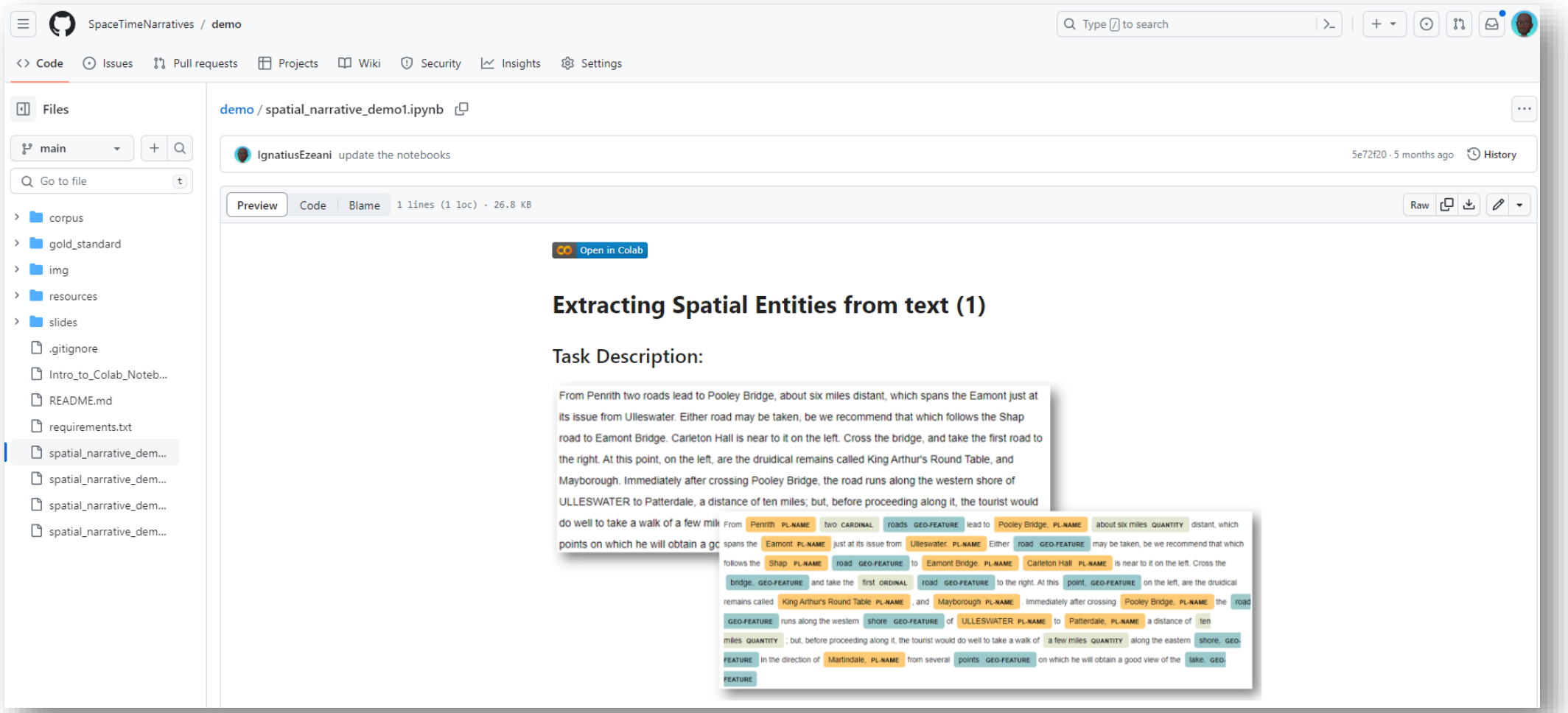
- This work expands the discourse on automatic extraction and analysis of spatial elements from text.
- We presented our preliminary work on an extensible framework for understanding the interplay between space and time in narratives.
- It includes a workflow for spatial element definition, corpus annotation, and the design and development of the spatial element '*Extractor*' model
- We also presented a top-level view of the ontology but the spatial relations and individual data instances are yet to be developed and included.
- Overall, this framework will support many downstream tasks in the processing of spatial narratives beyond geo-coding

Streamlit Demo



https://spacetimenarratives.streamlit.app/

Colab Notebooks



GitHub: https://github.com/SpaceTimeNarratives/demo

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Thanks for your attention

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