Automatic Extraction of Archaeological Events from Text

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How to represent archeological data?

RCAHMS
Memory keeper for Scotland

Royal Commission on the Ancient and Historical Monuments of Scotland

Skara Brae
(3180 BCE)

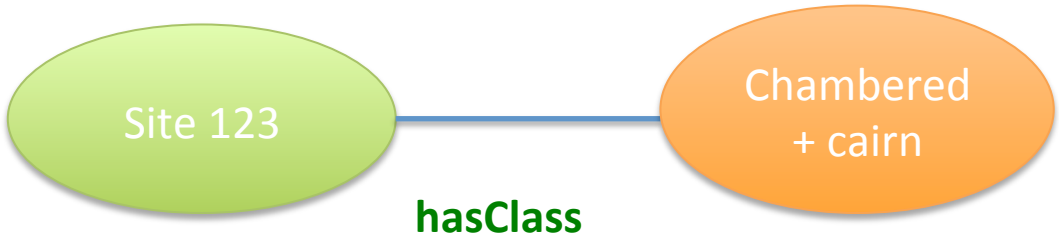
Faculy building
(21th Century)

Question: “Skara Brae **was found** at _____”

Automated extraction of events is a requirement

Automatic extraction of events

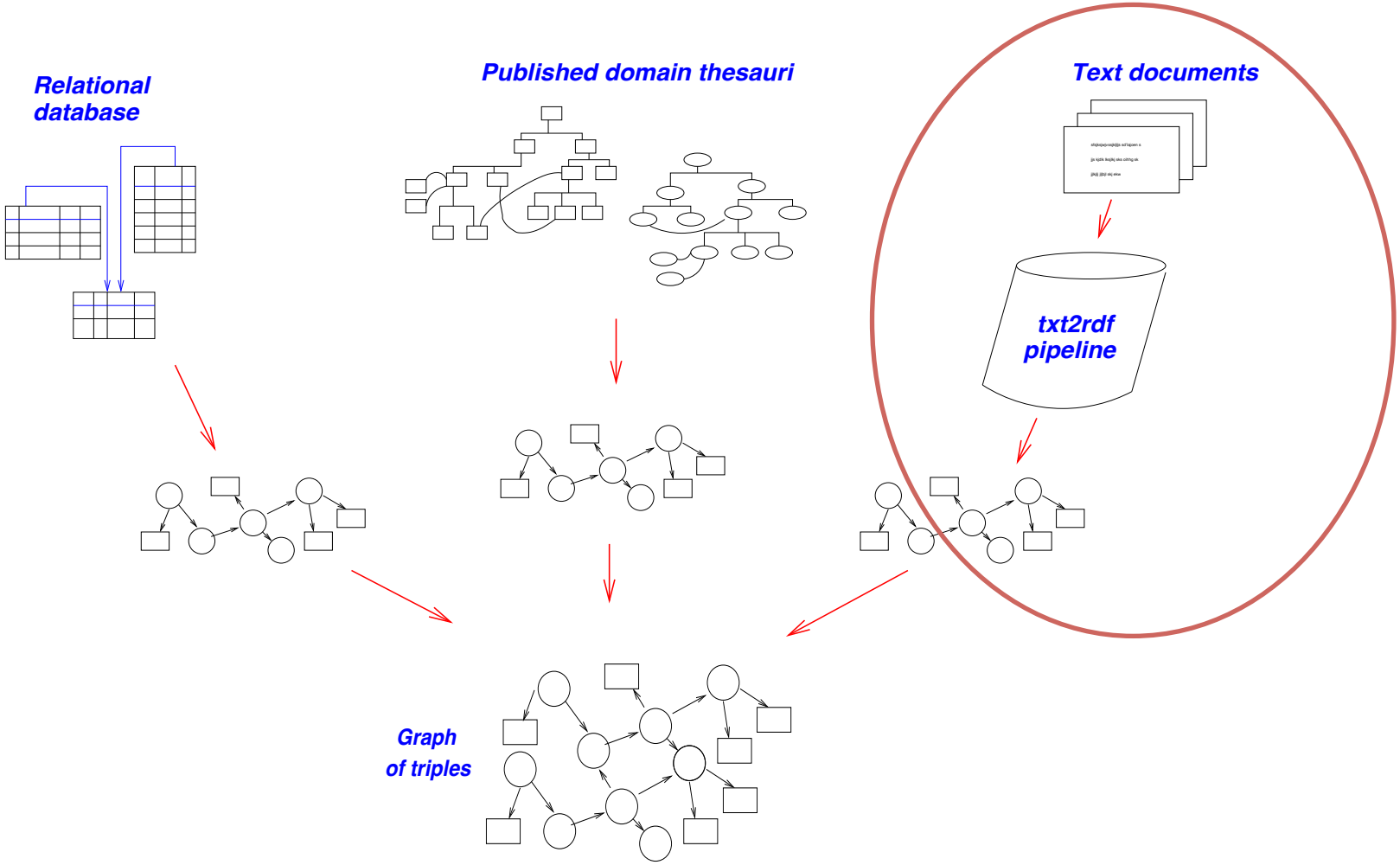
- Idea: Semantic web is useful
  - **site123** is **classified as** a **chambered cairn**



- Resource Description Format (RDF)
  - Subject – Predicate – Object

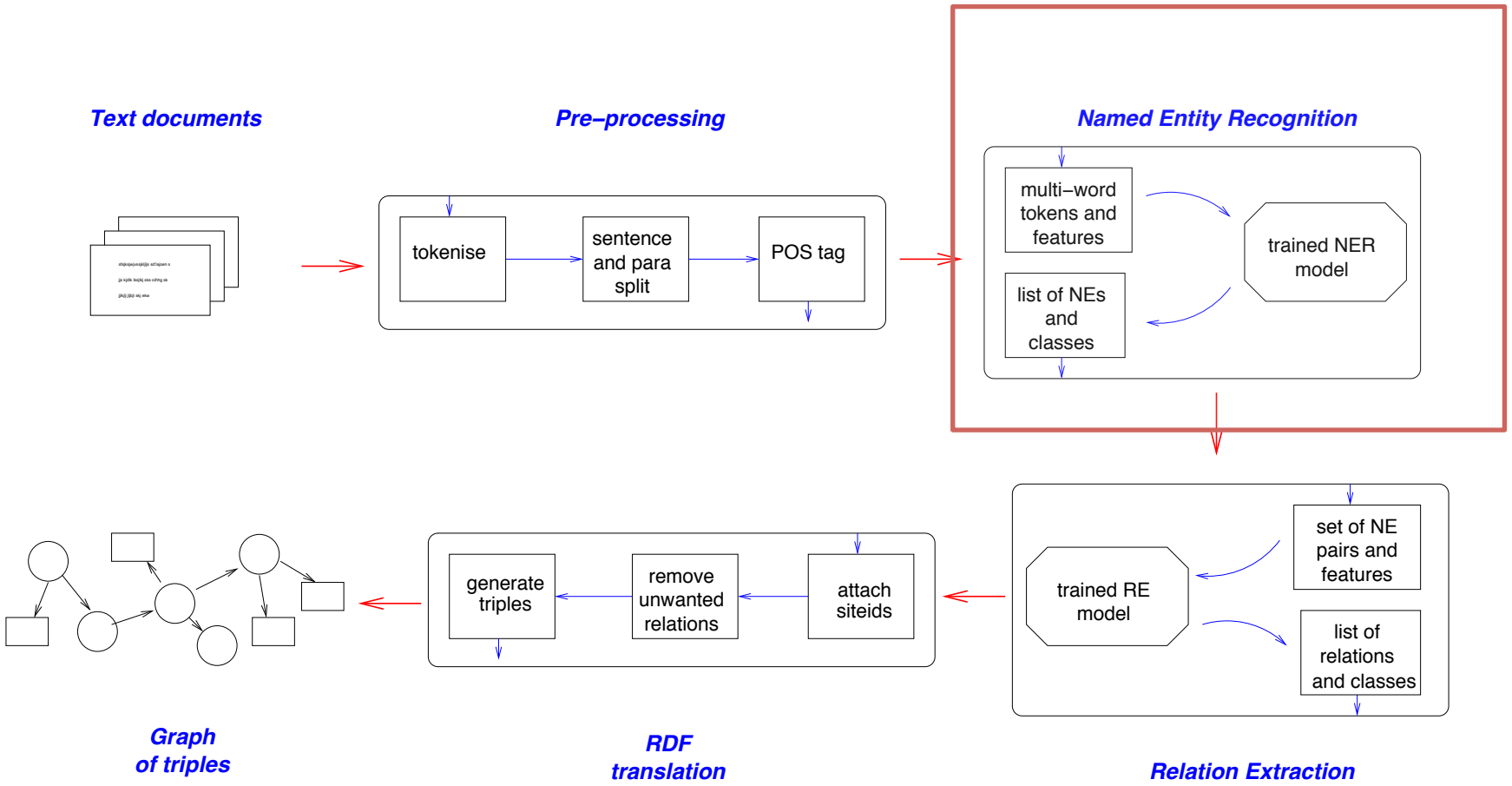
- How to convert text data to RDF format

Tether: converting RCAHMS data to RDF format



Img source: authors' presentation

txt2rdf: the pipeline



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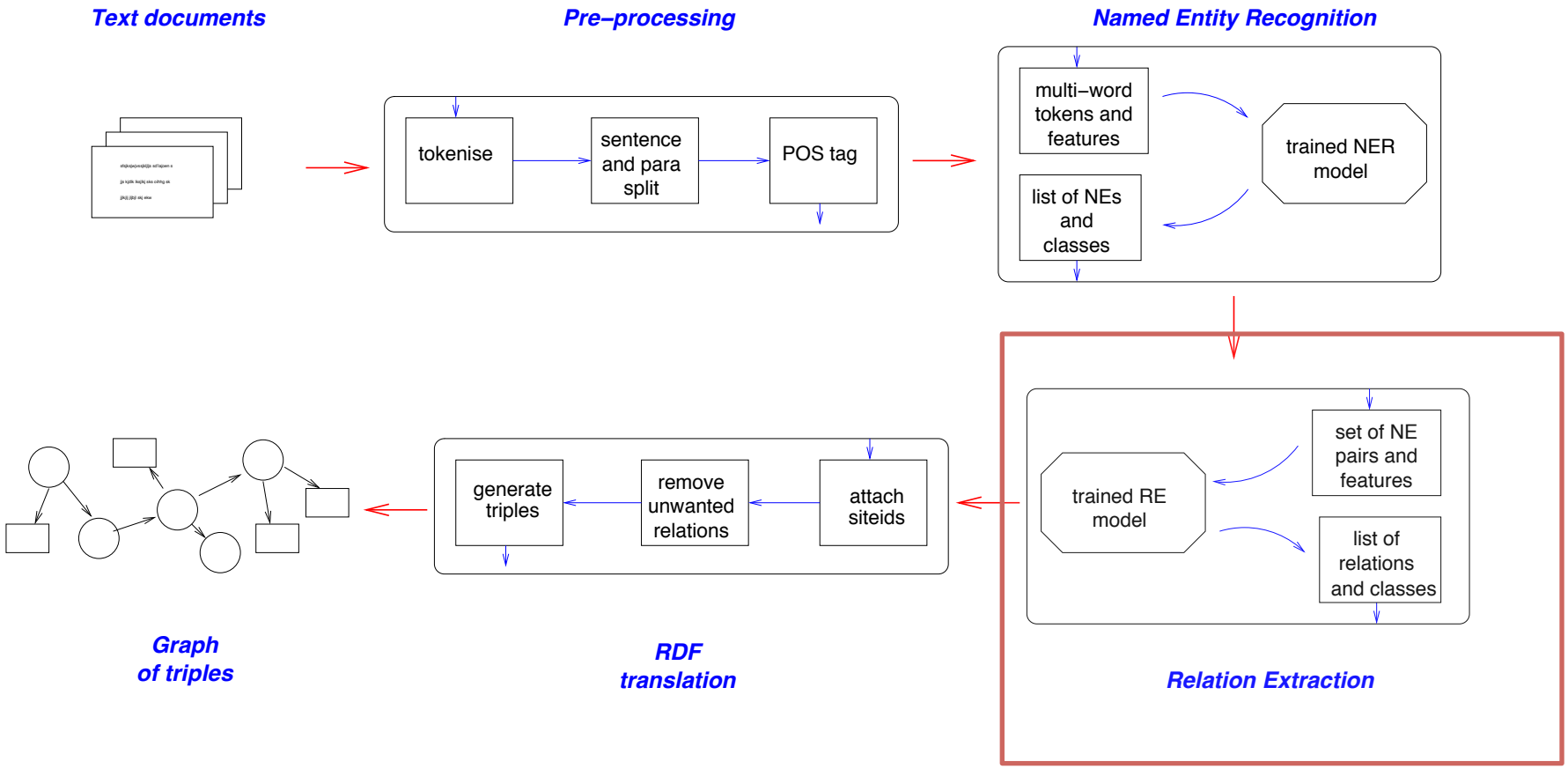
Named Entity recognition

List of Categories (ORG, COUNTRY…)

[DE] COUNTRY
[UdS] ORG

- 11 categories:
  - ORG, PERSNAME, ROLE, SITETYPE, ARTEFACT, PLACE, SITENAME, ADDRESS, PERIOD, DATE, EVENT
- Unorthodox ones:
  - EVENT – SURVEY, EXCAVATION, FIND
- Nesting:
  - [[[Edinburgh]^{PLACE} University]^{ORG} Library]^{ORG}

txt2rdf



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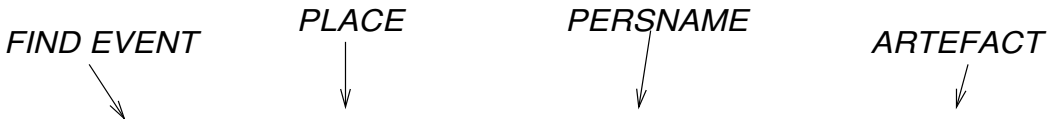
Finding binary relations in text

- Named Entity Recognition was first step
- Special attention paid to NE nesting
- Then look for relations between pairs of NEs:
  - generate all possible pairings per document
  - add features
    - NE classes, word separation, POS tags, nesting, in sentence...

Supervised learning for Relation extraction



The following were found in Unst by Mr A T Cluness : a steatite dish , ...

eventLocation	were_found	unst	*cls1=event*	*cls2=place*	*wdsep=+2...*
eventAgent	were_found	a_t_cluness	*cls1=event*	*cls2=persname*	*wdsep=+5...*
eventPatient	were_found	steatite_dish	*cls1=event*	*cls2=artefact*	*wdsep=+9...*
O	unst	a_t_cluness	*cls1=place*	*cls2=persname*	*wdsep=+9...*
O	unst	steatite_dish	*cls1=place*	*cls2=artefact*	*wdsep=+9...*
O	a_t_cluness	steatite_dish	*cls1=persname*	*cls2=artefact*	*wdsep=+9...*

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Relation extraction

- Basic predicate categories:
  - eventRel, hasLocation, hasPeriod, instanceOf, partOf, sameAs, seeAlso
- n-ary eventRel predicate:
  - eventAgent, eventAgentRole, eventDate, eventPatient, eventPlace
- event types:
  - survey, excavation, find, visit, description, creation, alteration

Working Example for txt2rdf

site456

{[SOUTH WALLS]} , {[MISBISTER]} , [[[[THE {LOFTS]]]]}

[ND38NW 29 centred 3325 8885]

Sites [[[[[[recorded]]]]]] during an [archaeological survey] undertaken on the lands of [[the {Loft]]} , [Longhope] , as part of the pilot scheme for the {[[[Historic {[Scotland]]]}} {Farm} {Ancient} {Monument} Survey Grant Scheme] . [ND 3311 8890] Two [small {cairns]} . [ND 3336 8889] {[Cairn]} . [ND 3339 8885] {[Cairn]} . [ND 3339 8886] {[Clearance cairn]} . [ND 3342 8884] [Sub-rectangular cairn]} . [ND 3339 8883] {[Well]} Sponsors : {[Historic {[Scotland]]}} , {[M J Jones]} . {{[[N Card]} {[1998]]

event

eventPlace

eventPatient

site456 – hasEvent – recordingX
recordingX – hasLocation – "ND 3342 8884"
recordingX – hasPatient – "Sub–rectangular cairn"

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Results: evaluating NER step

	Precision %	Recall %	F-score %	Count
ADDRESS	82.40	81.61	82.00	3,458
PLACE	95.00	66.80	78.44	2,503
SITENAME	64.55	61.20	62.83	2,712
DATE	95.12	82.08	88.12	3,519
PERIOD	84.02	45.54	59.07	400
EVENT	**94.98**	**63.66**	**76.22**	**3,176**
ORG	99.39	89.66	94.27	2,730
PERSNAME	96.71	74.82	84.37	2,318
ROLE	98.00	54.44	70.00	90
SITETYPE	85.24	52.39	64.89	5,668
ARTEFACT	75.83	18.06	29.17	879
Average	88.02	67.75	**76.57**	(27,453)

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Results: evaluating RE step

Relation	Precision %	Recall %	F-score %	Found
eventAgent	98.42	98.70	98.56	3,794
eventAgentRole	69.23	30.00	41.86	13
eventDate	98.75	98.68	98.71	3,189
eventPatient	87.77	84.61	86.16	1,553
eventPlace	83.58	72.70	77.76	341
Events Average	87.55	76.94	**80.61**	(8,890)
Overall Average	83.41	69.27	**75.68**	(21,932)

table source: authors presentation

Results: evaluating full txt2rdf pipeline

Relation	Avg Precision	Avg Recall	Avg F-score
eventAgent	97.46	82.18	88.72
eventAgentRole	0.00	0.00	0.00
eventDate	87.75	71.73	78.64
eventPatient	90.69	42.99	48.46
eventPlace	36.36	17.33	27.62
Overall Average	73.35	48.24	57.51

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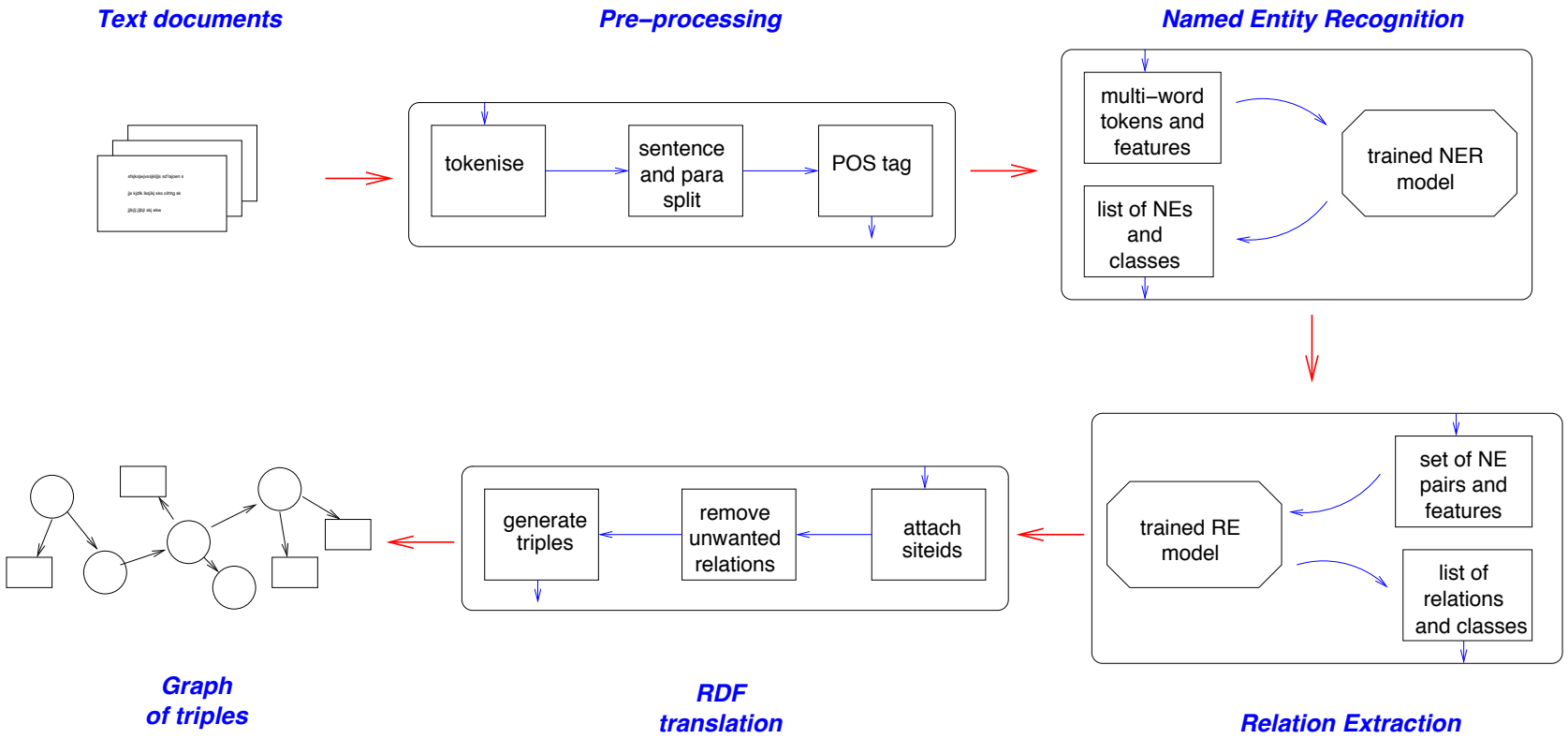
Summary

- Event modeling is unorthodox in NER but results good
- Event relations are easier than others
- Extraction to RDF graph, as shown...
- Automatic extraction of events from text is feasible

txt2rdf



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- Extra slides

- Event modelling is unorthodox in NER terms but results good
  - EVENT NE recognition: 76% F-score (avg: 77%)
- Event relations are **easier** than others:
  - average 81% F-score for event relations (overall avg: 76%)
- Models deliberately trained to favour Precision over Recall
- Extraction to RDF graph, as shown...
- ...or to populate RDB tables if desired
- Automatic extraction of events from text is feasible