Processing, Identification and Representation of Temporal Expressions and Events in Legal Documents

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Online

Outline

- Introduction
- State of the Art
- Materials and Methods
- Temporal Expressions
  - Corpora
  - Temporal Tagging
- Events
  - Corpus
  - Event Extraction
  - Event Representation Resources
- Conclusions and Future Work

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Domain context

EUR-Lex
Access to European Union law

~2M doc/ month **~46M** users 2021 **~58M** visits 2021

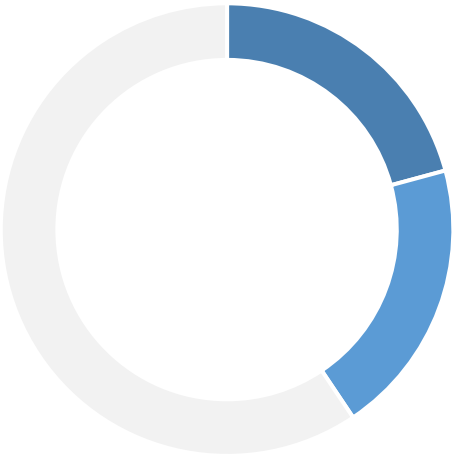
Source: https://eur-lex.europa.eu/statistics/statistics.html

Abogacía Española
CONSEJO GENERAL

Half of the respondents*

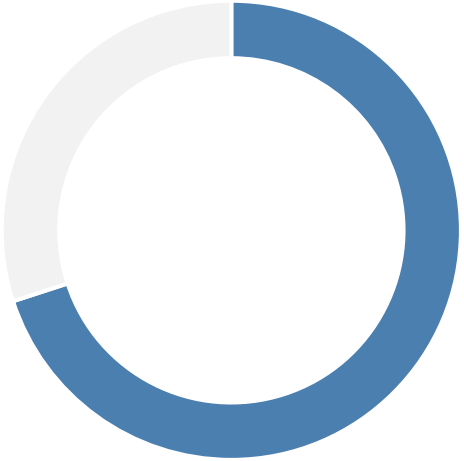
Source: https://www.abogacia.es/wp-content/uploads/2021/03/informe-El-sector-legal-cree-en-la-tecnologia.pdf

21-40% of the time



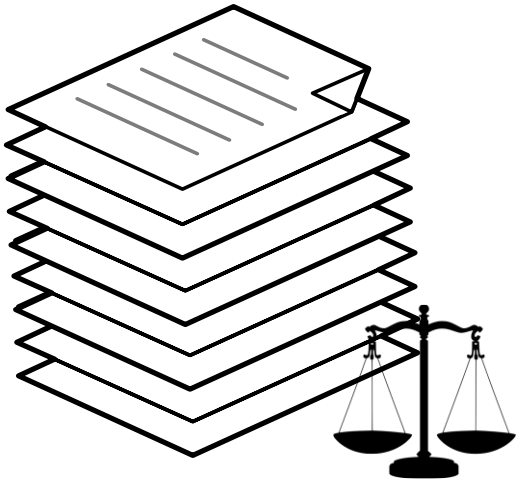
Information Analysis and Compilation

70% of the time



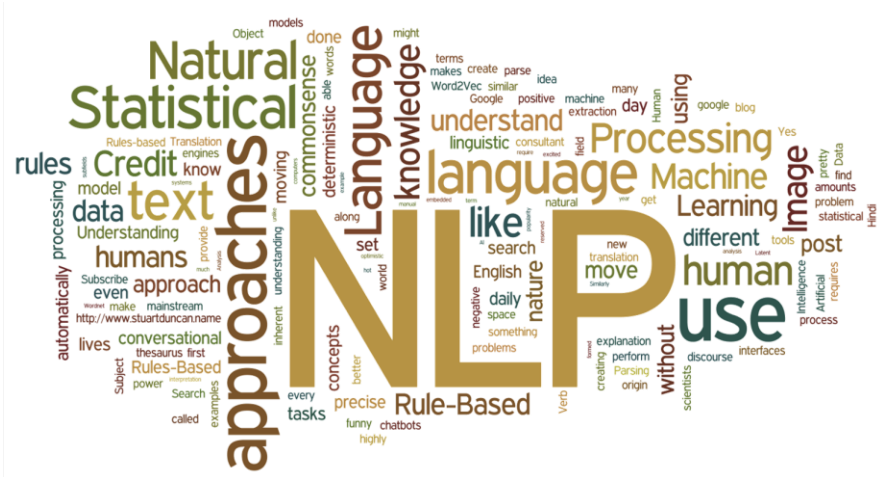
Document related activities have been seen previously

Domain context



82% of citizens consider that legal language [*legalese*] is excessively complicated and difficult to understand

(Comisión de expertos Modernización del lenguaje jurídico, 2011)



Text Classification

Summarizer

Information Retrieval

Search

Temporal Information Extraction

Translation

QA

NER

Chat Bot

Temporal Information

Temporal Expressions (TE): ‘when’ or ‘for how long’ something happen, a point or interval in a timeline

DATE TIME DURATION SET (INTERVAL)

Events: Something that happens.

Temporal Tagger: Tool that finds temporal information.

1. Detect temporal expressions.
2. Normalize them.

My anniversary is tomorrow

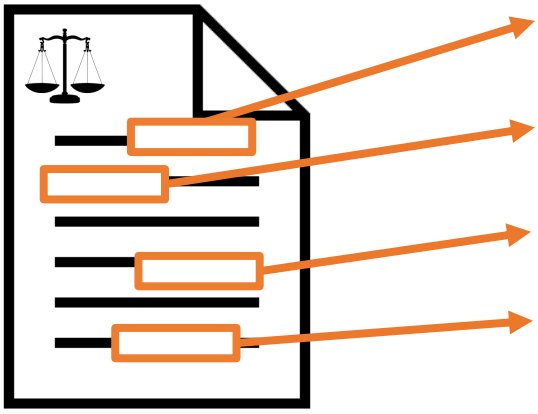
17/01/2022 → 18/01/2022

31/10/2020 → 01/11/2020

3. Additionally, event and relation extraction

Limitations

Legal decisions



"… as amended by Council Regulation (EC) No 1791 2006 of 20 November 2006'

"for 1 year and 6 months' […] less than a year'

"EUR 2000 […] §1408'

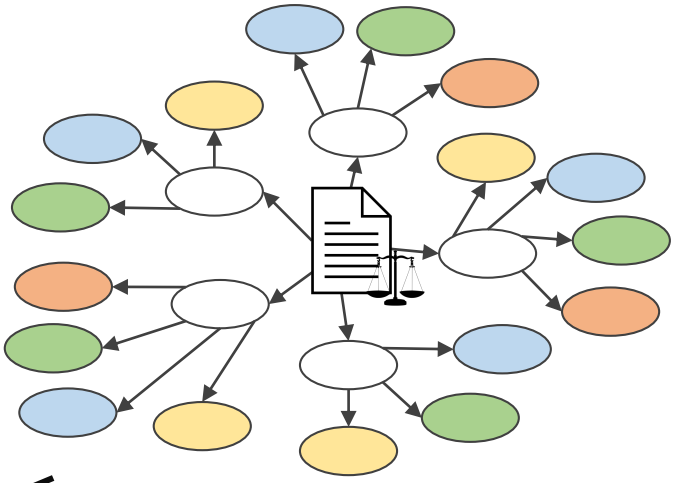
'three business days'

What events are the most relevant ones?

Spanish language

- Expressions uncovered ("mañana")
- Dates written with letters
- Different registers uncovered
- Just Castillian-Spanish

Motivation of the thesis



PATTERN DETECTION

SUMMARIZATION

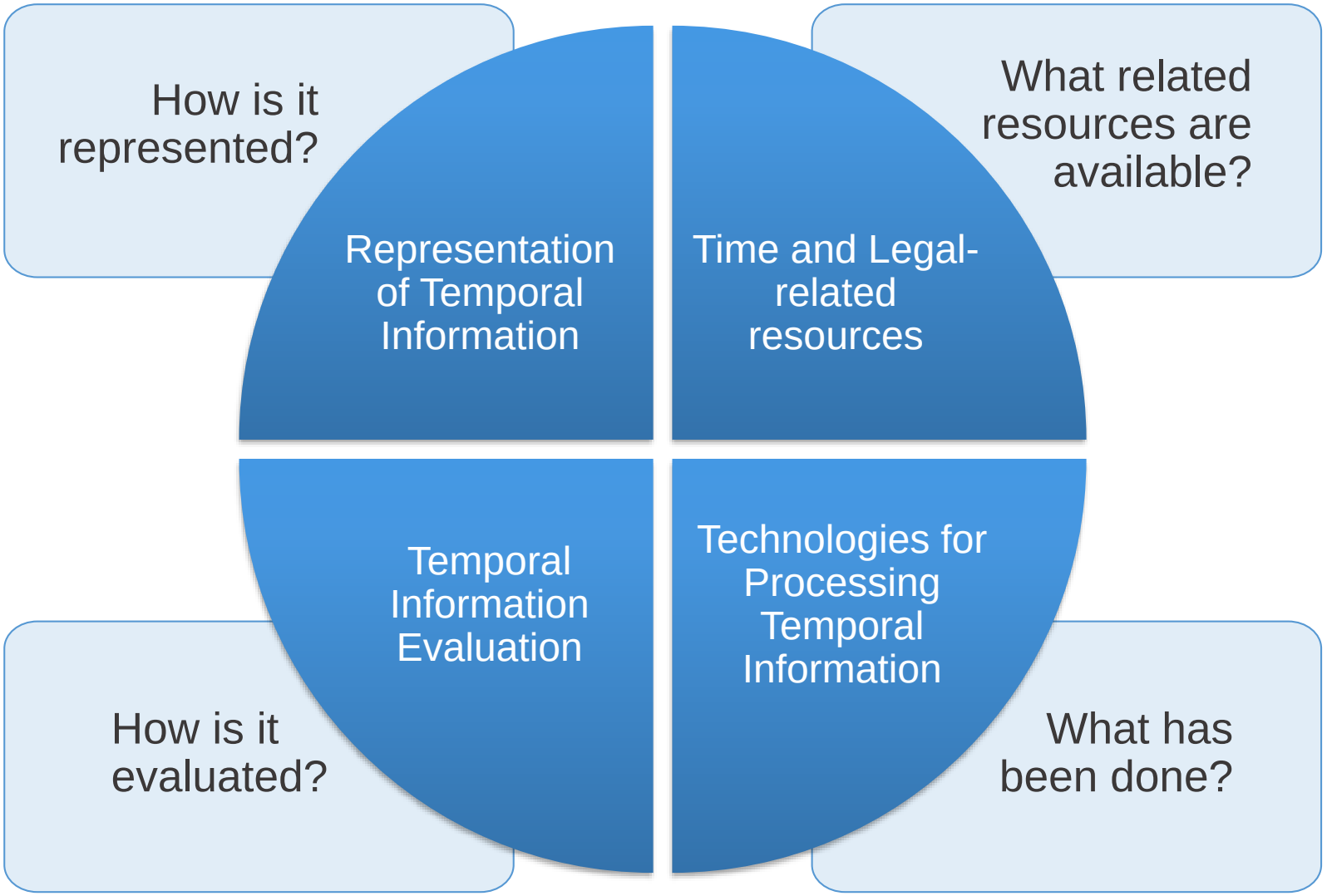
QUESTION ANSWERING

TIMELINE GENERATION

SEARCH ENGINE

Outline

Fields


How is it represented?
Representation of Temporal Information
Time and Legal-related resources
What related resources are available?
How is it evaluated?
Temporal Information Evaluation
Technologies for Processing Temporal Information
What has been done?

Representation of temporal information

Temporal Expressions TimeML

TimeML precursors

TIDES TIMEX2 (Ferro et al., 2001)

Sheffield STAG (Setzer, 2002)

TimeML

(Pustejovsky et al., 2010)

- Temporal Expressions
- Relations
- Events
- SIGNALS,MAKEINSTANCE

TimeML extensions

THYME Project (Styler et al., 2014)

Probabilistic approach (Angeli et al., 2012)

Events schemas and ontologies

Ann. Schemas

ACE, ERE, KBP, RED

Domain: GAF, CAMEO

Ontologies

W3C Time, SEM, TEO, ESO Event Ont. + Timeline Ont.

Other Representations

Legal: LKIF, Akoma Ntoso

Generic: NIF, Web Annotations

TimeML standard for Temporal Expressions, but no consensual way to represent events.

Need to integrate/ease the transition between representations.

Time-related and Legal-related resources

Corpora

Timebank corpus (Pustejovsky et al., 2003b)
TempEval challenges
MEANTIME corpus (Minard et al., 2016)

English

- Wikiwars corpus (Mazur and Dale, 2010)
- THYME corpus (Styler et al., 2014)
- Scientific abstracts (Strötgen and Gertz, 2012)
- Tweets (Tabassum et al., 2016)
- Colloquial texts (Strötgen and Gertz, 2012)

Spanish

- ModeS TimeBank (17th and 18th centuries)

- Lack of **Spanish corpora** annotated with temporal information.
- Lack of **legal corpora** annotated with temporal information.

Technologies for Processing Temporal Information

Temporal Taggers

Temporal Taggers	Characteristics		Tasks			
Name (year)	Approaches	Lang	Time Expression Identification	Time Expression Normalization	Event Detection	Relation Detection
HeidelTime (2012)	Rule-based	ES,+	X	X	-	-
SUTime (2012)	Rule-based	ES	X	X	-	-
TARSQI (2005)	Hybrid		X	X	X	X
CAEVO (2014)	Hybrid		X	X	X	X
ClearTK (2013)	Machine-Learning		X	-	X	X
SynTime (2017)	Rule-based		X	-	-	-
TERNIP (2010)	Rule-based		X	X	-	-
TIPSem (2010)	Hybrid	ES	X	X	X	X
USFD2 (2010)	Hybrid		*	*	-	*
UWTime (2014)	Hybrid		X	X	-	-

Event Extraction

- Hagege and Tannier (2008) an event is any verb, any deverbal noun, any noun argument of the preposition during, or any time span noun.
- Capet et al. (2008) ad hoc templates (core + coordinates).
- Application: timeline generation: TimeLineCurator (Fulda et al., 2015)

Technologies for Processing Temporal Information

Approaches in the legal domain

- Schilder (2005): three types of documents:
  - Transactional documents
  - Constraints in statutes or regulations
  - Legal narratives in case law
- Isemann et al. (2013) TI from regulations. Confusion between:
  - Episodic and generic statements
  - Legal references and dates

Event Extraction in the legal domain

- Lagos et al. (2010) several types of events (who, what, when and where).
- Maxwell et al. (2009) eventuality (event, state, or attribute)
- Spanish: Sierra et al. (2018), for instance, aims to extract events from Mexican legal texts (who, what, to whom and where)
- Portuguese: Bertoldi et al. (2014) manual semantic legal frames

Technologies for Processing Temporal Information

Related tools

Temporal Expressions

NER

NLTK [dates, timex extension] (Loper and Bird, 2002)

Spacy, OpenNLP [dates,times] (Honnibal et al., 2020) (Apache Soft. Fund., 2014)

CoreNLP [SUTime] (Manning et al., 2014)

Event Extraction related tasks

Semantic Role Labelling

AllenNLP (Gardner et al., 2017)

IxaPipes (Agerri et al., 2014)

Open IE

AllenNLP (Gardner et al., 2017)

CoreNLP (Manning et al., 2014)

Frame Identification

OpenSESAME (Swayamdipta et al., 2017)

Framat (Roth and Lapata, 2015)

FRED (Gangemi et al., 2017), TakeFive (Alam et al., 2021)

- Not many temporal taggers for Spanish.
- No temporal tagger covering specific legal considerations.
- Not automatic relevant event extraction in the legal domain.

Temporal Information Evaluation

Temporal Expressions

- The TimeML standard is evaluated using NLP measures (Precision, Recall, F1-measure)
- Aspects usually evaluated are:
  - The extent of the annotation fits the reference annotation
  - The type of the expression is correctly classified
  - The normalized value equals the reference one

<TIMEX3 tid="t1 " **type="DATE" value="1990-07-06"** >**6 July 1990**</TIMEX3>

Temporal Information Evaluation

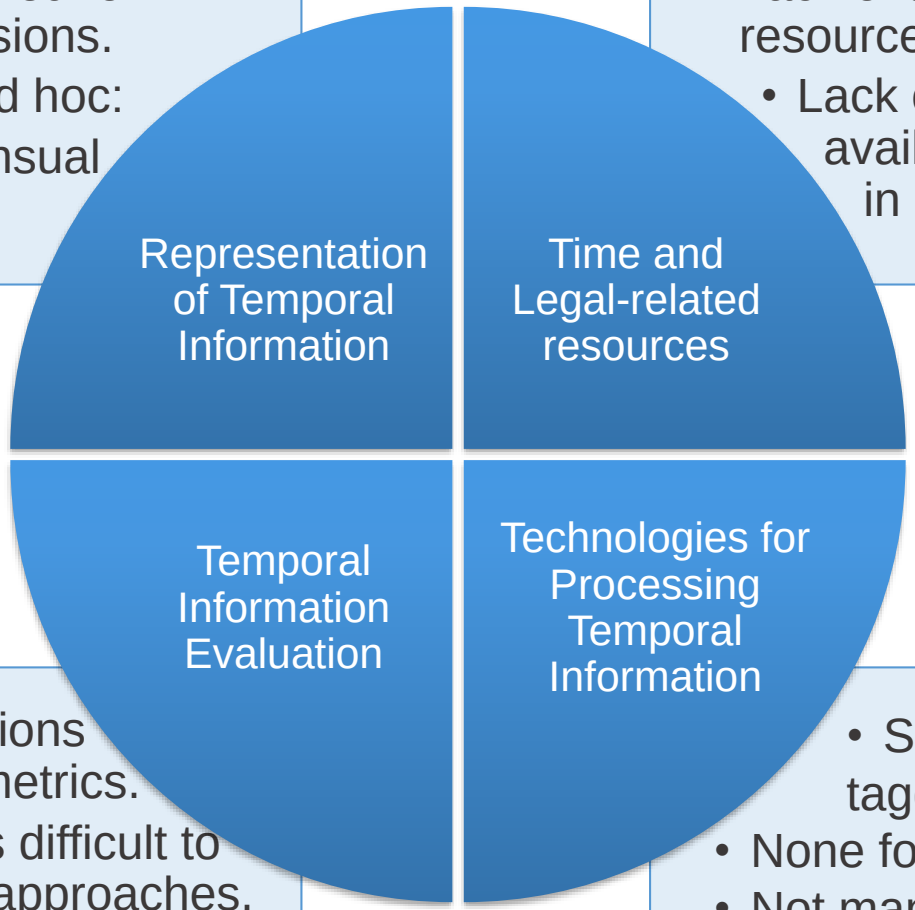
Events

- TempEval:
  - P,R,F1 to assess extent of the annotation and the event type
  - In 2015 shifted to temporal QA.
- ACE VDR value, a metric taking into account:
  - The extent of the event annotation
  - The event arguments and their attributes value and modality.
- BioNLP'09 shared task on event extraction
  - Different levels: Core (trigger,type), arguments, factuality
- Other ways: Task oriented (e.g., summarization).

Summary

- TimeML established for temporal expressions.
- Events usually ad hoc: No single consensual representation.

- Lack of time-related legal resources
  - Lack of time-related available resources in Spanish.



- Temporal Expressions use regular NLP metrics.
- Event extraction is difficult to compare to other approaches.

- Several temporal taggers for English
- None for the legal domain.
- Not many for Spanish.

Outline

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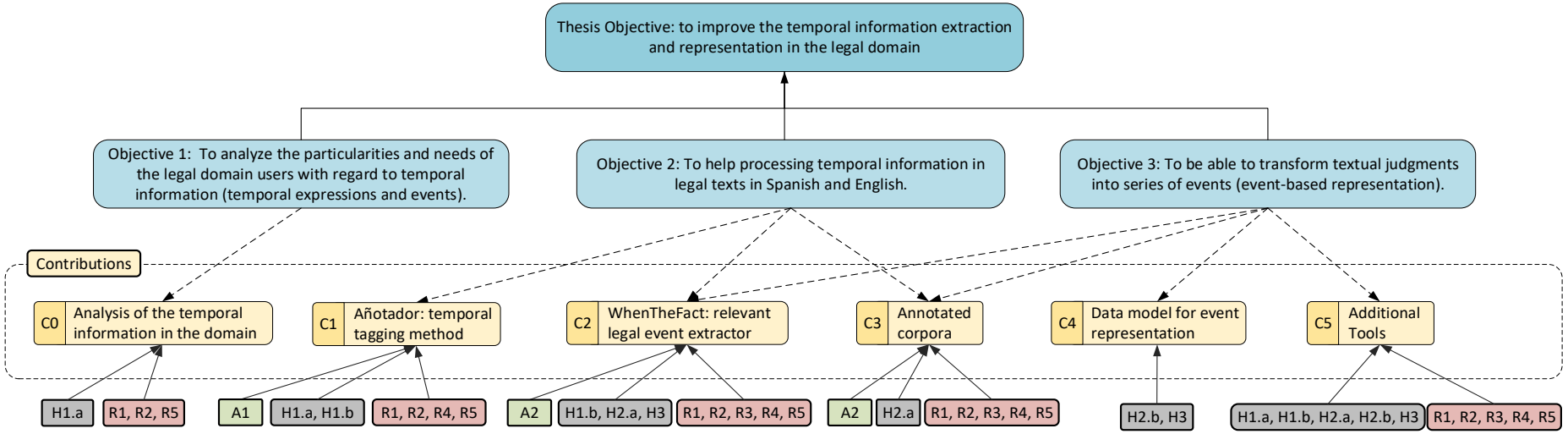
Research Objectives

Thesis objective: To improve the temporal information extraction and representation in the legal domain.



Assumptions

A1. We assume that the temporal expressions can be normalized to the TimeML standard (or the extensions proposed in this thesis).
A2. The concept of relevance is subjective and its definition highly depends on the the ad-hoc application it is considered for.

Hypothesis

H1.a. Temporal Expressions in legal texts present particularities that are not covered by the current temporal taggers.
H1.b. Preprocessing the legal text in order to handle part of these particularities and directly targeting others in the temporal tagger would improve the results with regard to applying a generic temporal tagger.
H2.a. Legal texts contain different types of events, with different relevance and framed in different timelines.
H2.b. The creation of a data model that allows the representation of these events together with contextual information will facilitate the document representation in an event-based semantic way within the text.
H3. The integration of the event-extractor for the legal domain and the data model will allow the population of a knowledge graph, that can later facilitate alternative semantic representations based on events.

Restrictions

R1. The scope of the research will be restricted to a certain type of legal documents, namely judgments, due to the high amount of temporal expressions and the narrative structure.
R2. We also limit the source to European courts, since the availability is not as limited as in other jurisdictions.
R3. Although the information related to an event can be spread through different sentences, and also several events can be present in a same sentence, in this work just one event per sentence is considered.
R4. Coreference is not tackled in this work.
R5. This research covers texts in Spanish and English.

Hypotheses

H1.a. Temporal Expressions in **legal texts present particularities that are not covered by the current temporal taggers**.

H1.b. Preprocessing the legal text in order to handle part of these **particularities** and directly targeting others in the temporal tagger would improve the results with regard to applying a generic temporal tagger.

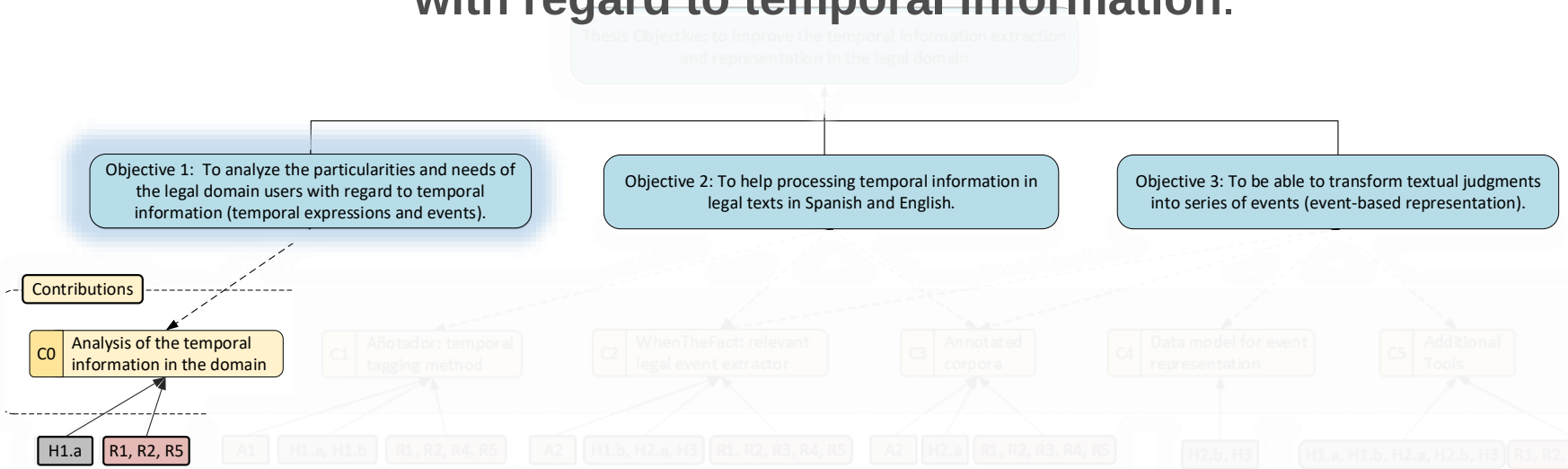
H2.a. Legal texts contain different types of events, with different relevance and framed in different timelines.

H2.b. The creation of a **data model** that allows the representation of these events together with contextual information and their annotation details will allow **facilitating the document representation in an event-based semantic way** within the text.

H3. The **integration of the event-extractor for the legal domain and the data model will allow the population of a knowledge graph**, that can later facilitate alternative semantic representations based on events such as timelines, semantic searches or summarization generation.

Research Objectives

O1. To **analyze the particularities and needs of the legal domain users with regard to temporal information.**

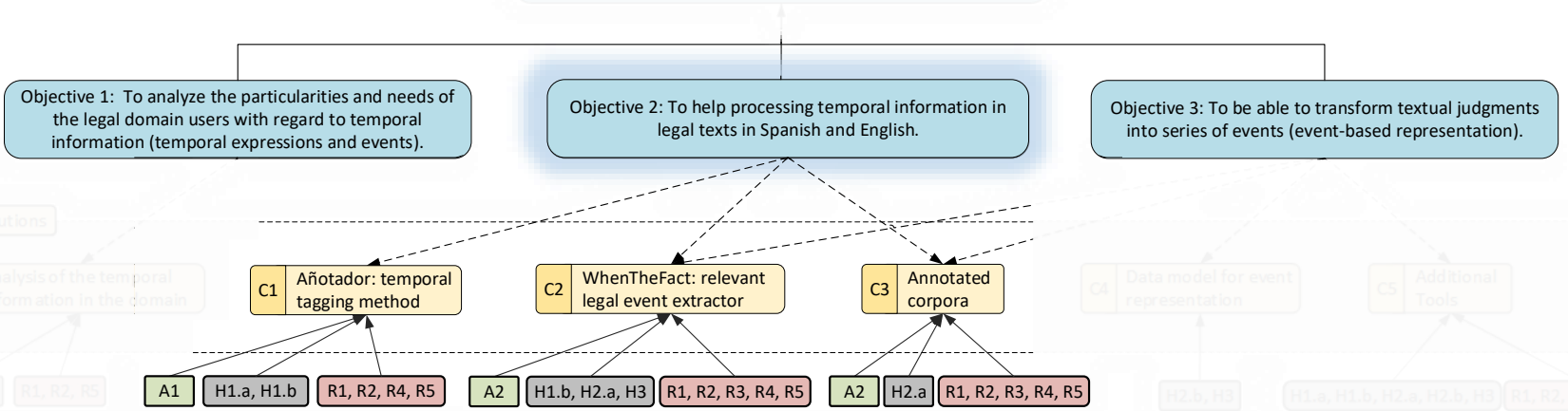


C0. Analysis of temporal information in the legal domain.

H1.a. Temporal Expressions in **legal texts present particularities that are not covered by the current temporal taggers.**

Research Objectives

O2. To **help processing temporal information in legal texts in Spanish and English.**



C1. Añotador: temporal tagger, C2. WhenTheFact: relevant legal event extractor, C3. Annotated Corpora

H1.a. Temporal Expressions in **legal texts present particularities that are not covered by the current temporal taggers**.

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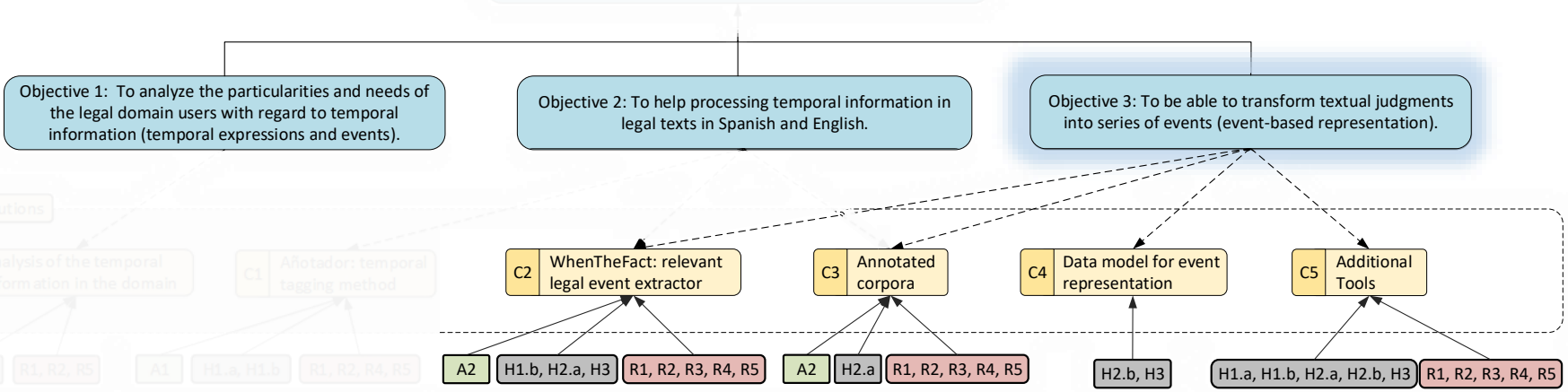
Research Objectives

O3. To **be able to transform textual judgments into series of events**. This would allow enhance further semantic tasks.



C2. WhenTheFact: relevant legal event extractor, C3. Annotated Corpora, C4. FT3: Data Model, C5. Additional Tools

H2.b. The creation of a **data model** that allows the representation of these events together with contextual information and their annotation details will allow **facilitating the document representation in an event-based semantic way** within the text.

H3. The **integration of the event-extractor for the legal domain and the data model will allow the population of a knowledge graph**, that can later facilitate alternative semantic representations based on events such as timelines, semantic searches or summarization generation.

- Corpora
- Temporal Tagging

TEMPORAL EXPRESSIONS

- Corpora
- Temporal Tagging

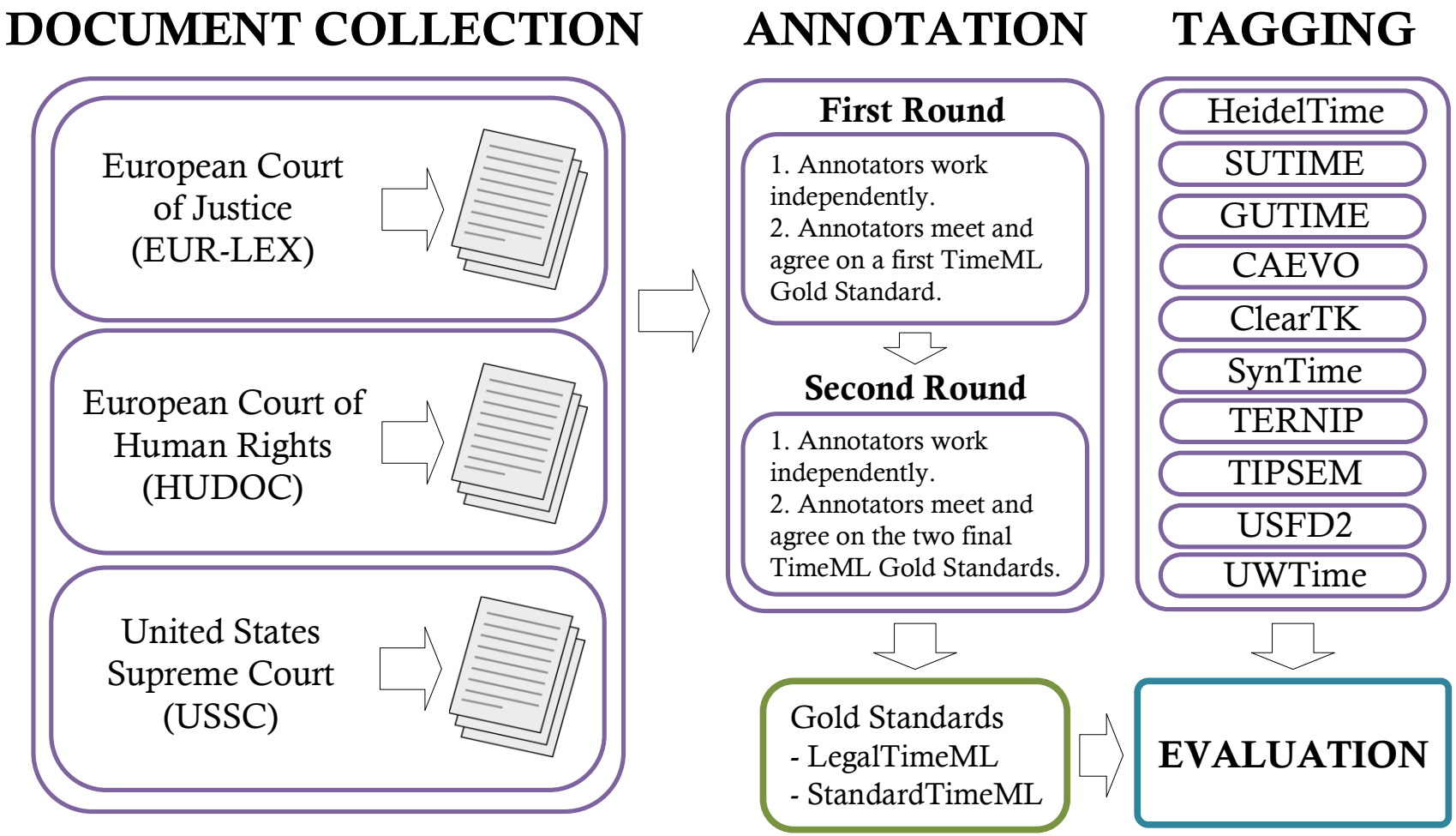
TEMPORAL EXPRESSIONS

Legal Corpus

TEMPCOURT

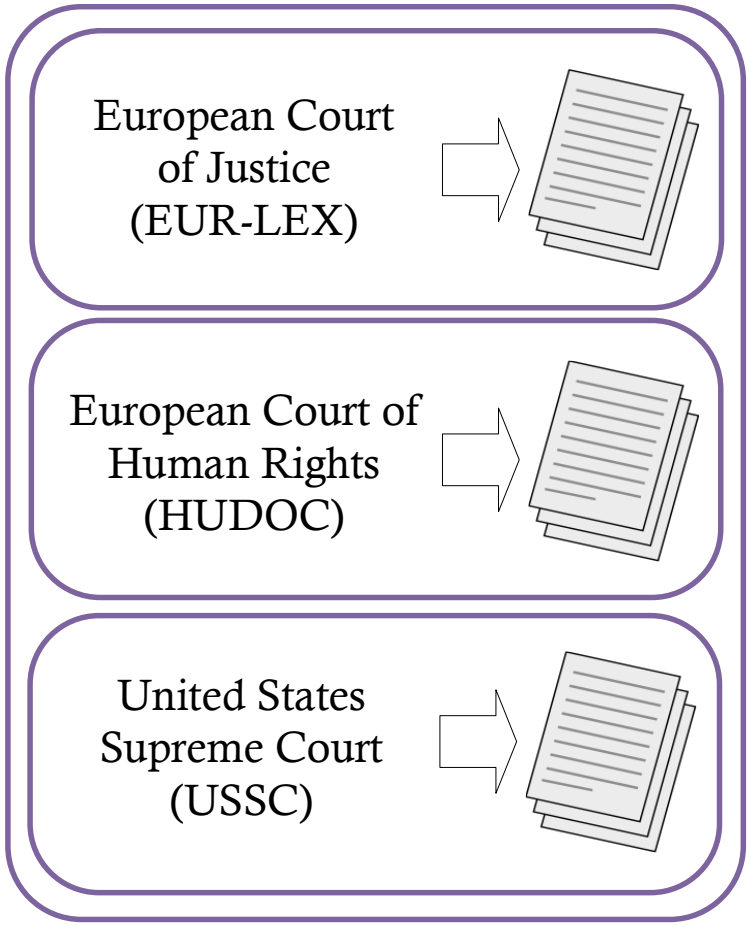
TempCourt Corpus

First corpus of legal documents annotated with TEs



TempCourt methodology

DOCUMENT COLLECTION



30 legal decisions:

- 10 from ECJ
- 10 from ECHR
- 10 from USSC

Normalization, standarization: from doc/pdf to text file

TempCourt methodology

DOCUMENT COLLECTION

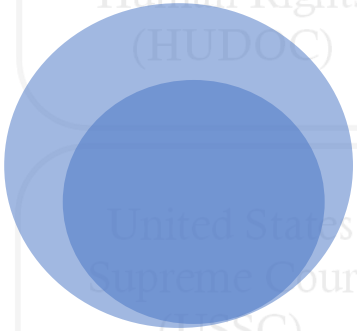
European Court of Justice (EUR-LEX)

European Court of Human Rights (HUDOC)

United States Supreme Court (USSC)

Two annotation sets:

- LegalTimeML
- StandardTimeML



StandardTimeML

LegalTimeML

ANNOTATION

First Round

1. Annotators work independently.
2. Annotators meet and agree on a first TimeML Gold Standard.

Second Round

1. Annotators work independently.
2. Annotators meet and agree on the two final TimeML Gold Standards.

Gold Standards
- LegalTimeML
- StandardTimeML

TAGGING

HeidelTime
SUTIME
GUTIME
CAEVO
ClearTK
SynTime
TERNIP
TIPSEM
USFD2
UWTime

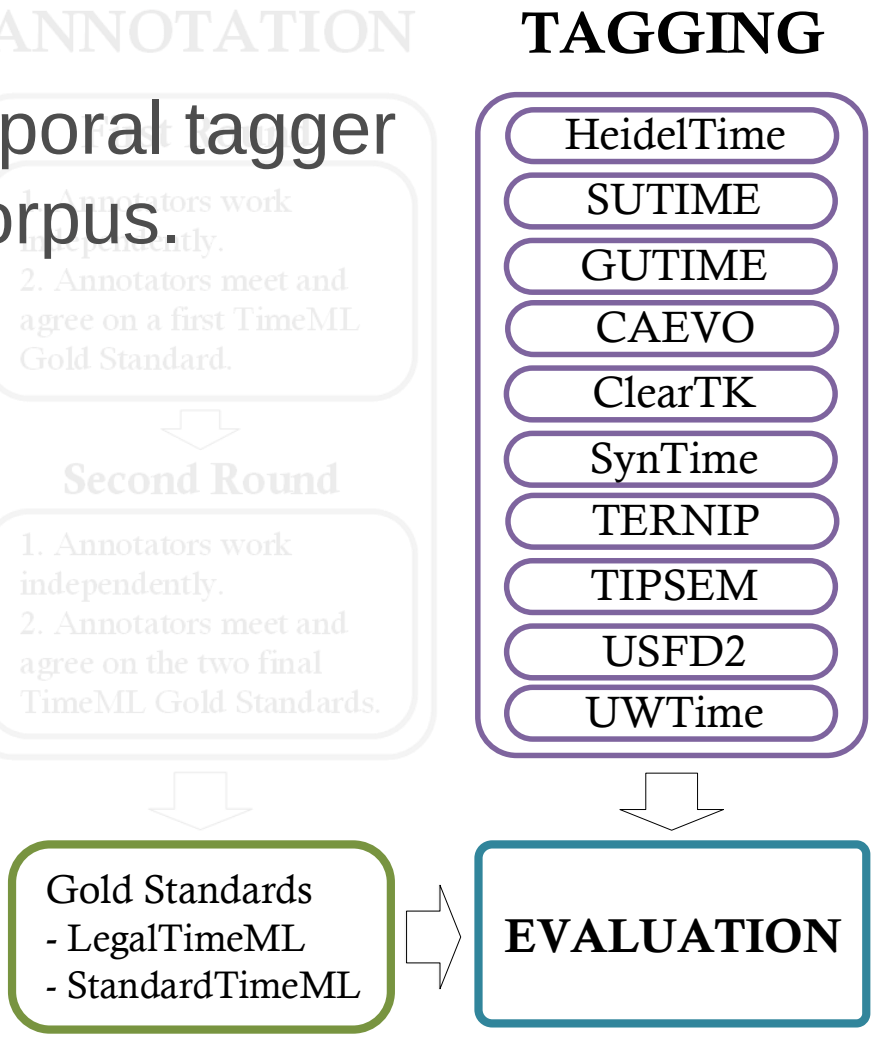
EVALUATION

TempCourt methodology

Also 10 state-of-the-art temporal tagger annotations added to the corpus.

Result:

- Two gold standards
- Benchmark of results of 10 temporal taggers for comparison



TempCourt

The annotations by the temporal taggers were analyzed, and the main lacks in legal texts were detected:

- Date formats (eg, “DD/MM/YYYY”)
- Currency identified as a year (“EUR 2000”)
- Polysemous words (“fall”, “may”)
- SETs considered DURATIONs (“Once a week”)
- Compund durations are separated (“One year and one day”).
- Series of dates (“15 and 16 December”)
- MODs not used
- Year-like expressions tagged (“No 1612/68”, “§1408”)

Navas-Loro, M., Filtz, E., Rodríguez-Doncel, V., Polleres, A., and Kirrane, S. (2019). “TempCourt: Evaluation of temporal taggers on a new corpus of court decisions”. *The Knowledge Engineering Review, 34*, E24.

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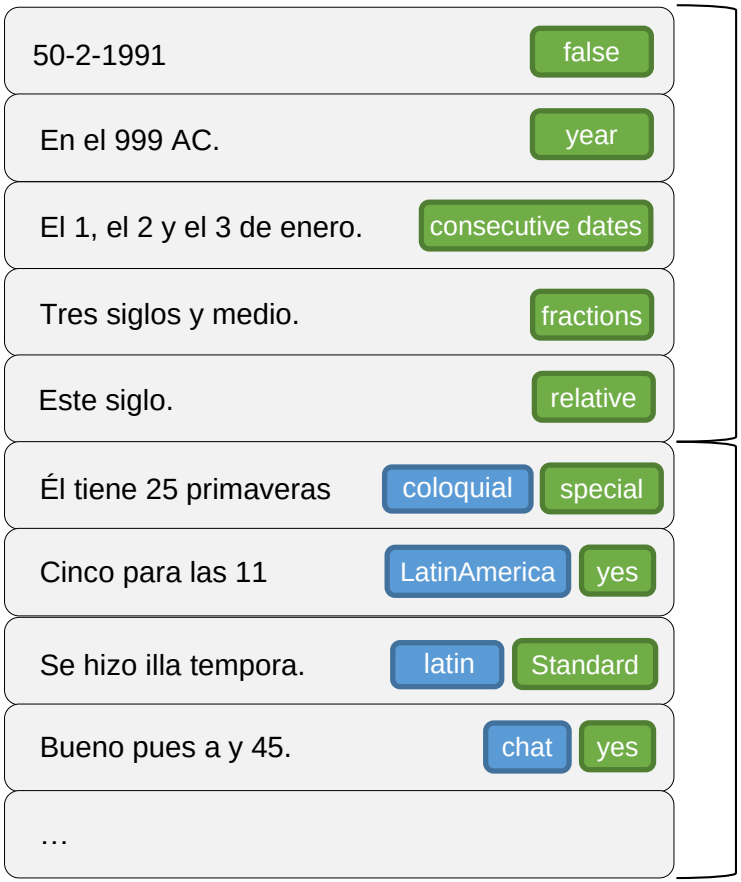
Spanish Corpus

HOURGLASS

Hourglass corpus

It is difficult to systematically test a temporal tagger.
We created a dataset named Hourglass, with two parts:



Synthetic part, developed for testing purposes.

- Includes Temporal Expressions that a temporal tagger should cover.
- Includes **tags** in order to facilitate the evaluation of different expressions.

People part, contributors foreign to the task provide expressions.

- They had different backgrounds.
- They came from different Spanish-speaking countries and regions.
- Each expression tagged with its **register**.

Hourglass examples

The following examples were difficult to handle to the taggers:

Example	Añotador	SUTime	HeidelTime
"**1 año, 6 meses y un día**" ("**1 year, 6 months and one day**")	**1 año, 6 meses y un día**	1 año, 6 meses y un día	**1 año**, **6 meses** y **un día**
"**Cinco para las 11**." ("**Five to eleven**.")	**Cinco para las 11**.	Cinco para las 11.	Cinco para las 11.
"lo vuestro dura **1h**, no?" ("your stuff lasts **1h**, right?")	lo vuestro dura **1h**, no?	lo vuestro dura 1h, no?	lo vuestro dura 1h, no?
"en **cero coma**" (in a short amount of time)	en cero coma	en cero coma	en cero coma

Navas-Loro, M. and Rodríguez-Doncel, V. "Annotador: a Temporal Tagger for Spanish". Journal of Intelligent & Fuzzy Systems, vol. 39, no. 2, pp. 1979-1991, 2020.

- Corpora
- Temporal Tagging

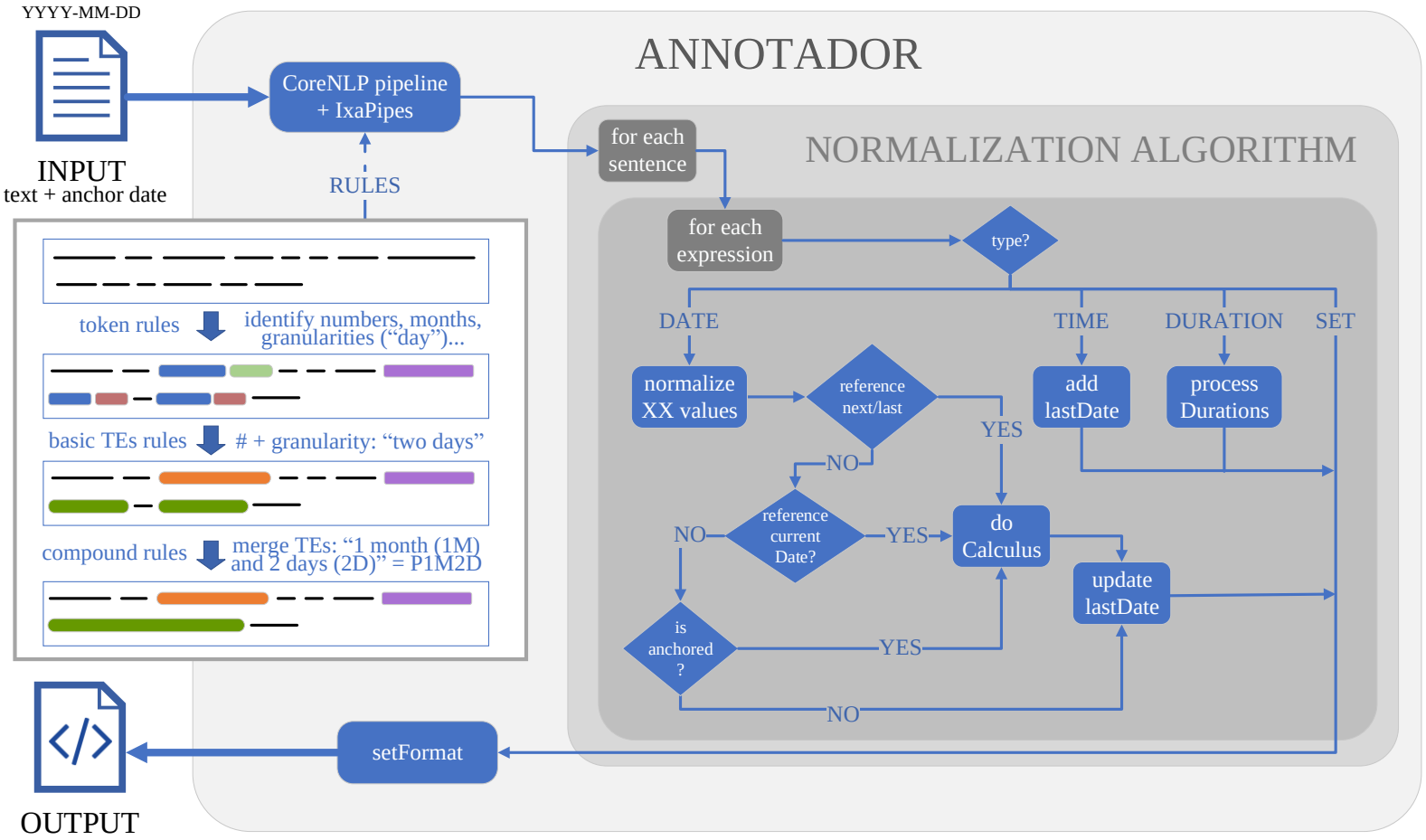
TEMPORAL EXPRESSIONS

Temporal tagging

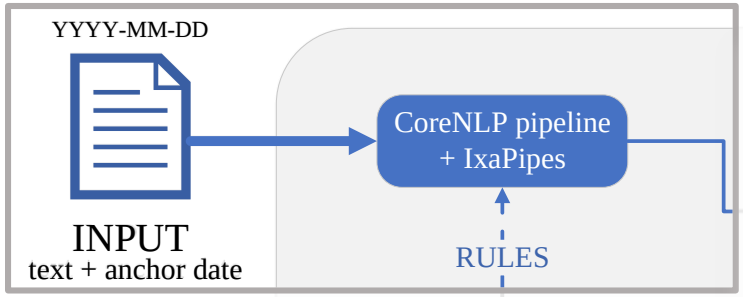
AÑOTADOR

Añotador

Añotador is a temporal tagger for Spanish and English that targets both generic texts or legal texts.



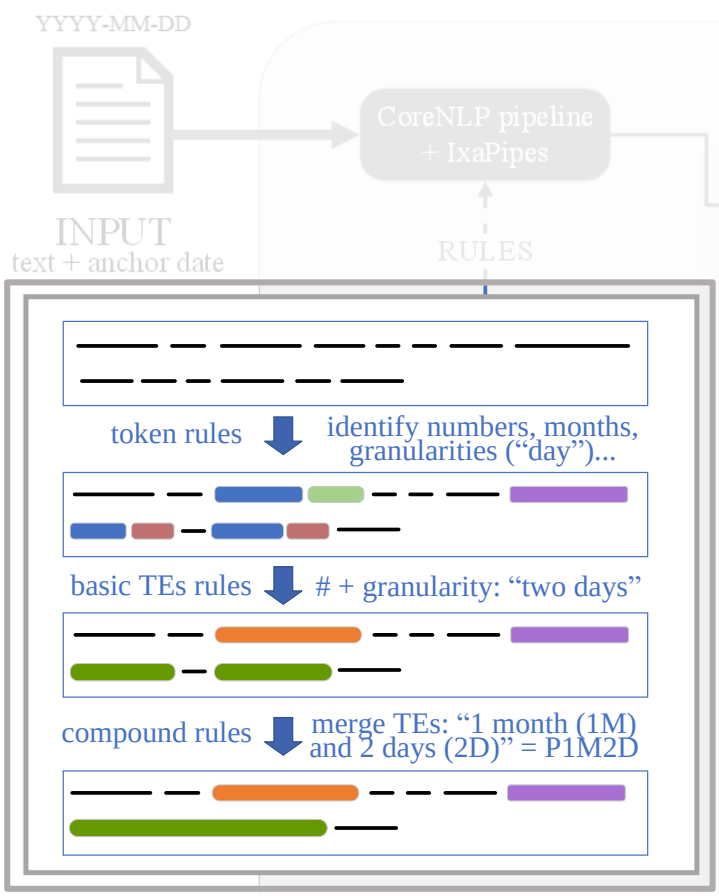
Pipeline of Añotador



1. Preprocessing:

- We get as input the text and the anchor date (if none, we assume the current day)
- We use CoreNLP for lemmatizing, sentence splitting…
- We added IxaPipes models for Spanish to improve the quality of the output.

Pipeline of Añotador



2. Rules:

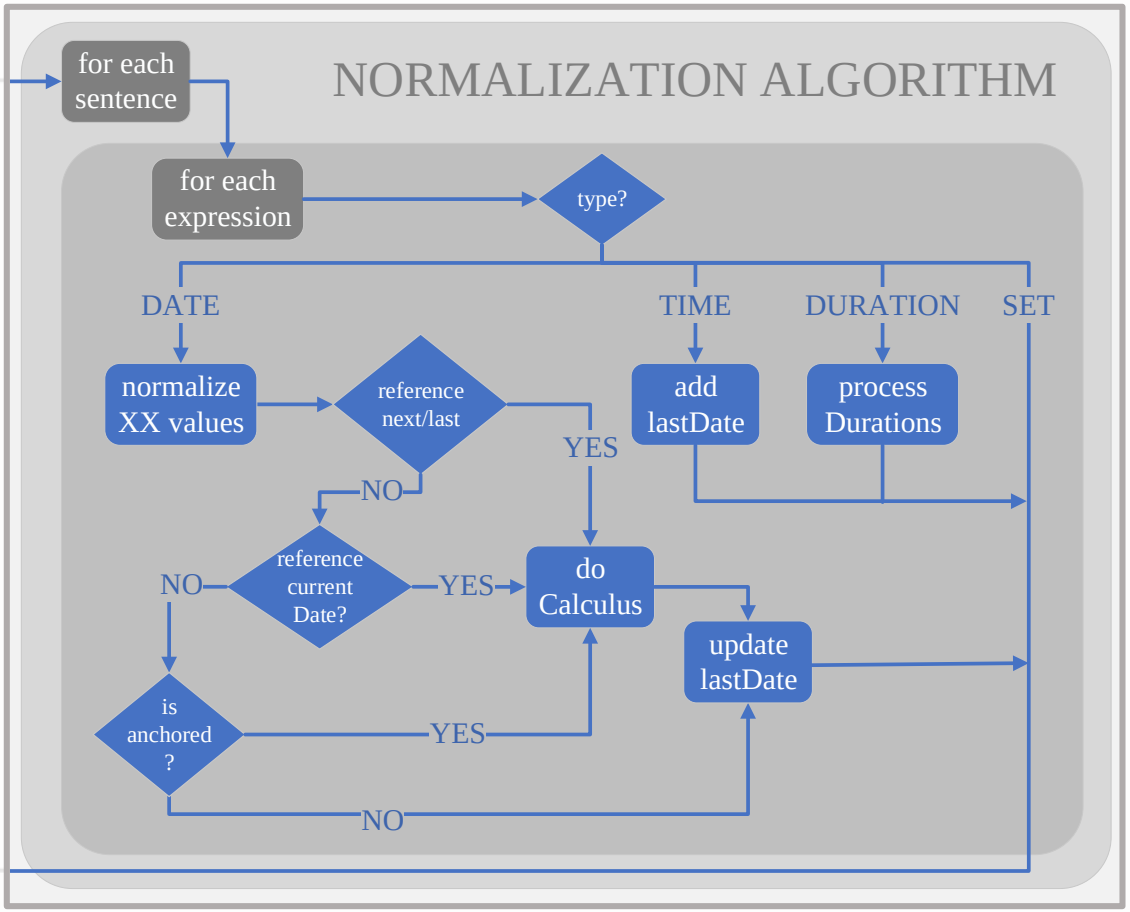
More than 100 rules written in CoreNLP TokensRegex format.

1. **Token-based rules** for expressions such as numerals, granularities…
2. **Basic temporal expression rules**, working on previously found basic expressions
3. **Compound expression rules**, for inheritance values or composition.
4. **Literal expression rules**, for specific expressions.

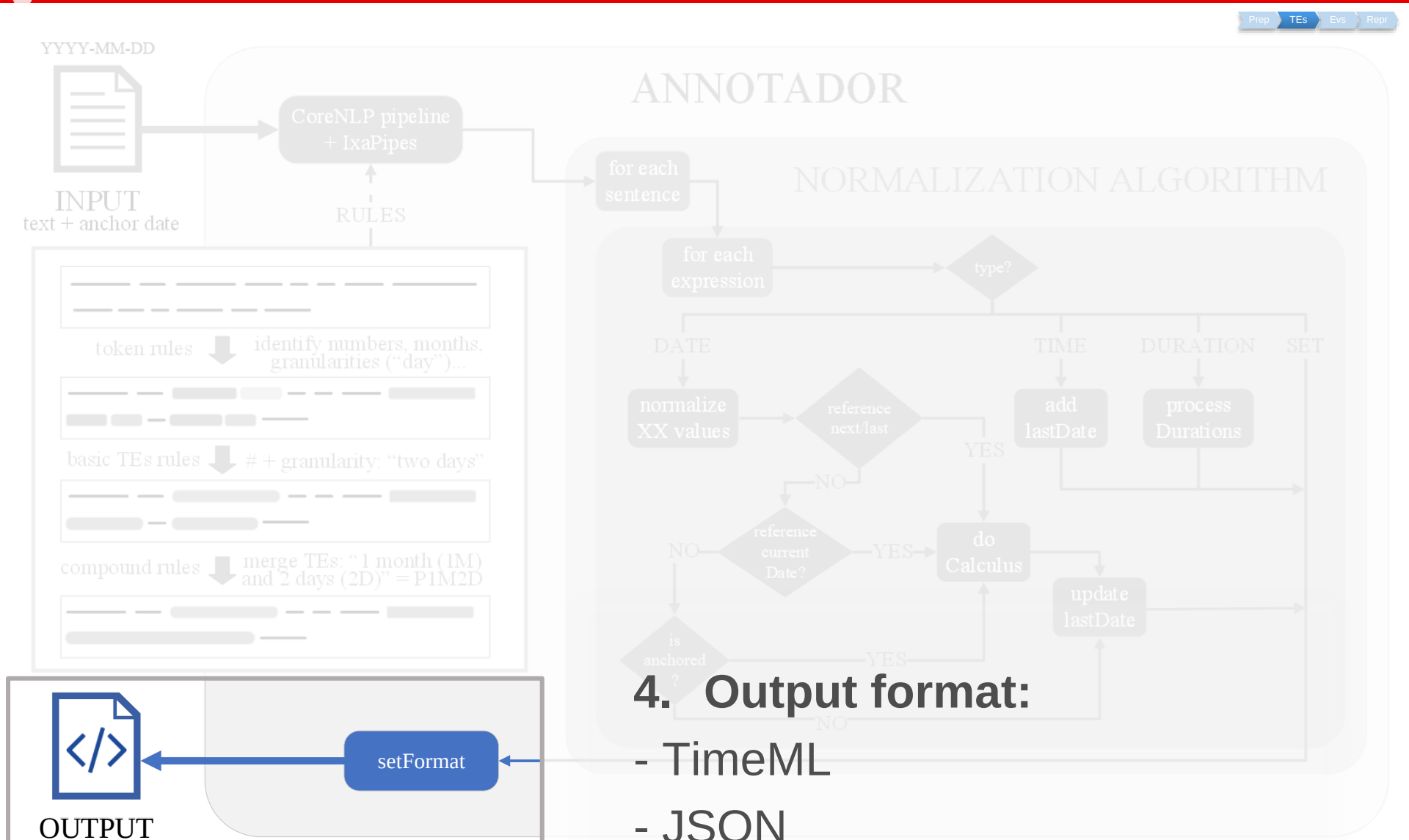
Pipeline of Añotador

3. Normalization algorithm:

- Works for each sentence sepparately.
- Different approaches for each type of expressions.
- Can take into account different reference dates.



Pipeline of Añotador



4. Output format:

- TimeML
- JSON

Special Cases – Legal Domain

- **Format**-processing is covered (e.g. to avoid links).
- New tags for **intervals** and a new option to normalize the **granularity business days** (BD).
- Additionally, some frequent temporal expressions that are not used in this sense, but are frequent **taglines in the legal domain** (such as “now”), were omitted.
- Most temporal taggers were not able to identify **years when written with letters**, in particular for Spanish.
- **Composed DURATIONs** (e.g. “one day and three hours”) are often annotated separately by previous temporal taggers.

Special Cases - Spanish

Añotador covers cases that other temporal taggers do not meet:

- The tricky case of the word “mañana”, frequent in Spanish:
  - “mañana” (f. *noun*) means “morning”.
  - “mañana” (*m. noun*) means “the future”.
  - “mañana” (*adv*) means “tomorrow”.
  - “pasado mañana” (*adv*) means “the day after tomorrow”.
  - “pasado” (*adv*) equals to “pasado mañana”.
  - “pasado” (*noun* or *adjective*) means “past” (*noun* or *adj*).
  - Also syntactically: “por la mañana” vs “en la mañana” (“in the morning”)
- Different registers (*antaño*, cultured way of “in the past”).
- Latin American expressions, that have never been considered in previous temporal taggers.

Use cases

Use Case 1 Lynx Project

- Build a Legal Knowledge Graph with documents processed by NLP microservices.
- Añotador processed different legal texts in Spanish and English.

Use Case 2 Collaboration with CENDOJ (Judicial Documentation Centre)

Use Case 3 As an occasional service within other tasks

- Terminology Extraction: to avoid dates to be included as relevant words.
- Translation Memory Matching: to detect dates (Ranasinghe et al., 2020).
- Anonymization: in a national project in order to delete dates from texts.

Añotador Evaluation

User validation

- Used in the Lynx project for both legal English and Spanish.
- Refined by CENDOJ for legal Spanish.
- Used as an API for several NLP tasks.
- Demo of Añotador freely accessible to any user; general users were asked to test the tool and report the main problems they found.

Corpora Evaluation

- Different aspects of temporal expressions covered:
  - Extension, normalization, type of temporal expression.
- P, R, F1 metrics will be considered:
  - Lenient: a partially tagged expression is considered a hit.
  - Strict: just expressions tagged exactly as in the test are considered correct.
  - Average: average of lenient and strict.

General Spanish Evaluation

Hourglass corpus

		strict			lenient			average		
Temporal Tagger	Attribute	P	R	F1	P	R	F1	P	R	F1
Añotador (2019)	value	**0.72**	**0.71**	**0.72**	**0.80**	**0.78**	**0.79**	**0.76**	**0.74**	**0.75**
	type	**0.79**	**0.77**	**0.78**	**0.89**	**0.87**	**0.88**	**0.84**	**0.82**	**0.83**
	extent	**0.83**	**0.82**	**0.82**	**0.95**	**0.92**	**0.94**	**0.89**	**0.87**	**0.88**
HeidelTime (2012)	value	0.57	0.48	0.52	0.64	0.53	0.58	0.60	0.51	0.55
	type	0.61	0.51	0.55	0.82	0.69	0.75	0.72	0.60	0.65
	extent	0.62	0.52	0.57	0.87	0.73	0.80	0.75	0.63	0.68
SUTime (2012)	value	0.30	0.08	0.13	0.45	0.12	0.19	0.38	0.10	0.16
	type	0.47	0.13	0.20	0.80	0.21	0.34	0.64	0.17	0.27
	extent	0.47	0.13	0.20	0.89	0.24	0.37	0.68	0.18	0.29

General Spanish Evaluation

TempEval-2 (news)

		strict			lenient			average		
Temporal Tagger	Attribute	P	R	F1	P	R	F1	P	R	F1
Añotador (2019)	value	0.80	**0.78**	0.79	0.83	**0.80**	0.82	0.82	**0.79**	0.80
	type	0.84	**0.82**	**0.83**	0.91	**0.88**	**0.89**	**0.88**	**0.85**	**0.86**
	extent	0.87	**0.84**	0.85	0.93	**0.90**	**0.92**	0.90	**0.87**	**0.89**
HeidelTime (2012)	value	**0.84**	0.75	**0.80**	**0.86**	0.77	**0.82**	**0.85**	0.76	**0.81**
	type	**0.85**	0.76	0.81	0.89	0.79	0.84	0.87	0.78	0.82
	extent	**0.90**	0.81	**0.85**	0.94	0.84	0.89	**0.92**	0.83	0.87
SUTime (2012)	value	0.64	0.22	0.33	0.83	0.29	0.43	0.73	0.26	0.38
	type	0.65	0.23	0.34	**0.93**	0.32	0.48	0.79	0.28	0.41
	extent	0.67	0.23	0.35	**0.96**	0.33	0.49	0.81	0.28	0.42

Best results in different registers.

Very good results in news, specially recall.

Legal Evaluation

StandardTimeML
LegalTimeML

TempCourt - ECHR

Temporal Taggers	lenient			strict			lenient+value			strict+value		
Name (year)	P	R	F1	P	R	F1	P	R	F1	P	R	F1
Añotador (2019)	0.98	0.96	0.97	0.94	**0.93**	**0.93**	**0.91**	**0.89**	**0.90**	**0.88**	**0.87**	**0.87**
	0.87	0.97	0.92	**0.83**	**0.93**	**0.88**	**0.81**	**0.90**	**0.85**	**0.77**	**0.86**	**0.81**
HeidelTime (2012)	**0.99**	**0.99**	**0.99**	0.84	0.84	0.84	0.78	0.78	0.78	0.78	0.78	0.78
	0.88	**0.99**	**0.93**	0.71	0.80	0.75	0.67	0.75	0.71	0.64	0.72	0.68
SUTime (2012)	0.88	0.87	0.88	0.85	0.84	0.84	0.78	0.78	0.78	0.76	0.75	0.75
	0.76	0.85	0.80	0.71	0.80	0.76	0.66	0.74	0.79	0.64	0.72	0.68
TARSQI (2005)	0.96	0.93	0.94	**0.95**	0.92	**0.93**	0.86	0.84	0.85	0.86	0.84	0.85
	0.84	0.92	0.88	**0.83**	0.92	0.87	0.74	0.82	0.78	0.74	0.82	0.78
CAEVO (2014)	0.88	0.87	0.87	0.83	0.82	0.82	0.78	0.78	0.78	0.75	0.75	0.75
	0.75	0.85	0.80	0.70	0.79	0.74	0.65	0.74	0.69	0.64	0.72	0.67
ClearTK (2013)	0.92	0.78	0.85	0.34	0.32	0.35	-	-	-	-	-	-
	0.80	0.77	0.78	0.33	0.32	0.33	-	-	-	-	-	-
SynTime (2017)	0.98	0.93	0.96	0.83	0.79	0.81	-	-	-	-	-	-
	0.86	0.93	0.90	0.70	0.76	0.73	-	-	-	-	-	-
TERNIP (2010)	0.94	0.95	0.95	0.92	0.93	0.92	0.86	0.88	0.87	0.85	0.86	0.85
	0.83	0.95	0.89	0.80	0.92	0.85	0.75	0.86	0.80	0.72	0.83	0.77
TIPSem (2010)	0.78	0.85	0.81	0.64	0.70	0.67	0.64	0.71	0.67	0.63	0.69	0.66
	0.69	0.86	0.76	0.62	0.77	0.69	0.64	0.79	0.71	0.61	0.76	0.68
USFD2 (2010)	0.73	0.61	0.67	0.69	0.58	0.63	0	0	0	0	0	0
	0.65	0.62	0.64	0.61	0.58	0.60	0	0	0	0	0	0
UWTime (2014)	0.90	0.53	0.67	0.51	0.30	0.38	0.55	0.33	0,41	0.51	0.30	0.38
	0.86	0.58	0.69	0.48	0.32	0.38	0.51	0.34	0.41	0.48	0.32	0.38

Legal Evaluation

StandardTimeML
LegalTimeML

TempCourt - ECJ

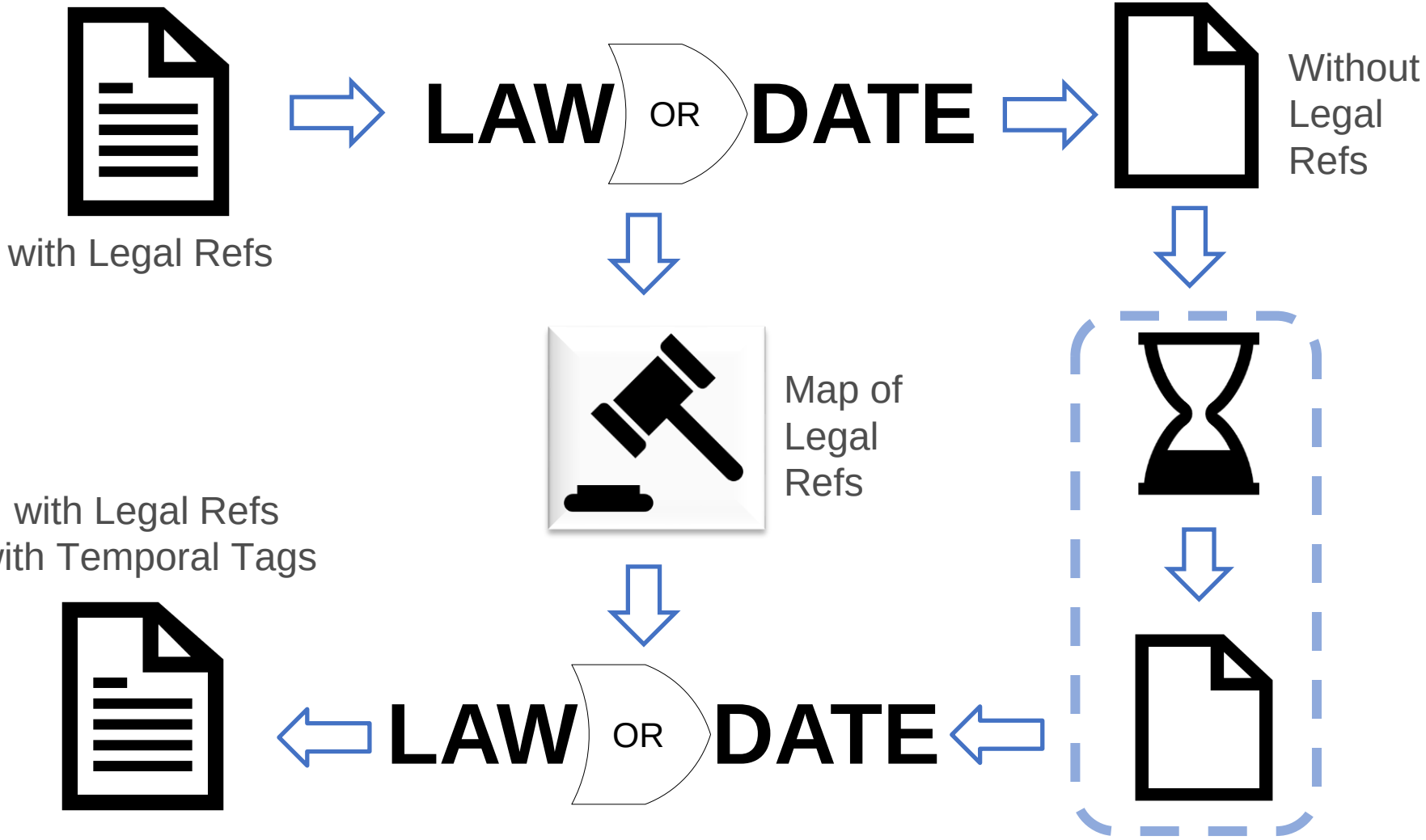
Temporal Taggers	lenient			strict			lenient+value			strict+value		
Name (year)	P	R	F1	P	R	F1	P	R	F1	P	R	F1
Añotador (2019)	**0.98**	0.94	**0.96**	0.96	0.92	**0.94**	**0.96**	0.92	**0.94**	0.94	0.90	**0.92**
	0.54	0.94	**0.69**	0.52	0.91	**0.67**	**0.53**	0.92	**0.67**	0.51	0.89	**0.65**
HeidelTime (2012)	0.48	0.95	0.64	0.47	0.94	0.63	0.47	**0.94**	0.62	0.47	**0.93**	0.62
	0.27	0.97	0.42	0.26	**0.96**	0.42	0.26	**0.94**	0.40	0.26	**0.93**	0.40
SUTime (2012)	0.81	0.97	0.88	0.79	**0.95**	0.86	0.78	0.93	0.85	0.77	0.92	0.84
	0.44	0.95	0.60	0.43	0.93	0.58	0.41	0.90	0.57	0.41	0.89	0.56
TARSQI (2005)	**0.97**	0.87	0.91	**0.97**	0.86	**0.91**	0.94	0.84	0.89	0.94	0.84	0.88
	0.51	0.82	0.63	0.50	0.82	0.62	0.48	0.78	0.60	0.48	0.78	0.60
CAEVO (2014)	0.89	0.74	0.81	0.85	0.70	0.77	0.86	0.71	0.77	0.85	0.70	0.77
	0.49	0.74	0.59	0.46	0.70	0.56	0.46	0.70	0.56	0.46	0.69	0.55
ClearTK (2013)	0.77	0.88	0.82	0.32	0.36	0.34	-	-	-	-	-	-
	0.42	0.88	0.57	0.18	0.37	0.24	-	-	-	-	-	-
SynTime (2017)	0.89	**0.99**	0.93	0.81	0.90	0.85	-	-	-	-	-	-
	0.49	**0.98**	0.65	0.46	0.92	0.61	-	-	-	-	-	-
TERNIP (2010)	0.97	0.88	0..92	0.96	0.88	0.91	**0.96**	0.87	0.91	**0.95**	0.87	0.91
	0.54	0.89	0.67	**0.53**	0.88	0.66	**0.53**	0.88	0.65	**0.52**	0.87	**0.65**
TIPSem (2010)	0.72	0.81	0.76	0.64	0.72	0.68	0.62	0.70	0.65	0.61	0.69	0.65
	0.41	0.83	0.54	0.37	0.75	0.49	0.35	0.71	0.47	.34	0.70	0.46
USFD2 (2010)	0.31	0.54	0.39	0.29	0.51	0.37	0.02	0.04	0.03	0.02	0.03	0.02
	0.20	0.65	0.31	0.19	0.61	0.29	0.02	0.06	0.03	0.02	0.05	0.02
UWTime (2014)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0

Temporal tagging

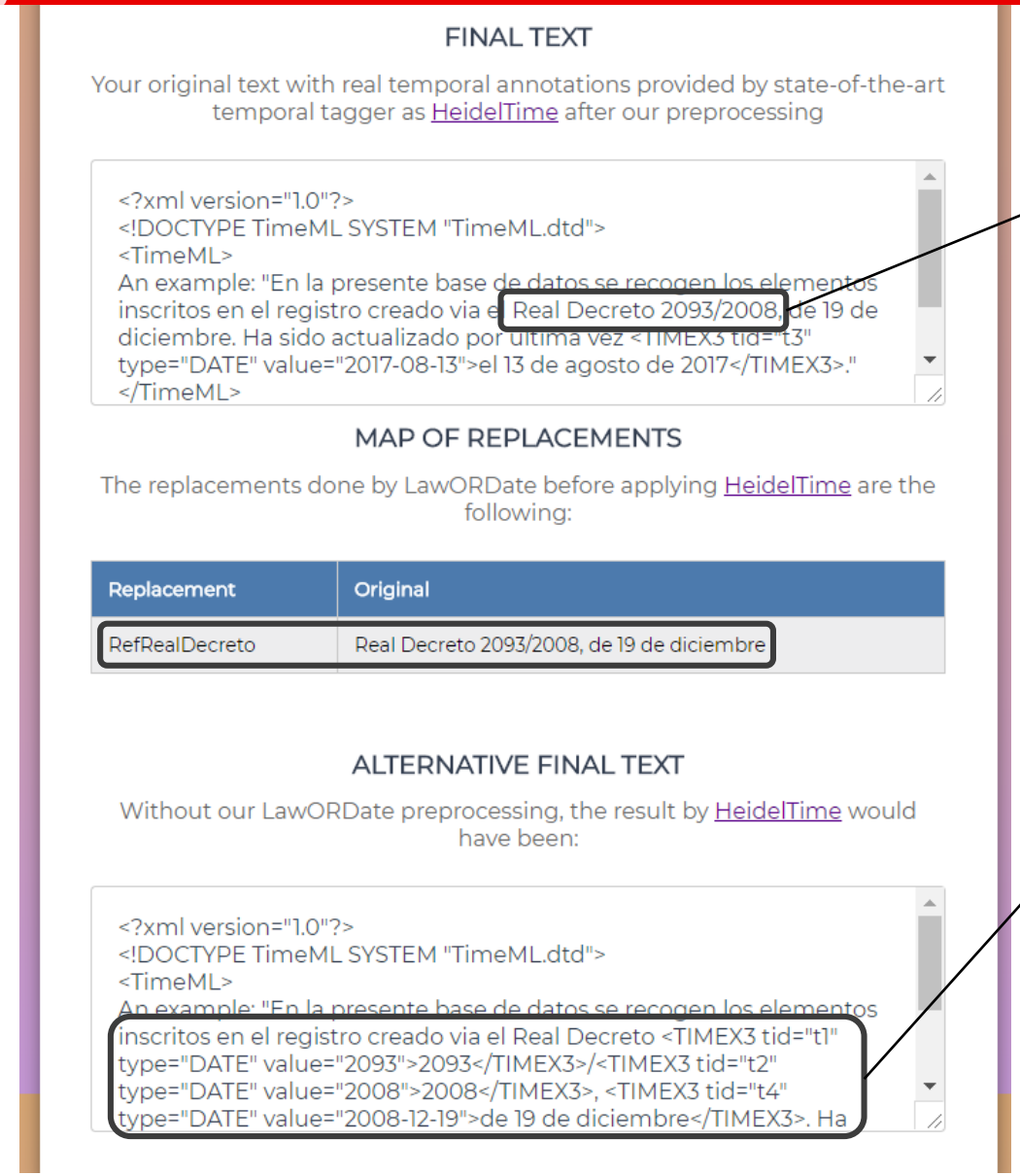
LAWORDATE

LawORDate

Idea Patterns to “clean” misleading expressions for temporal taggers



LawORDate



Prep TEs Evs Repr

Result of Heideltime **using LawORDate**:

- It does not annotate Real Decreto as a date…
- … because it is in the map of LawORDate

Result of Heideltime **without using LawORDate**:

- Annotates the different parts of Real Decreto as a date…
- … so the annotations are not correct.

Summary

Temporal Expression-related contributions

H1.a

An analysis of temporal tagging of the legal domain.

H1.a H2.a

Corpus of legal decisions in English.

Corpus of short texts in Spanish to systematically test temporal taggers.

H1.b

A tool that allows the user to preprocess citations that can be misleading to temporal taggers.

H1.a H1.b

A temporal tagger for Spanish and English that

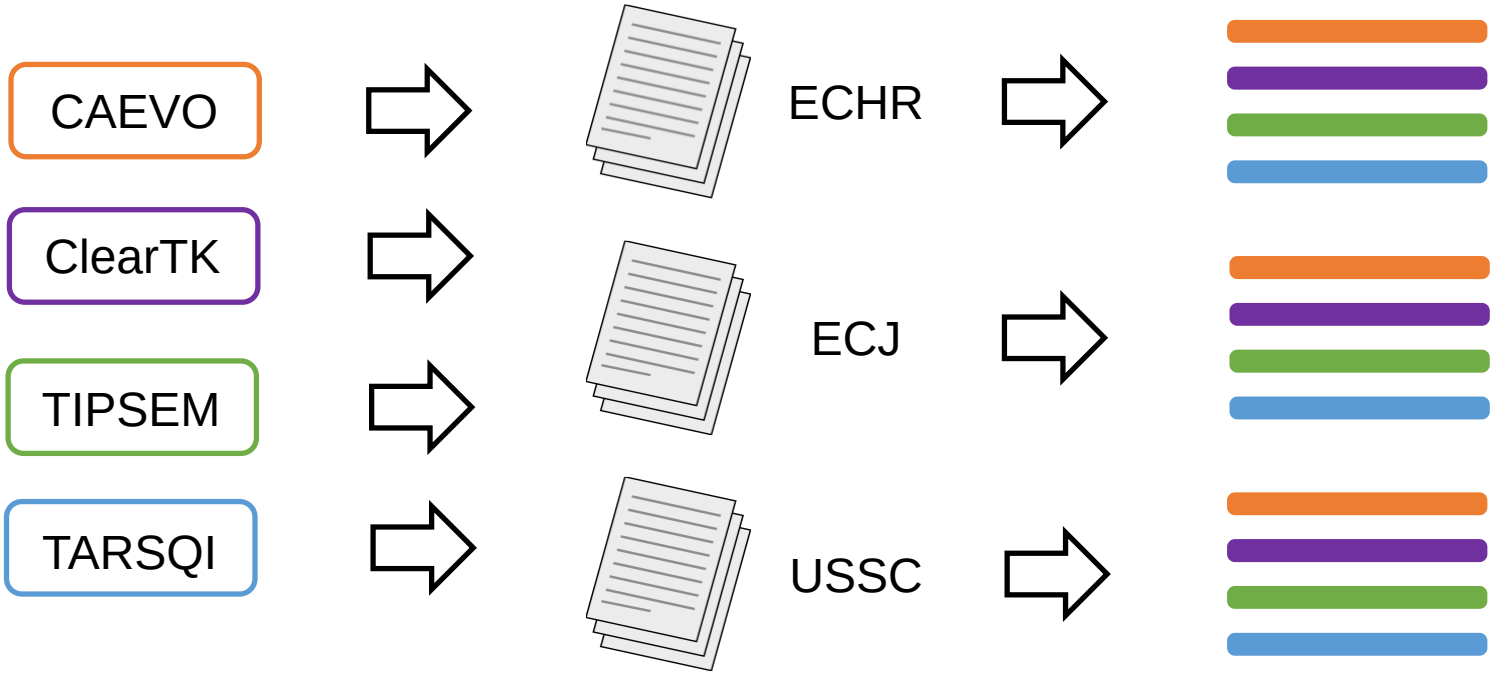
1) covers untackled particularities of the Spanish language,
2) has a special implementation for the legal domain

- Corpus
- Extraction
- Representation

EVENTS

Is it clear what is an event?

- Is it clear what is an event?
  - How many events are there?
  - What is annotated as event?
  - Is there agreement?
- Test in TempCourt



How many events are there?

How many events are there?

Between the 7 and the 9% of the tokens in a document (12 and 13% in the case of TARSQI) are considered events!

Calculus per sentence:

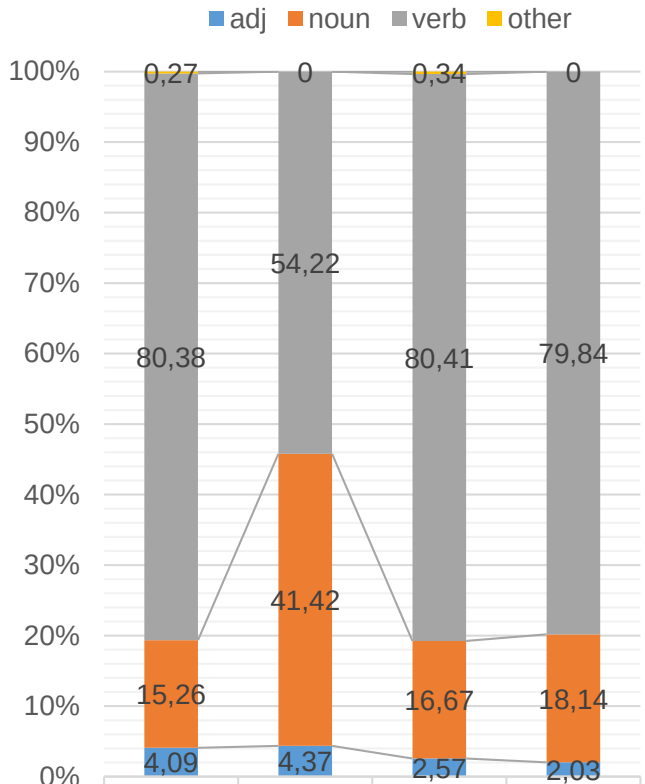
- 0,99~1,59 events per sentence for the ECHR part
- 2,26~4 events per sentence for ECJ
- 1,43~2,31 events per sentence for USSC

On average every sentence has at least one event, and even more in the case of documents with longer sentences.

What is annotated as event?

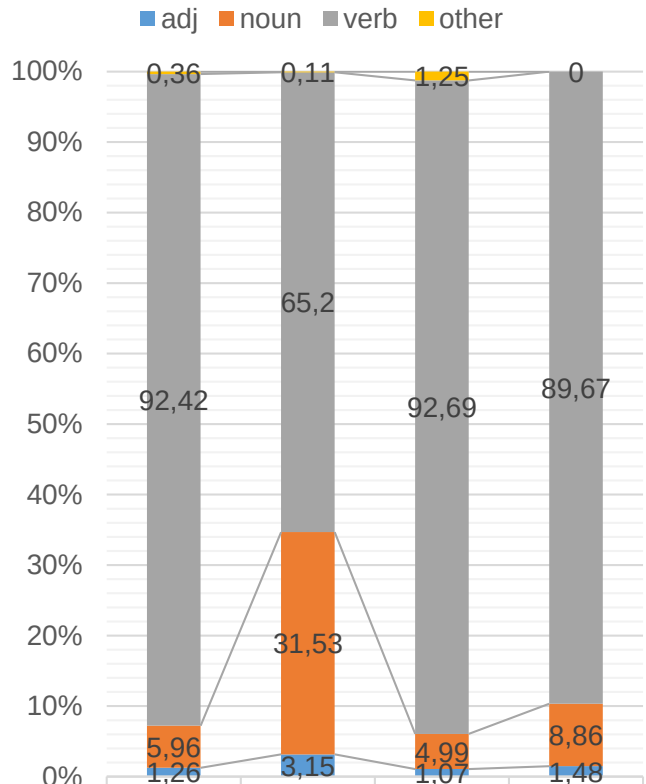
What is annotated as event?

ECJ



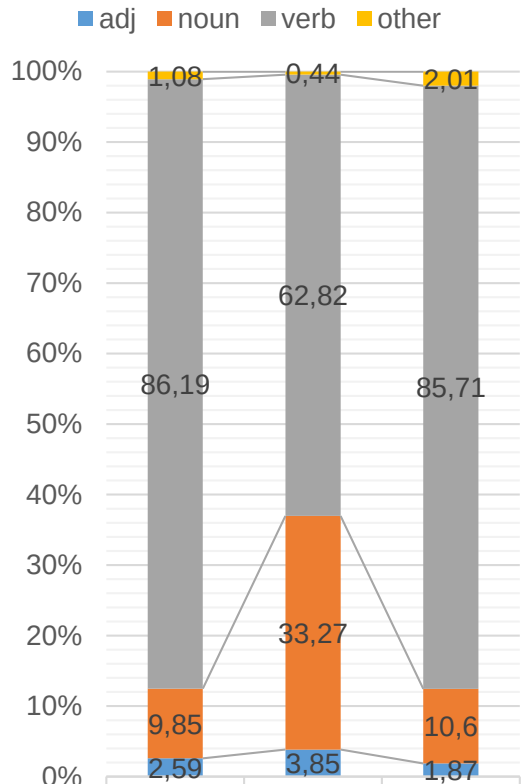
	CAEVO	TARSQI	ClearTK	TIPSEM
other	0,27	0	0,34	0
verb	80,38	54,22	80,41	79,84
noun	15,26	41,42	16,67	18,14
adj	4,09	4,37	2,57	2,03

ECHR



	CAEVO	TARSQI	ClearTK	TIPSEM
other	0,36	0,11	1,25	0
verb	92,42	65,2	92,69	89,67
noun	5,96	31,53	4,99	8,86
adj	1,26	3,15	1,07	1,48

USSC



	CAEVO	TARSQI	ClearTK
other	1,08	0,44	2,01
verb	86,19	62,82	85,71
noun	9,85	33,27	10,6
adj	2,59	3,85	1,87

Is there agreement?

ECHR

	CAEVO	CLEARTK	TARSQI	TIPSEM
CAEVO		0,76	0,56	0,72
CLEARTK	0,76		0,58	0,79
TARSQI	0,56	0,58		0,55
TIPSEM	0,72	0,79	0,55	

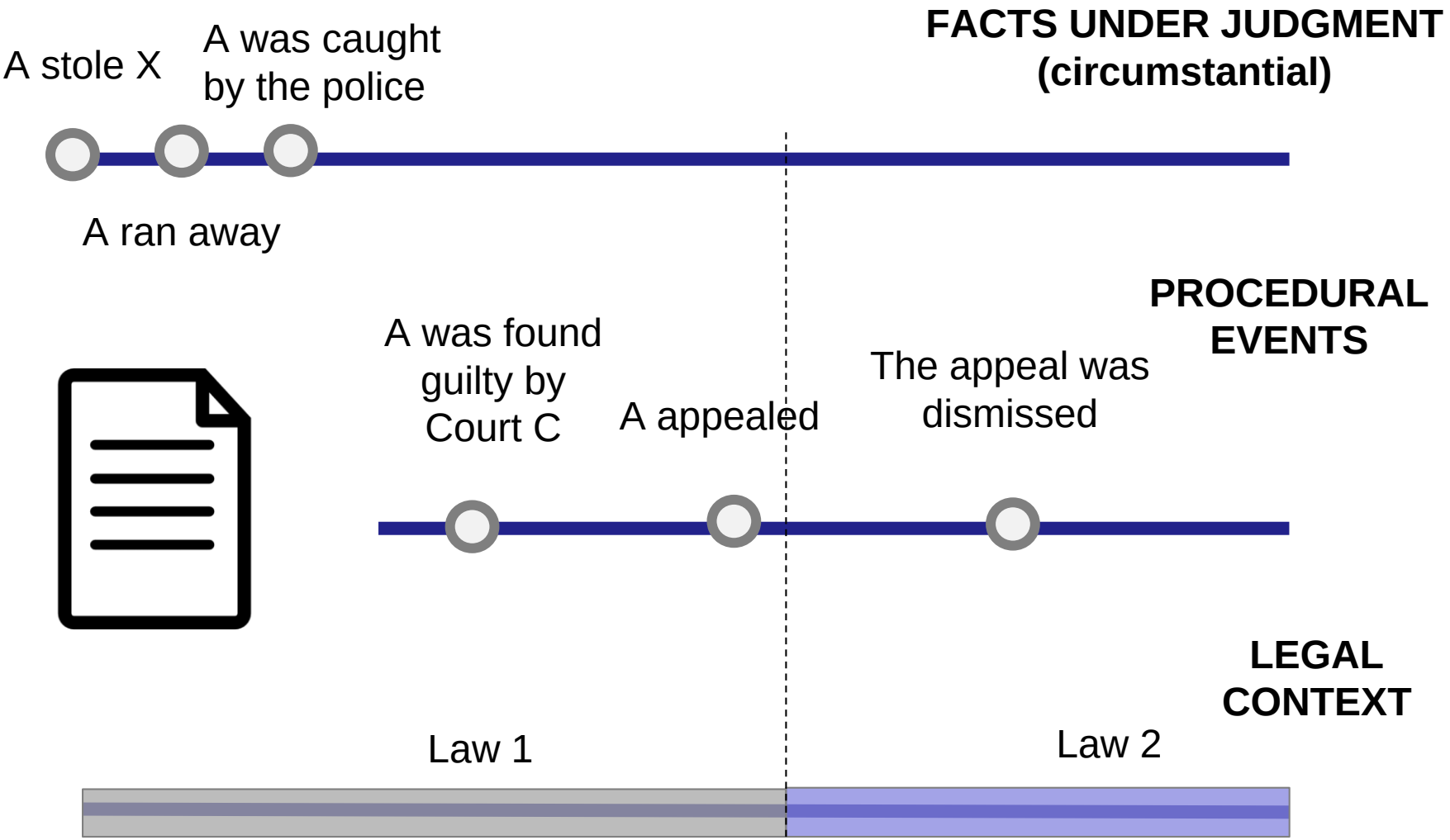
ECJ

	CAEVO	CLEARTK	TARSQI	TIPSEM
CAEVO		0,69	0,48	0,69
CLEARTK	0,69		0,50	0,73
TARSQI	0,48	0,50		0,52
TIPSEM	0,69	0,73	0,52	

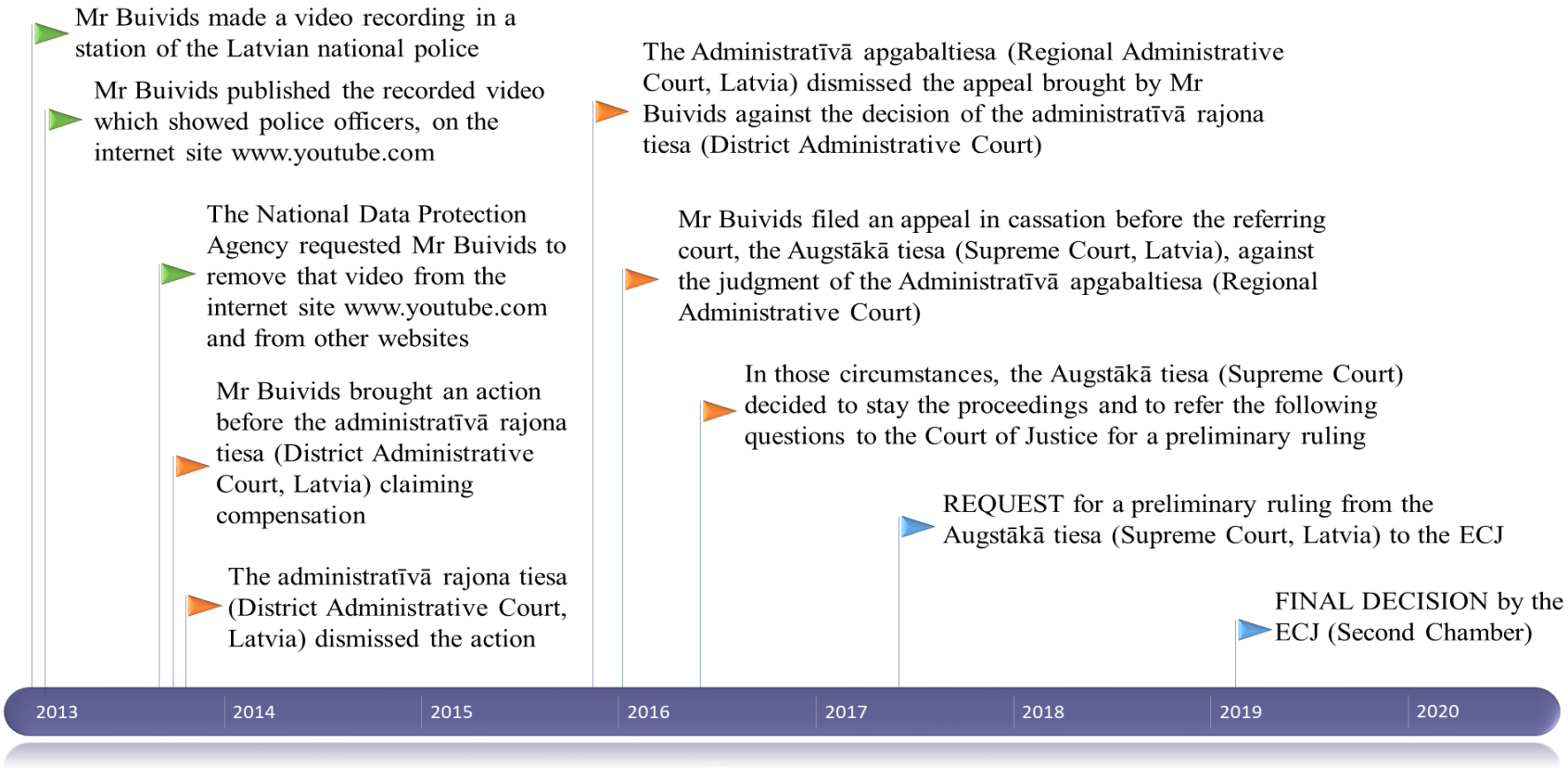
USSC

	CAEVO	CLEARTK	TARSQI
CAEVO		0,25	0,52
CLEARTK	0,25		0,17
TARSQI	0,52	0,17	

Temporal Dimensions



Temporal Dimensions



- Temporal dimension of the case (circumstantial)
- Temporal dimension of the legal process (procedural)

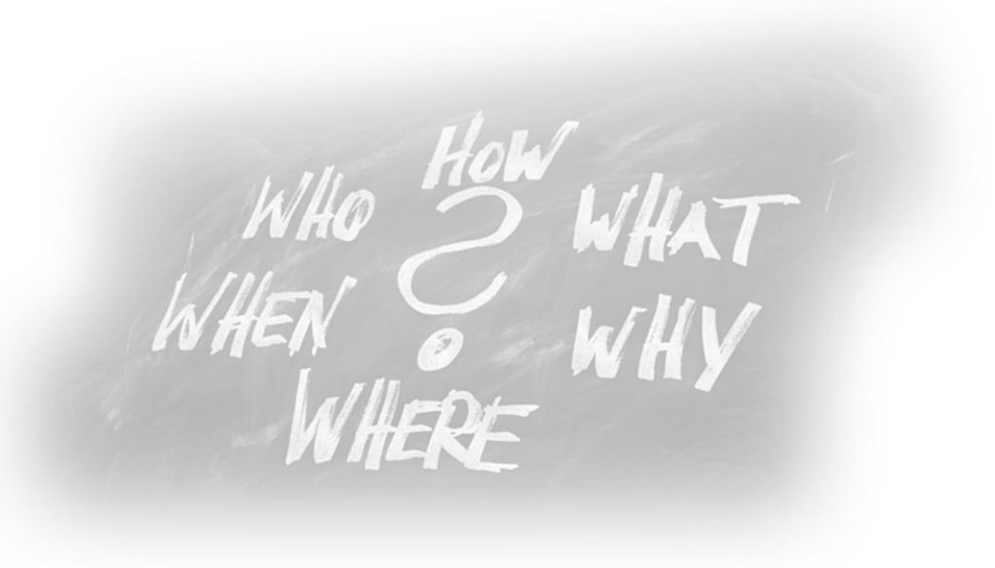
EventsMatter corpus

Conclusions from analysis:

- High variability of what is an event.
- Too many events! Preferably only **relevant** ones.
- Not all the events are recognized, importance of light verbs (e.g. request a preliminary **ruling**)
- TimeML just covers time-related information.

Creation of the EventsMatter corpus.

Filtz, E., **Navas-Loro, M.,** Santos, C., Polleres, A., and Kirrane, S. (2020). “EventsMatter: Extraction of Events from Court Decisions”. *JURIX2020, Frontiers in Artificial Intelligence and Applications. Volume 334: Legal Knowledge and Information Systems, p.33-42, 2020*

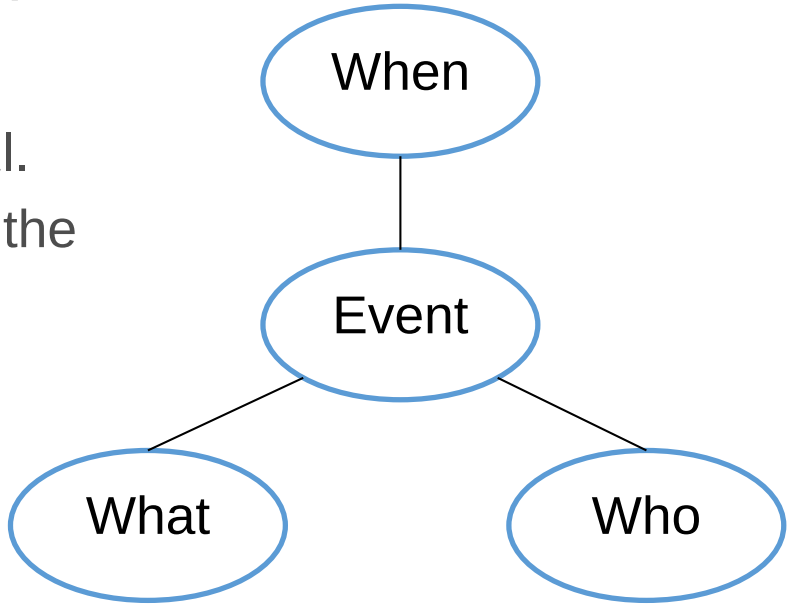


- Corpus
- Extraction
- Representation

EVENTS

EventsMatter corpus

- 30 documents from the European Court of Human Rights.
- Annotation of **event-what-when-who** by two experts.
- Two types of events: **procedural** and **circumstances**.
- Several annotation rounds and discussion on tricky cases and relevance; main difficulties:
  - Events can depending on the case.
  - “Legal verbs” not always procedural.
  - Nested events, where one event is the “when” of another.
  - Factuality of the event.
  - Relevance of the event.
  - Annotation of repeated events.



- Corpus
- Extraction
- Representation

EVENTS

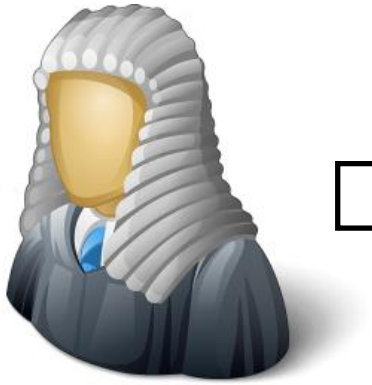
Events Extraction

CONTRACTFRAMES

ContractFrames - Current situation

Legal cases

Laws



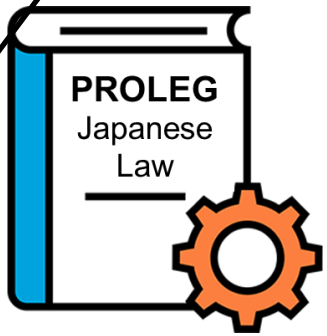
Knowledge

ContractFrames - Ideal situation

Legal cases

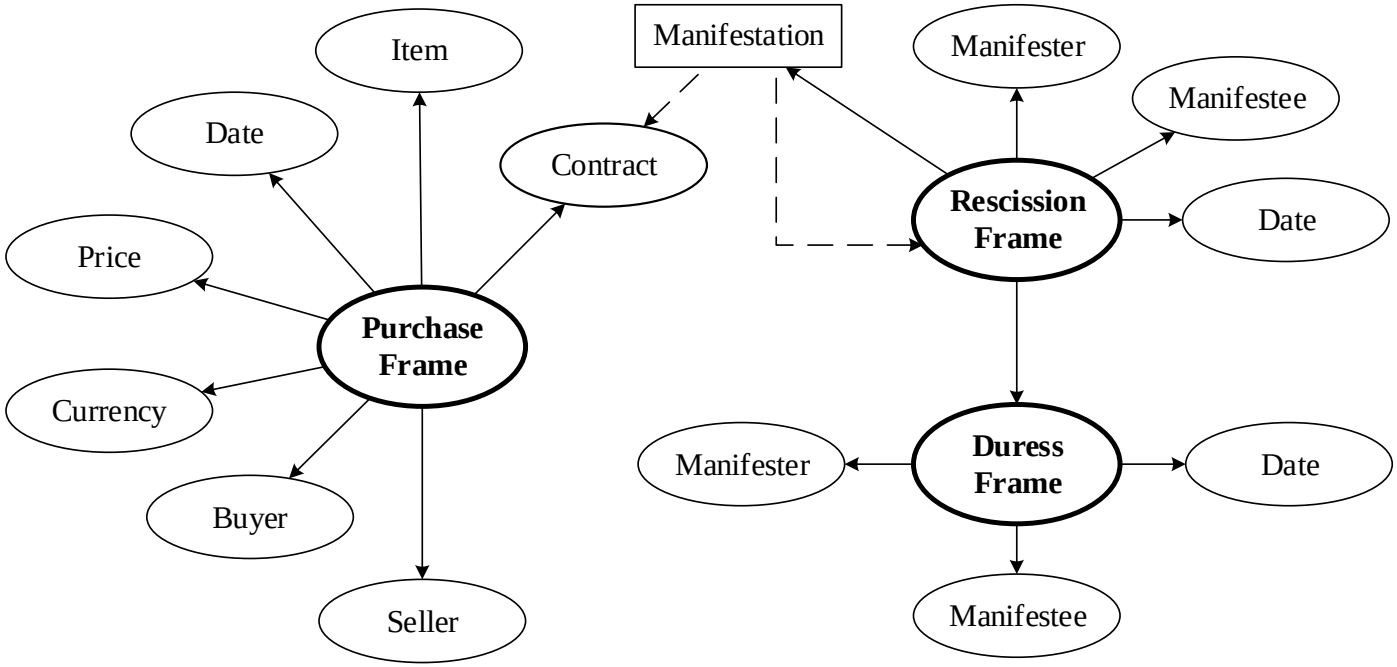
Knowledge

Laws



ContractFrames - Modelization of the events

- We build **frames** for representing the different events that can affect to the status of a contract.
- Output them as PROLEG facts.



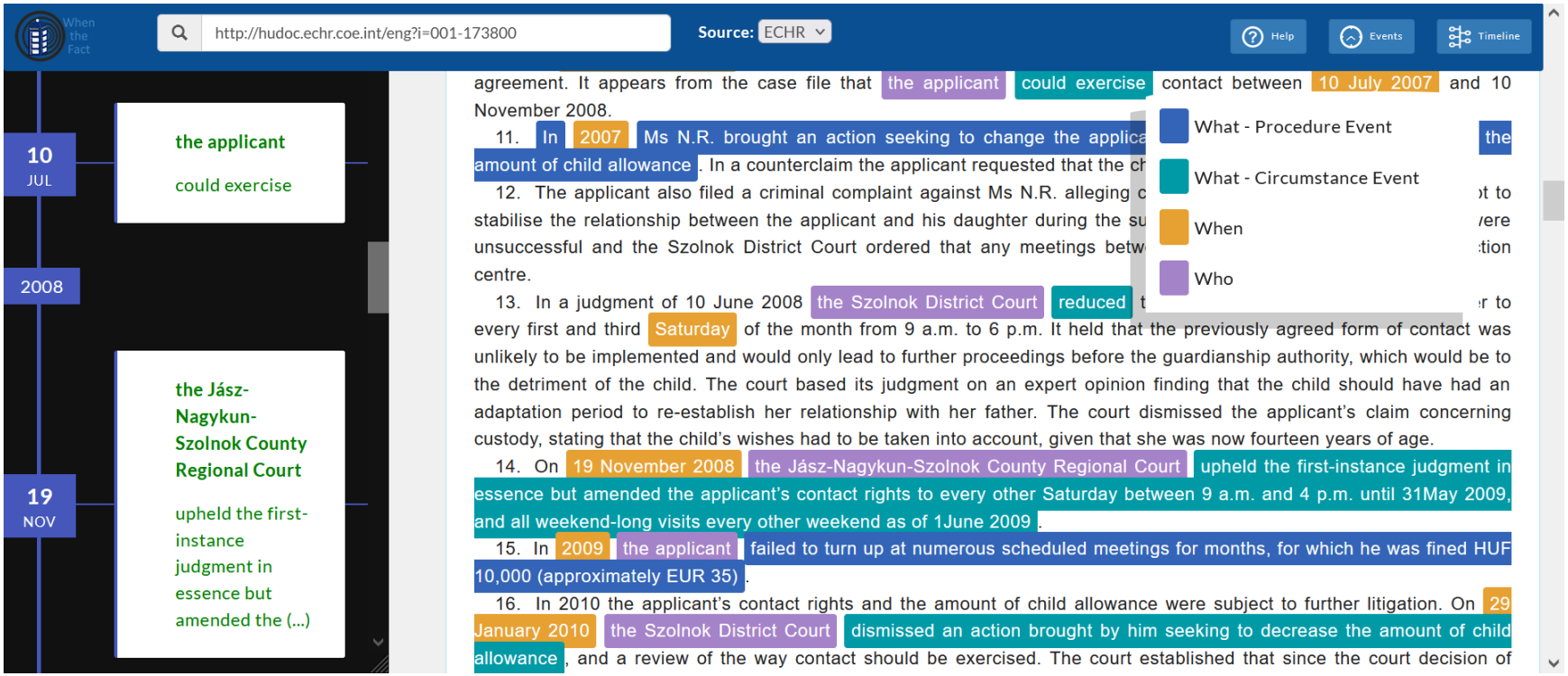
Navas-Loro, M., Satoh, K., Rodríguez-Doncel, V. (2018). "Contract-Frames: Bridging the gap between natural language and logics in contract law". *JSAI International Symposium on Artificial Intelligence.* Springer, Cham, 2018.

Events Extraction

WHENTHEFACT

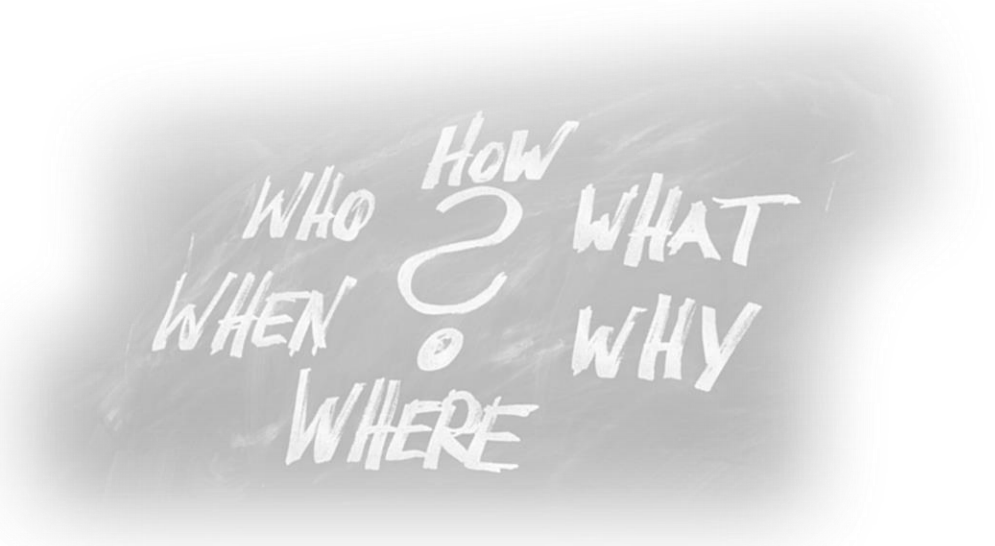
Objective: Find relevant events in European legal decisions.

- who-when-what events (procedural/circumstance)
- Timeline created from the relevant events found.



Implementation

- Uses Structure Extraction:
  - Relevance
  - Efficency.
- Different strategies:
  - Frames from EventsMatter training.
  - Manually hierachy-based selection of legal-related frames from FrameNet.
  - Semantic similarity for additional relevant events.
- Dependency parsing for arguments.



- Corpus
- Extraction
- Representation

EVENTS

Event-related resources

FT3 ONTOLOGY

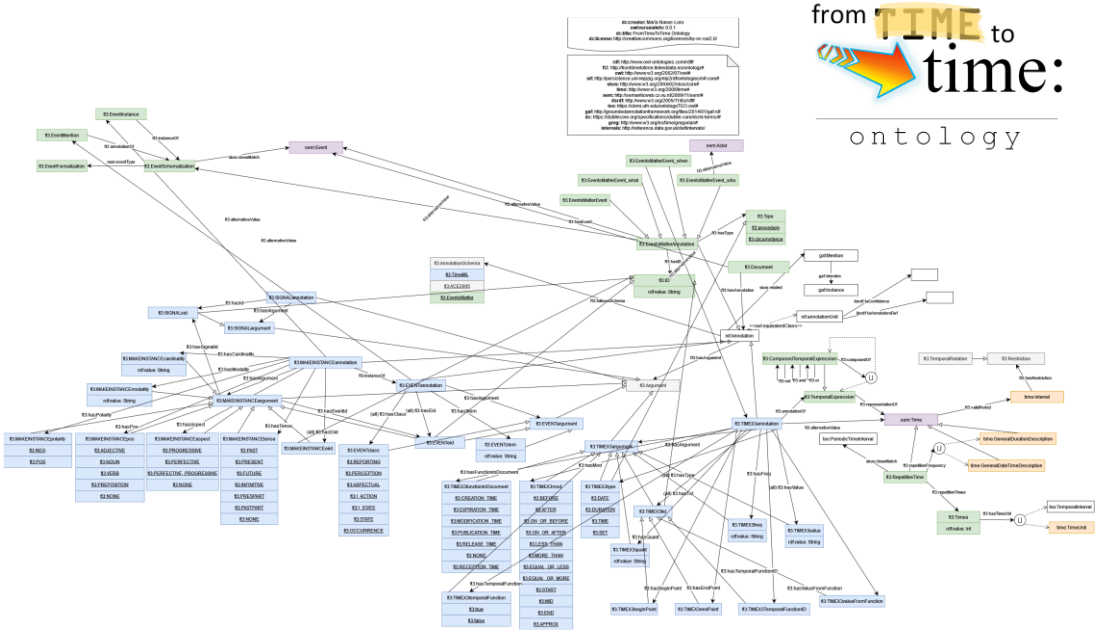
FromTimeToTime Ontology

Objectives

1. Event-based representation of information.
2. Representation of events and annotations for latter tasks.
3. Facilitate translation among time-related annotation formats and ontologies.

Main design decisions

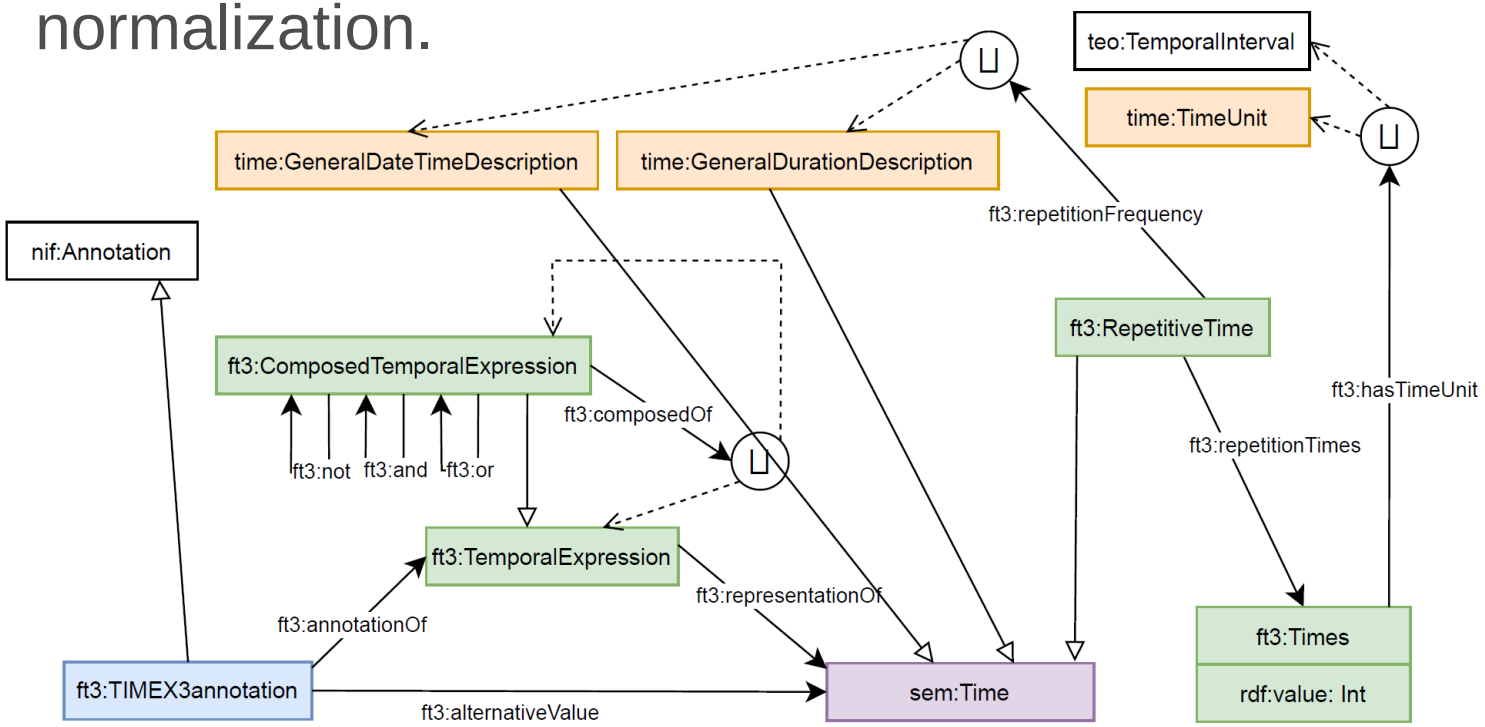
- High level clases:
  - *ft3:Guidelines*
  - *ft3:Annotation*
  - *ft3:Argument.*
- Ontology reuse:
  - SEM
  - TEO
  - NIF
  - TIME



FromTimeToTime Ontology

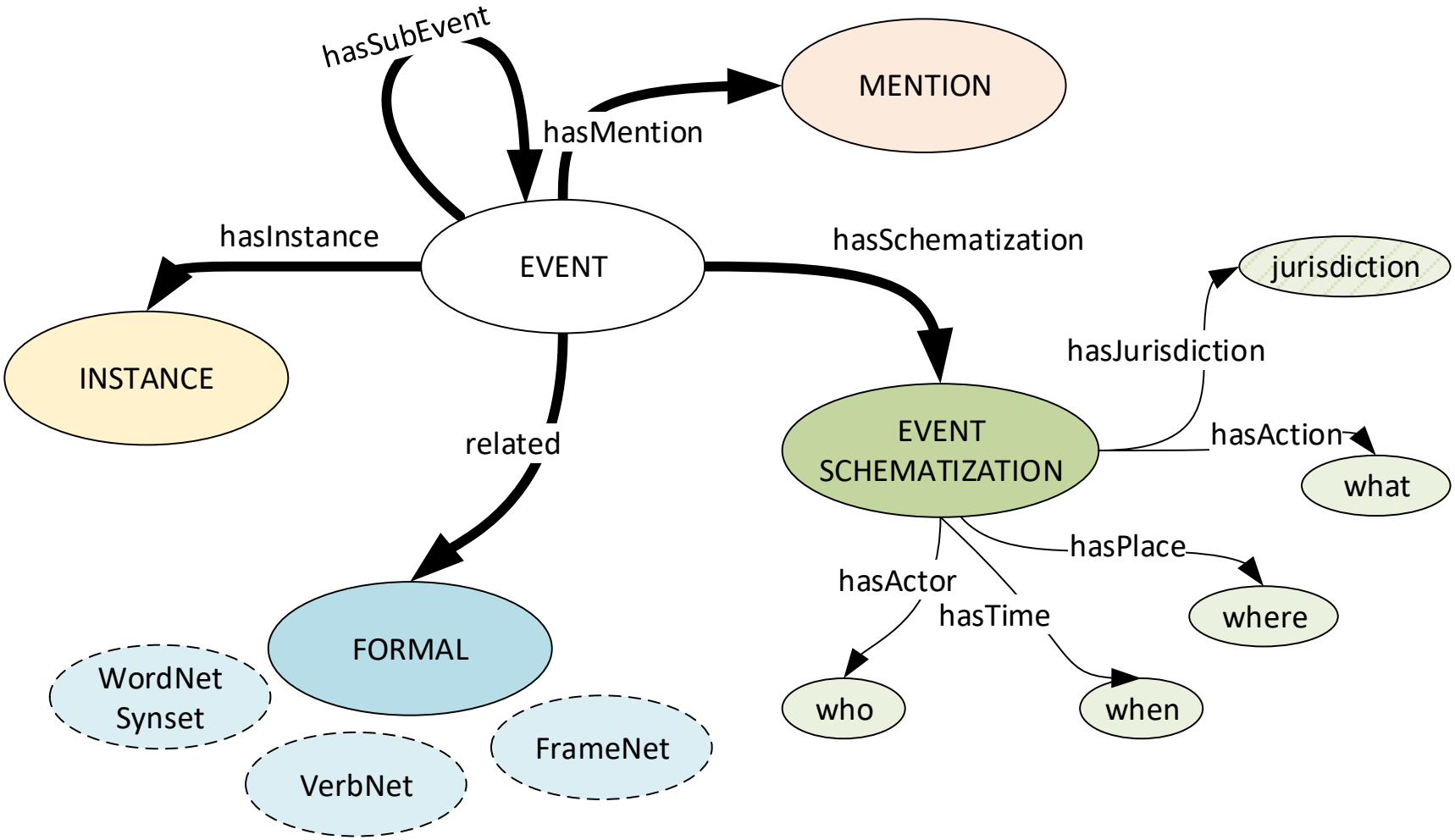
Temporal Expressions

1. Expressivity: *ft3:ComposedTemporalExpressions*.
2. Bridge between the annotation and the normalization.



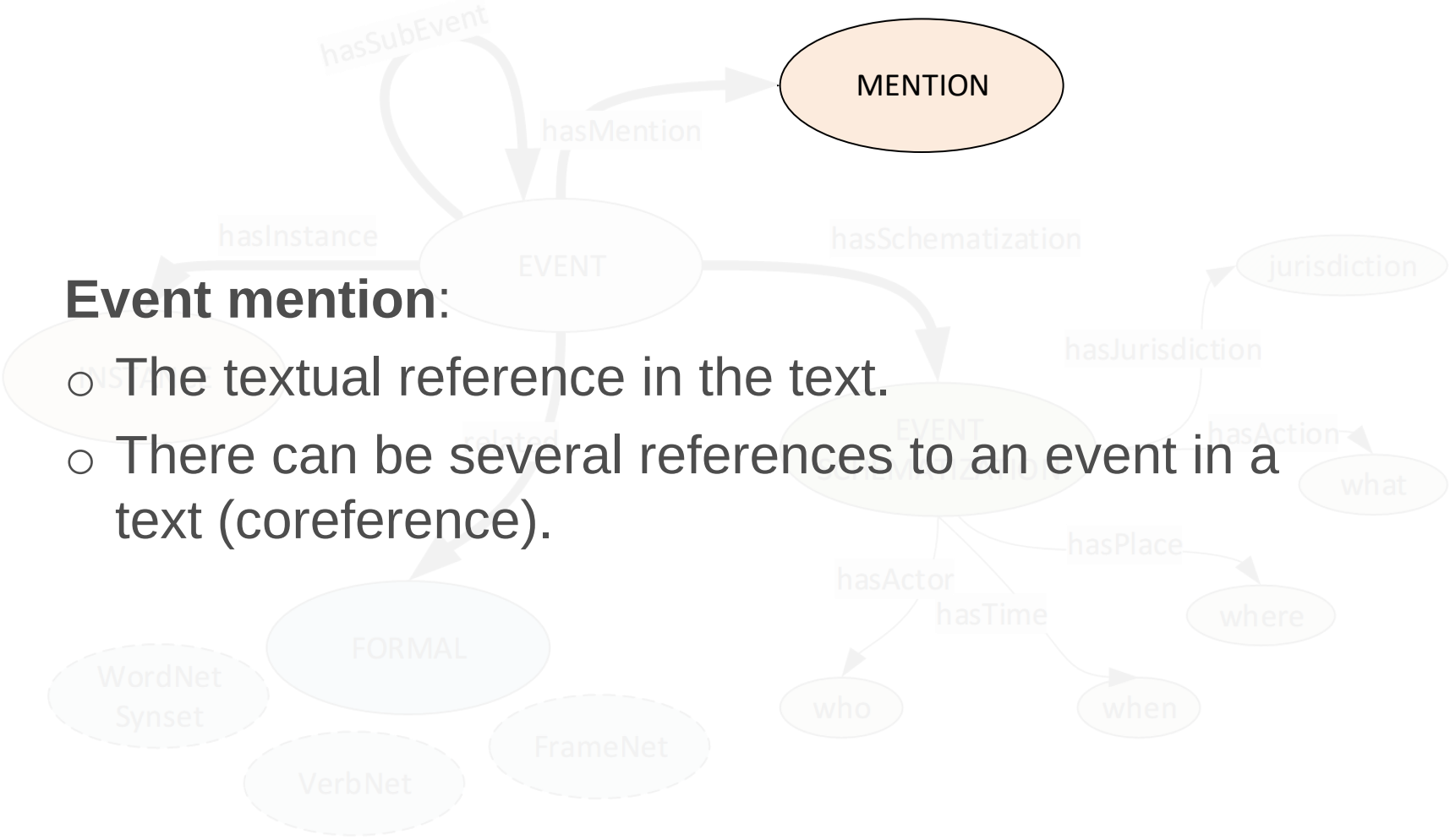
FromTimeToTime Ontology

Events distinction among different concepts



FromTimeToTime Ontology

Events distinction among different concepts



Event mention:

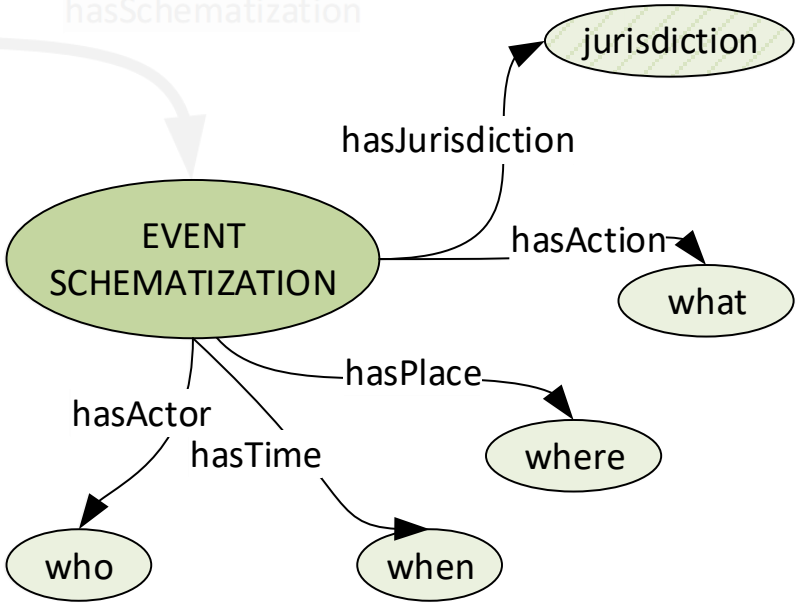
- The textual reference in the text.
- There can be several references to an event in a text (coreference).

FromTimeToTime Ontology

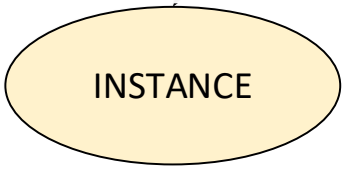
Events distinction among different concepts

Event schematization:

- The abstract representation of the information about an event, such as who, where, and so on.
- It is a midpoint between text, reality and abstraction.
- This representation can be useful to support Question Answering (QA) routines.



Events distinction among different concepts



Event instance:

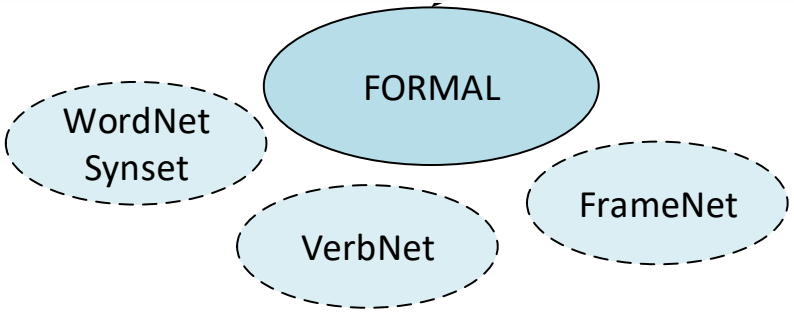
- The actual happening of an event in reality.
- One mention can imply several instances.
- In some cases, the amount of instances cannot be derived.

FromTimeToTime Ontology

Events distinction among different concepts

Event formalization:

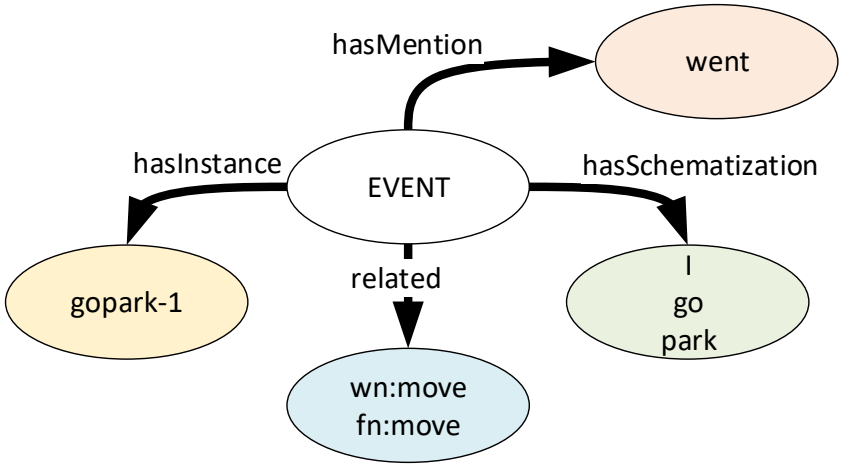
- An abstract representation of the event, a possible formalization in the form of frame, for instance.
- It can be considered as a way to classify events by linking them to resources such as WordNet or FrameNet.



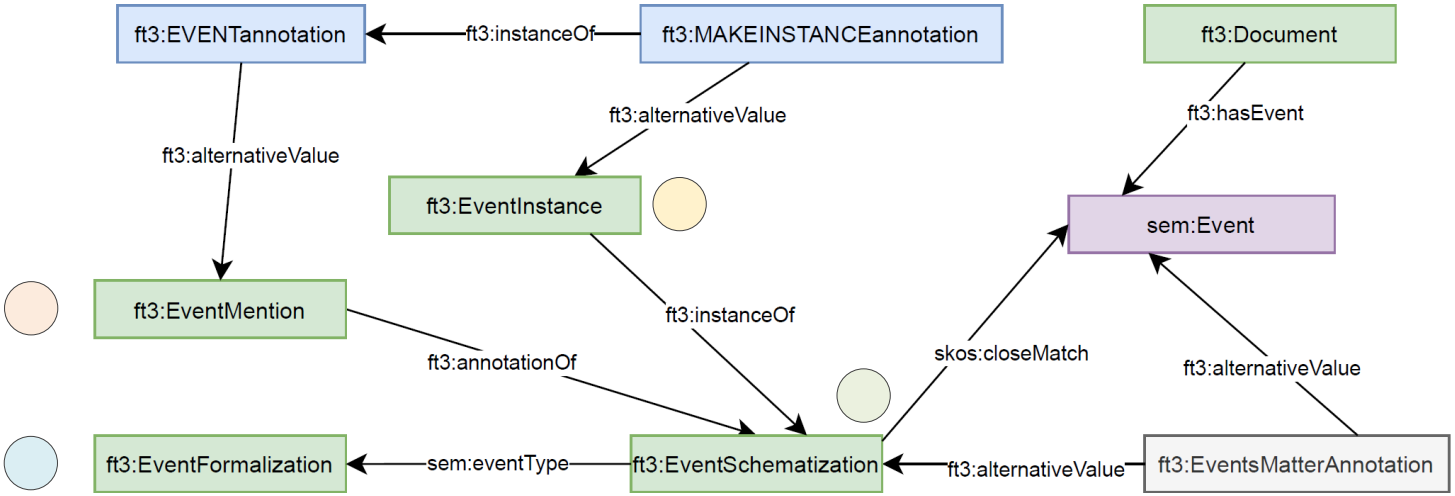
FromTimeToTime Ontology

Example

I went to the park



Events in ft3



Event-related resources

FT3 CONVERTER

FT3 Converter


TimeML

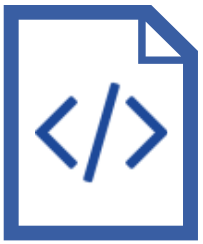
fromTimeToTime converter

MAP

type, mod, id, value, stem, lemma, prov…

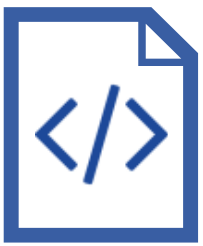
TIMEMAP

hour, week, day, ref, timeunit, partday…


ft3+time


ft3


EventsMatter


ft3+event

ft3 Converter: On 6 October 1990 he married Ms N.R.

EventsMatter

```
On <Event_when tid="t4" type="DATE" value="1990-10-06">6 October 1990</Event_when> <Event_who argument="who" tid="t4">he</Event_who> <Event_what argument="what" tid="t4" type="circumstance" prov="eventsmattertrain" lemma="marry">married</Event_what> Ms N.R.
```

TimeML

```
<?xml version="1.0" ?>
<TimeML xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:noNamespaceSchemaLocation="http://timeml.org/timeMLdocs/TimeML_1.2.1.xsd">
On <TIMEX3 tid="t4" type="DATE" value="1990-10-06">6 October 1990</TIMEX3> he <EVENT eid="t4" class="circumstance">married</EVENT> Ms N.R.
</TimeML>
```

ft3

```
<https://fromtimetotime.linkeddata.es/doc/samples/doc002>
a nif:Context , ft3:Document ;
nif:beginIndex "0"^^xsd:nonNegativeInteger ;
nif:endIndex "36"^^xsd:nonNegativeInteger ;
nif:title "X"^^xsd:String ;
nif:isString """On 6 October 1990 he married Ms N.R.""" ;
nif:AnnotationUnit […]
```

ft3 Converter: Annotation Unit

```
<https://fromtimetotime.linkeddata.es/doc/samples/doc002/EventsMatter/Event_whenannotation_t4_5> [
        a ft3:EventsMatterEvent_when ;
        nif:beginIndex "3"^^xsd:nonNegativeInteger ;
        nif:endIndex "17"^^xsd:nonNegativeInteger ;
        ft3:hasID "t4"^^xsd:String ;
        nif:isString """6 October 1990""" ;
        ft3:hasTid "t4"^^xsd:String;
        ft3:hasValue "1990-10-06"^^xsd:String;
        ft3:hasType ft3:DATE ;
        ];
<https://fromtimetotime.linkeddata.es/doc/samples/doc002/EventsMatter/Event_whatannotation_t4_6> [
        a ft3:EventsMatterEvent_what ;
        nif:beginIndex "21"^^xsd:nonNegativeInteger ;
        nif:endIndex "28"^^xsd:nonNegativeInteger ;
        ft3:hasID "t4"^^xsd:String ;
        nif:isString """married""" ;
        ft3:hasType ft3:circumstance ;
        ft3:hasProv "eventsmattertrain"^^xsd:String;
        ft3:hasLemma "marry"^^xsd:String;
        ];
<https://fromtimetotime.linkeddata.es/doc/samples/doc002/EventsMatter/Event_whoannotation_t4_7> [
        a ft3:EventsMatterEvent_who ;
        nif:beginIndex "18"^^xsd:nonNegativeInteger ;
        nif:endIndex "20"^^xsd:nonNegativeInteger ;
        ft3:hasID "t4"^^xsd:String ;
        nif:isString """he""" ;
        ];
```

ft3 Converter: time and events

ft3+time

```
ft3:alternativeValue [
<https://fromtimetotime.linkeddata.es/doc/samples/doc002/Time_t4> [
        a sem:Time,
        time:GeneralDateTimeDescription ;
        time:year "1990"^^xsd:gYear ;
        time:monthOfYear greg:October ;
        time:month "--10"^^xsd:gMonth ;
        time:day "---06"^^xsd:gDay ;];
        ];
];
```

ft3+events

```
ft3:hasEvent [
<https://fromtimetotime.linkeddata.es/doc/samples/doc002/EVENT_t4> [
        a sem:Event ;
        sem:EventType "marry" ;
        ft3:hasType ft3:circumstance ;
        ft3:hasID """t4""" ;
        sem:hasTime [
        <https://fromtimetotime.linkeddata.es/doc/samples/doc002/Time_t4> [
                a sem:Time, time:GeneralDateTimeDescription ;
                time:year "1990"^^xsd:gYear ;
                time:monthOfYear greg:October ;
                time:month "--10"^^xsd:gMonth ;
                time:day "---06"^^xsd:gDay ; ];] ;
        sem:hasActor """he"""^^xsd:String ; ]
].
```

Event-related resources

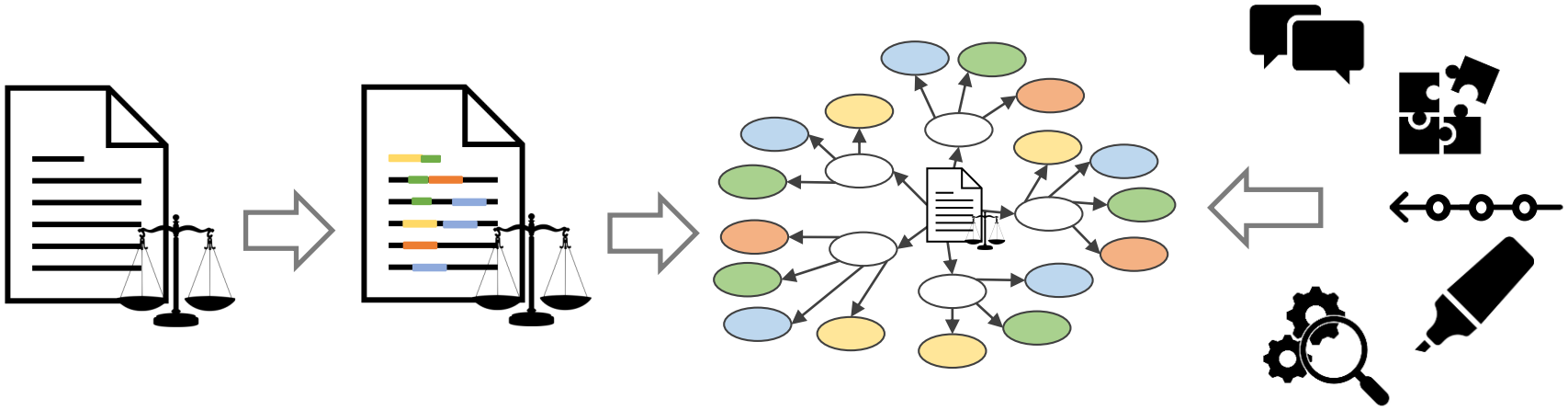
EVENT-BASED KNOWLEDGE GRAPH

FromTimeToTime

We propose **Event-Based Knowledge Graphs**:

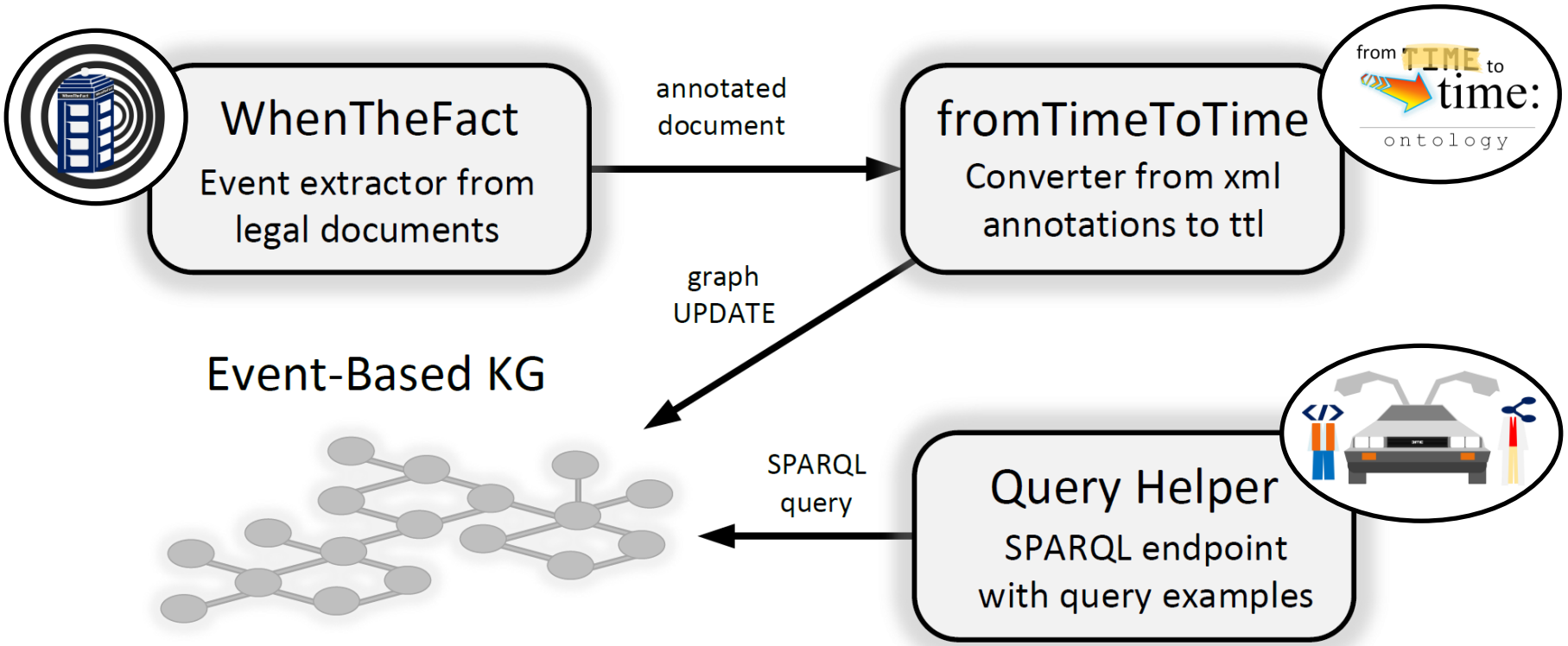
"Knowledge Graphs where information is represented as a series of events."

- We describe legal decisions using the events as the basis, being *blocks* that describe the legal judgment.
- A case is considered a narrative of events in different dimensions, namely procedural or relative to the case under judgment.
- Useful for various applications within the legal domain.



FromTimeToTime

Pipelining all the tools in the thesis, we can go from a legal decision to a Legal Event-Based Knowledge Graph that can be queried for further application.



Summary

Event-related contributions

H2.a

EventsMatter, a legal corpus annotated with relevant events.

H1.b H2.a H3

ContractFrames for contract lifecycle events

Event Extractor **WhenTheFact** for legal texts

H2.b H3

fromTimeToTime pipeline of resources:

- **ft3 Ontology** for temporal information and annotation representation.
- **ft3 Converter** for conversion among formats.
- **Legal EBKG+query helper** for further exploitation.

Outline

- Introduction
- State of the Art
- Materials and Methods
- Temporal Expressions
  - Corpora
  - Temporal Tagging
- Events
  - Corpus
  - Event Extraction
  - Event Representation Resources
- Conclusions and Future Work

Conclusions

C0. Analysis. Temporal information in the legal domain.

C1. Añotador. Design and implementation of a temporal tagger for Spanish and English.

C2. WhenTheFact. Design and implementation of an event extractor for European judgments.

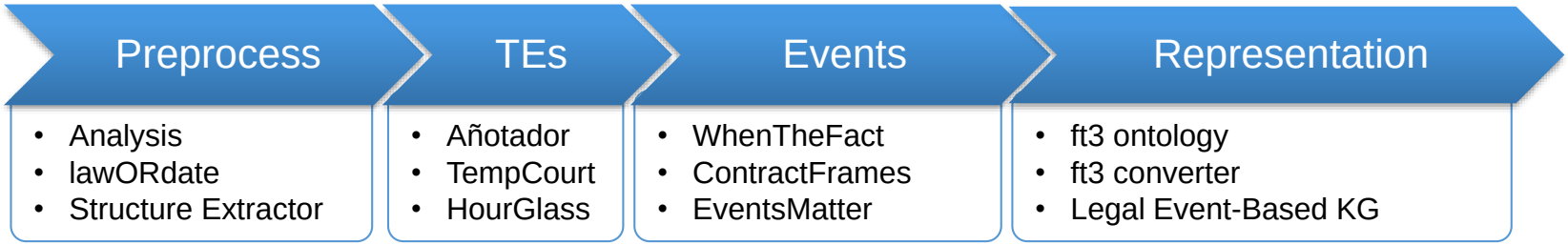
C3. Corpora. Annotated with temporal information.

- **C3.1. TempCourt corpus.** Corpus of judgments in English from different courts.
- **C3.2. HourGlass corpus.** Corpus of short texts in Spanish of different provenance.
- **C3.3. EventsMatter corpus.** Corpus of judgments in English annotated with events.

C4. ft3 Ontology. Representation of temporal information and data related to its annotation.

C5. Additional Tools. Standalone applications, integrated, or complementary to others.

- **C5.1. lawORdate.** Web service that handles misleading legal citations in Spanish.
- **C5.2. ContractFrames.** Software that extracts events about the lifecycle of a contract in English.
- **C5.3. Structure Extractor.** Section detector from judgments, part of WhenTheFact.
- **C5.4. ft3 Converter.** Online converter among different temporal annotation formats.
- **C5.5. Legal EBKG.** Knowledge graph populated with events of legal decisions.



Research Stays

(Jul-Oct 2017)

Vienna, Austria
Prof. Sabrina Kirrane
and Prof. Axel Polleres

- *TempCourt (KER)*
- *EventsMatter (JURIX2020)*

(Jul-Oct 2018)

Tokyo, Japan
Prof. Ken Satoh

- *Contract Frames (JURISIN2018)*

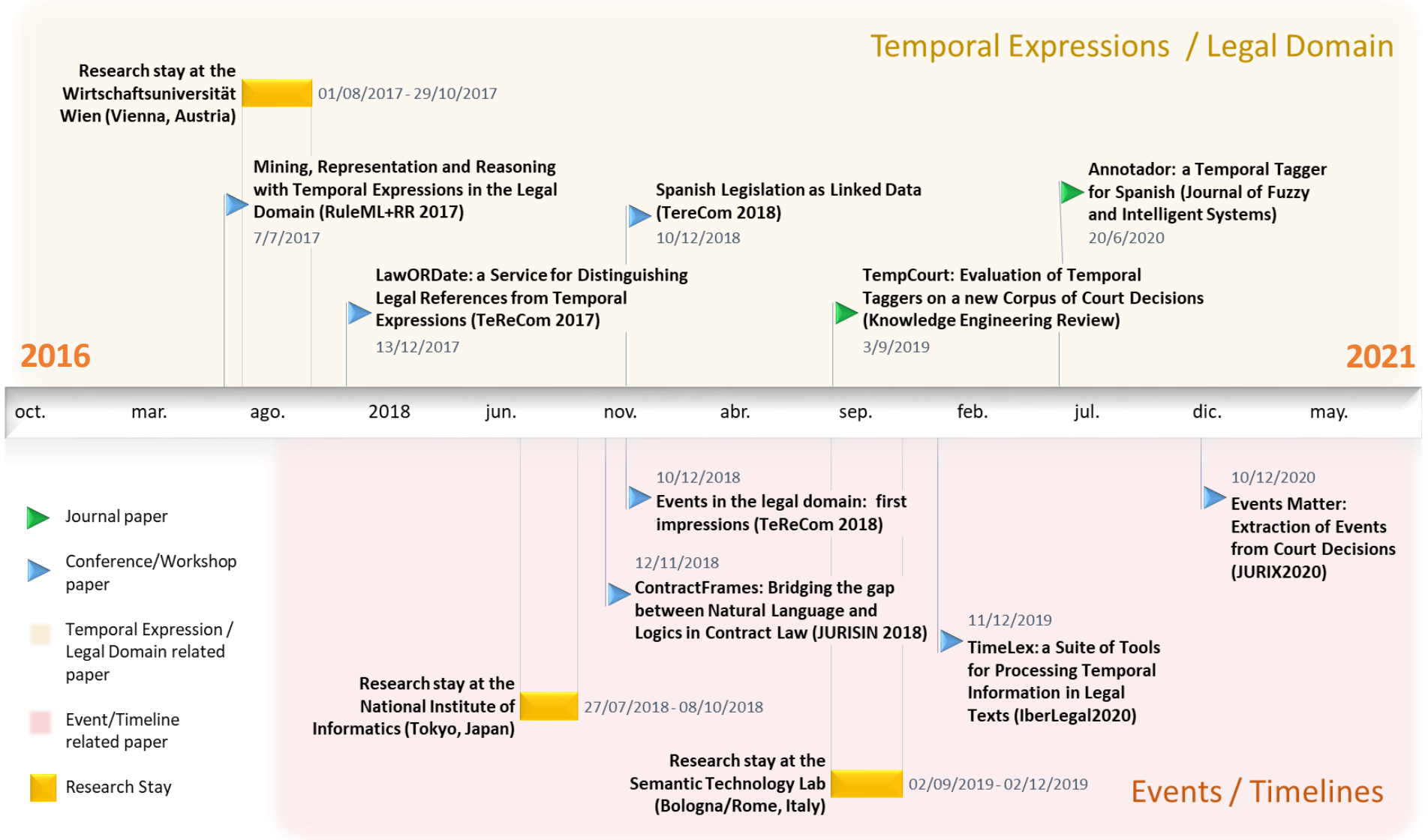
(Sep-Dec 2019)

Bologna/Rome, Italy
Prof. Aldo Gangemi

Aditionally, visit to

Barcelona

Timeline


Temporal Expressions / Legal Domain
Research stay at the Wirtschaftsuniversität Wien (Vienna, Austria)
01/08/2017 - 29/10/2017
Mining, Representation and Reasoning with Temporal Expressions in the Legal Domain (RuleML+RR 2017)
7/7/2017
LawORDate: a Service for Distinguishing Legal References from Temporal Expressions (TeReCom 2017)
13/12/2017
Spanish Legislation as Linked Data (TereCom 2018)
10/12/2018
TempCourt: Evaluation of Temporal Taggers on a new Corpus of Court Decisions (Knowledge Engineering Review)
3/9/2019
Annotador: a Temporal Tagger for Spanish (Journal of Fuzzy and Intelligent Systems)
20/6/2020
2016
2021
oct. mar. ago. 2018 jun. nov. abr. sep. feb. jul. dic. may.
Journal paper
Conference/Workshop paper
Temporal Expression / Legal Domain related paper
Event/Timeline related paper
Research Stay
10/12/2018
Events in the legal domain: first impressions (TeReCom 2018)
12/11/2018
ContractFrames: Bridging the gap between Natural Language and Logics in Contract Law (JURISIN 2018)
11/12/2019
TimeLex: a Suite of Tools for Processing Temporal Information in Legal Texts (IberLegal2020)
10/12/2020
Events Matter: Extraction of Events from Court Decisions (JURIX2020)
Research stay at the National Institute of Informatics (Tokyo, Japan)
27/07/2018 - 08/10/2018
Research stay at the Semantic Technology Lab (Bologna/Rome, Italy)
02/09/2019 - 02/12/2019
Events / Timelines

Journal and Conference Papers

Journal papers

Spanish corpora for Sentiment Analysis: a survey. (2019) **M. Navas-Loro**, V. Rodríguez-Doncel. Language Resources and Evaluation, pp 1–38.

TempCourt: evaluation of temporal taggers on a new corpus of court decisions. (2019) **M. Navas-Loro**, E. Filtz, V. Rodríguez-Doncel, A. Polleres, S. Kirrane. The Knowledge Engineering Review, Vol 34, E24.

Annotador: a Temporal Tagger for Spanish. (2020) **M. Navas-Loro**, V. Rodríguez-Doncel. Journal of Intelligent & Fuzzy Systems 39 (2020), Vol 2, 1979–1991

Lynx: A Knowledge-based AI Service Platform for Content Processing, Enrichment and Analysis for the Legal Domain. (2020) J. Moreno Schneider, G. Rehm, E. Montiel-Ponsoda, V. Rodríguez-Doncel, P. Martín-Chozas, **M. Navas-Loro**, et al. Special Issue of the Information Systems Journal.

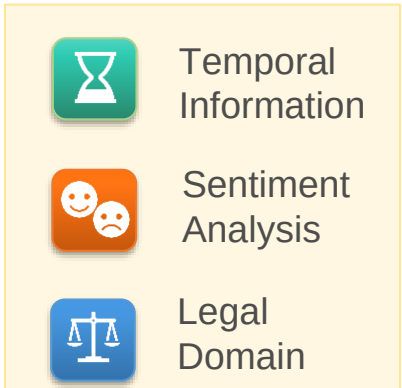
(TO BE SUBMITTED) Tools for building an event-based knowledge graph from legal decisions. (2021) **M. Navas-Loro**, V. Rodríguez-Doncel.

Conference

Spanish Corpus for Sentiment Analysis Towards Brands. **M. Navas-Loro**, V. Rodríguez-Doncel, et al. In SPECOM 2017, Proc. Springer,

ContractFrames: Bridging the gap between natural language and logics in contract law. **M. Navas-Loro**, K. Satoh, and V. Rodríguez-Doncel. JSAI Int. Symposium on AI. Springer, 2018.

Events Matter: Extraction of Events from Court Decisions. E. Filtz, **M. Navas-Loro**, C. Santos, A. Polleres, S. Kirrane. In Proc. of JURIX 2020,



Workshop Papers and other outcomes

Mining, Representation and Reasoning with Temporal Expressions in the Legal Domain (2017). **M. Navas-Loro**. In *Proceedings of the Doctoral Consortium, Challenge, Industry Track, Tutorials and Posters (RuleML+RR 2017).*

OEG at TASS 2017: Spanish Sentiment Analysis of tweets at document level (2017). **M. Navas-Loro**, V. Rodríguez-Doncel. In *Proceedings of the Workshop TASS (SEPLN 2017). pp. 43–49.*

MAS: A Corpus of Tweets for Marketing in Spanish (2018). **M. Navas-Loro**, V. Rodríguez-Doncel, I. Santana-Perez, A. Fernández-Izquierdo, A. Sánchez. In *The Semantic Web: ESWC 2018 Satellite Events. pp. 363–375.*

LawORDate: a Service for Distinguishing Legal References from Temporal Expressions (2017). **M. Navas-Loro**. In *Proceedings of the 1st Workshop TeReCom (JURIX 2011). pp. 25–31.*

Events in the legal domain: first impressions (2018) **M. Navas-Loro**, C. Santos. In *Proceedings of the 2nd Workshop TeReCom (JURIX 2018).*

Spanish Legislation as Linked Data (2018) V. Rodríguez-Doncel, **M. Navas-Loro**, E. Montiel-Ponsoda, P. Casanovas. In *Proceedings of the 2nd Workshop TeReCom (JURIX 2018).*

TimeLex: a Suite of Tools for Processing Temporal Information in Legal Texts (2019) **M. Navas-Loro**, V. Rodríguez-Doncel. In *Proceedings of the 2nd Workshop Iberlegal (JURIX 2019)*.

- Software registered in the Registry of the Region of Madrid.
- Collaborations and projects:
  - Lynx
  - LPS-BIGGER
  - CENDOJ
- ActúaUPM competition finalist
- Usage of the software:
  - Anonymization
  - Date detection
  - Named Entity Recognition
  - Legal document annotation

Future Work

Short-term improvements

- Extending the corpora available: both **languages and domains**.
- Processing **more types of documents**.
- Facilitate the **queries** to the EBKG for legal practitioners.
- Enriching the knowledge graph with **metadata**: helpful for **co-reference**.

Future Work

In depth research lines

- Extending the event extraction to **more languages**.
  - ECJ Multilinguality via semantic similarity, already started.
- **Deep Learning** for covering more events.
  - Knowledge-based is good for procedural events *(transversal).*
  - Circumstantial events are too heterogeneous.
  - Deep Learning might be helpful
- Further **exploit the EBKG**.

Processing, Identification and Representation of Temporal Expressions and Events in Legal Documents

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Asunción Gómez-Pérez

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17/01/2022
Online