Hybrid AI for eLegislation

Prof. Monica Palmirani – University of Bologna, CIRSFID-ALMA AI – Italy

29th November 2024

GenAI in Legal Domain

Lawyer apologizes for fake court citations from ChatGPT

By Ramishah Maruf, CNN
Updated 3:28 PM EDT, Sun May 28, 2023

US judge orders lawyers to sign AI pledge, warning 'they make stuff up'

By Jacqueline Thomsen ˅
May 31, 2023 8:56 PM GMT+2 · Updated 10 hours ago

THE TECHNOLOGY 202

ChatGPT is now writing legislation. Is this the future?

Analysis by Cristiano Lima
with research by Aaron Schaffer
January 23, 2023 at 8:55 a.m. EST

But in what may be a first, a Massachusetts state senator has used a surging new tool to help write a bill aimed at restricting it: ChatGPT, the artificial intelligence chatbot.

Home / News / Technology / Artificial Intelligence / EU Commission issues internal guidelines on ChatGPT, generative AI

EU Commission issues internal guidelines on ChatGPT, generative AI

By Luca Bertuzzi | EURACTIV.com ⏱ Est. 4min   📅 31 mag 2023

Different goals of AI in Legislative Drafting

Creation of structure of document	Linguistic Translation	Creation of executive summary	Assist of preamble	Assist of Amendment
Assist the Consolidation	Assist in the Definitions	Smart Legislative Drafting of the references	Semantic annotation	Classification
Clustering	Analysis of impact	Analysis of effectiveness	Policy Checking	Similarity in comparative law
	Smart Search Engine	Conversional Query	Quality Checking	

Weakness of LLM/ML in Legal Domain

- **Structure**: LLM works at sentence level/document level and this approach is not capable to understand the structure (e.g., sequence of articles)

- **Context**: LLM loses the context (e.g., jurisdiction, temporal parameters)

- **Innovation**: LLM depends to the past data series (e.g., new brilliant solution has no historical series)

- **Reference**: ML does not consider the normative and juridical citations. The normative references evolve over time (e.g., art. 3 is not the same forever)

- **Time**: the LLM is timeless and the legislation is integrated in the legal system

- **Provenance**: LLM is trained with heterogenous sources and in Legal Domain it is fundamental to have authoritative legal sources

eLegal evolution
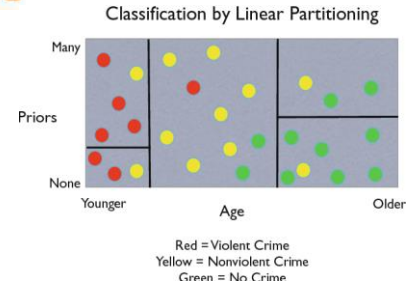
1990s   **2000s**   **2010s**   **2020s**   **2030s**

AI and Law

Logic programming – AI simbolica

Semantic Web e Knowledge representation

ML, Classification, clustering, NLP, predict

Legal data analytics

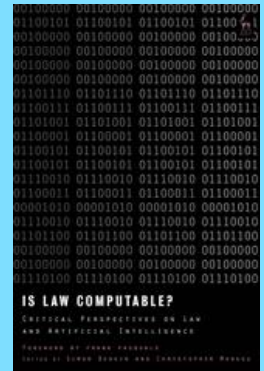Blockchain & Smart Contract

«Rule As Code»

CRACKING THE CODE
RULEMAKING FOR HUMANS AND MACHINES
@OPSIGOV OPSI Observatory of Public Sector Innovation OECD

digital.nsw
NSW GOVERNMENT
Digital Transformation   Policy   Design System   Get Involved   Blog

Rules as Code – NSW Joins the Worldwide Movement to Make Better Rules

Integration of Legal Theory and ICT for a Legal Smart Legal Order

Hybrid AI Framework for Legal Analysis of the EU Legislation Corrigenda

Monica PALMIRANI[a1], Francesco SOVRANO[b], Davide LIGA[a], Salvatore SAPIENZA[a] and Fabio VITALI[b]

[a]CIRSFID-ALMA-AI, University of Bologna
[b]DISI, University of Bologna

IS LAW COMPUTABLE?

From code to text
Several critical issues
- *Computational legalism*
- Democratic risks
- Ethical concerns

Legal Theoretical Framework
- Normativity and legitimacy in smart legal order
- Interpretation and legal theory using computational linguistics approach
- Explicability & Transparency using HCI
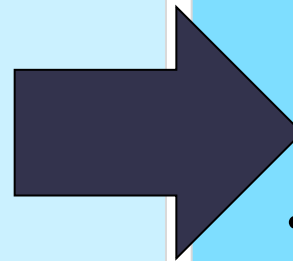
AI and Legislation Domain: critical analsysis

- Law is **not only rules** (e.g., principles and values).

- Norms have been adapted according to the **evolution of the society – dynamic model**

- '**artificial languages**' (e.g., programming language) is a subset of natural language (Chomsky 2006)

- Norms sometime are intentionally **vague** for implementing flexibility and interpretations (hermeneutic)

- **Prediction** based on the past should be mitigated to the new events (computational legalism)

- Predictions influence decision-makers and future human behaviour (Hildebrandt 2021)

- **Autonomy** and transparency are pillars of normativity (Günther 2021)

- The **right of disobey** as moment of creativity of new norms
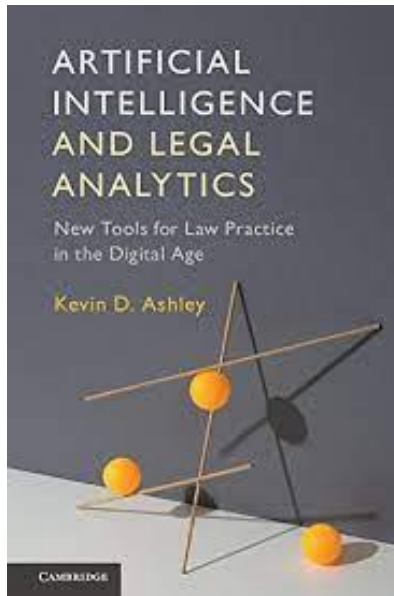
Klaus Günther

From Normative to Smart Orders?

Abstract: The increasing penetration of new digital technologies, especially artificial intelligence, into almost all areas of society's life has led to the emergence of smart orders. These are orders that are designed to minimize or eliminate deviations from their norms through intelligent design and algorithmic operations. The article explains some examples of smart orders and shows that, at least in principle, a distinction can be made between algorithmically optimized, norm addressee-oriented prevention and addressee-substituting pre-emption of deviant behavior by digital technologies. The focus of the article is then on the question of whether and, if so, in what sense smart orders are still normative orders at all. In the course of the analysis, it becomes apparent that while legal orders and other normative orders pursue the goal of effective enforcement of their norms, they do not pursue the ideal of complete non-deviance. It becomes clear that one of the essential aspects of normative orders is that they are addressed to persons who must embrace them as autonomous and, at the

Critical issues in legal domain

- Provenance of the legal sources

- Data/Platform sovereignty

- Explicability, Transparency, Accountability

- Bais, Discrimination, Risk assessment

- Parliamentary Autonomy

- Separation of Power

- Integrity of democratic processes (e.g., rules of law)

- Free Mandate (e.g., not depending to the technology)

- Continuity of Power (e.g., blackout)

Guidelines for AI in Parliaments

Editors
Fotios Fitsilis
Jörn von Lucke
Franklin De Vrieze

July 2024

WFD

Digital-ready
policies

European Commission
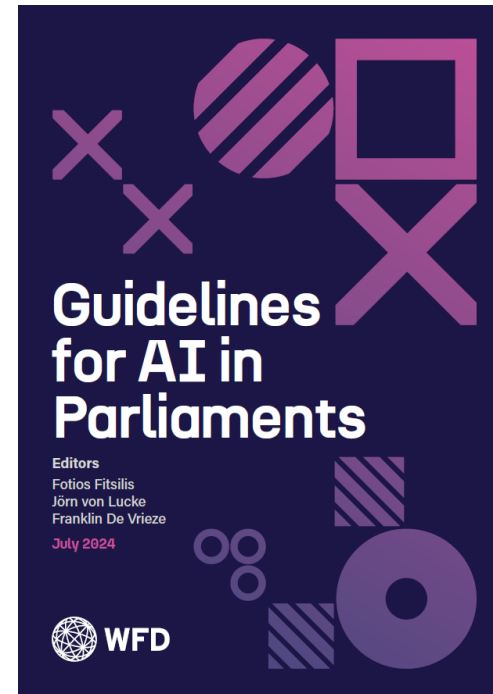
Law as Code

Digital-ready policies:
Components and enabler

1. User-centric processes ready for automation

2. Alignment with digital policies

3. Once-only principle and reuse of data

4. Evolving ICT landscape

5. Innovation & Digital technologies

6. Digital-ready drafting

Enabler:
Multidisciplinary teams

Legal Knowledge Modelling – Law as Code

Legal document in XML - context
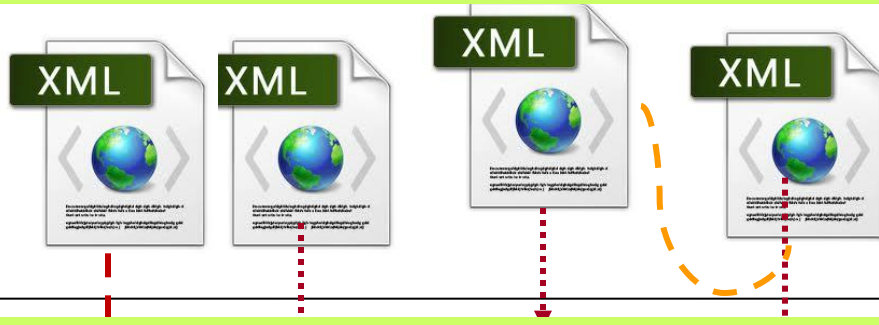
Legal Ontology – semantic level
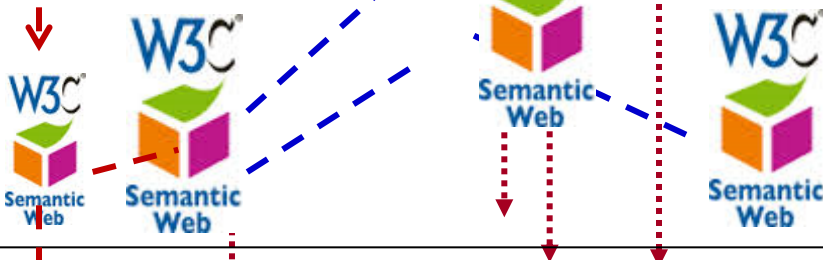
Logic Rules – deontic level
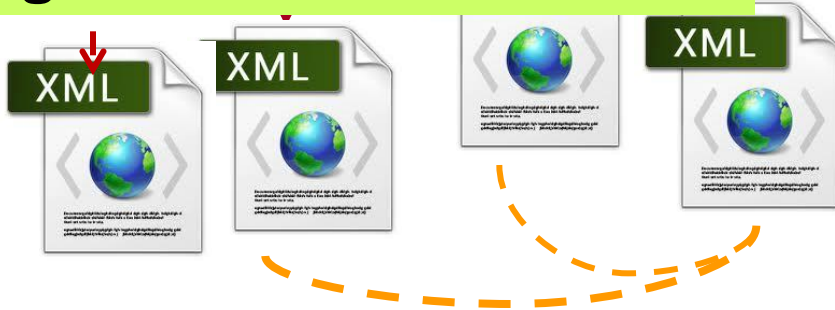
Argumentation/Justification

Services

- Definizione dei goal

ENGINE

Report
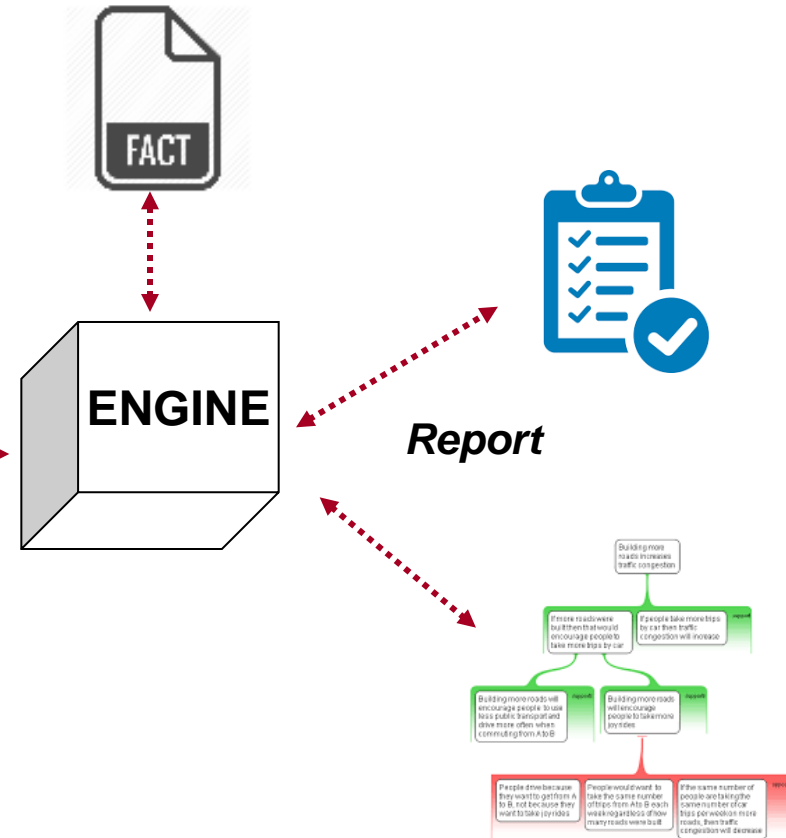
Different goals of AI in Parliaments

1. **Generation** of the legislation/amendment/debates/summary– *ex-ante*

2. **Modelling**/representing/classifying/extracting/ checking the source of the law– *ex-post*

3. **Prediction** of some output– *pro-futuro*

4. **Executing**/reasoning rules– *real-time*

Hybrid AI for the Legal Domain

Content, Context, Semantic, Processing

Symbolic

Non-Symbolic

Sub-Symbolic

- AI
- Smart Contract

- Regression
- Data Science

Algorithm-driven

Data-driven

Document-driven

Semantic Web-driven

- LegalXML

- KG
- Legal Ontology

Similarity World Constitutions
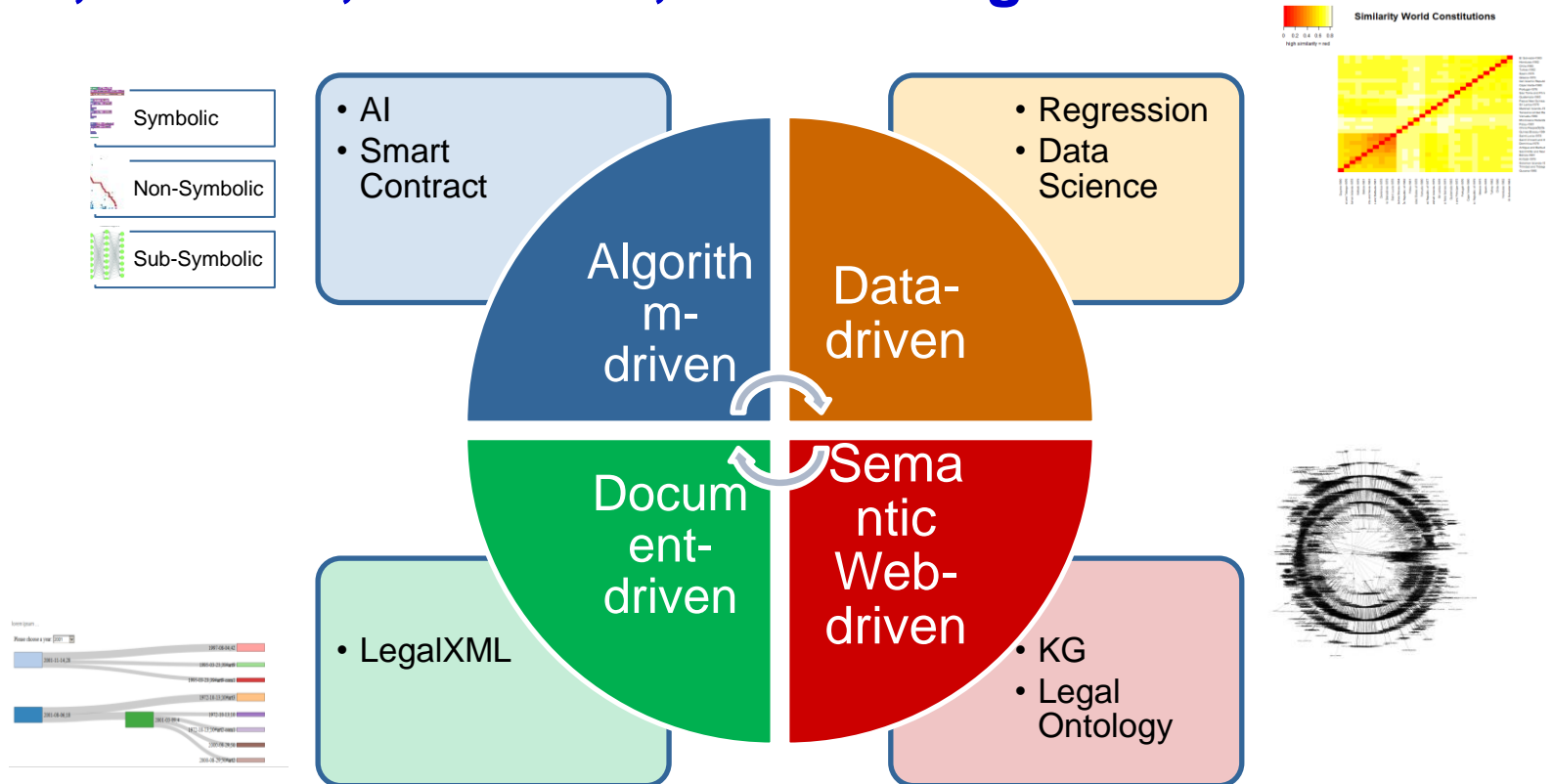
Neuro-symbolic

Sub-Symbolic AI   Symbolic AI

XAI
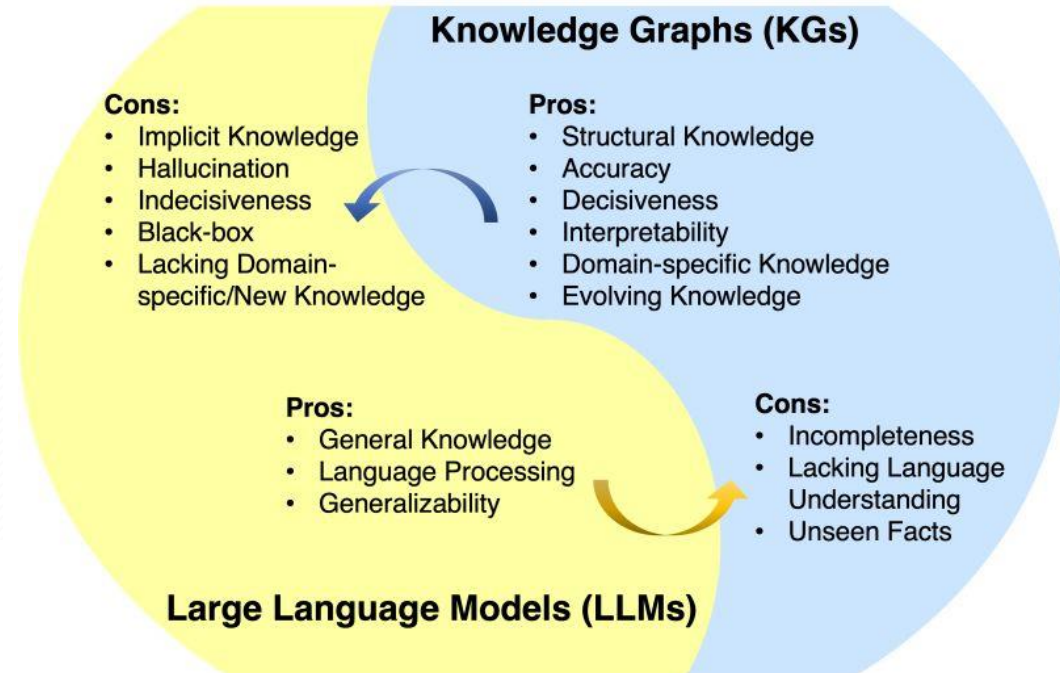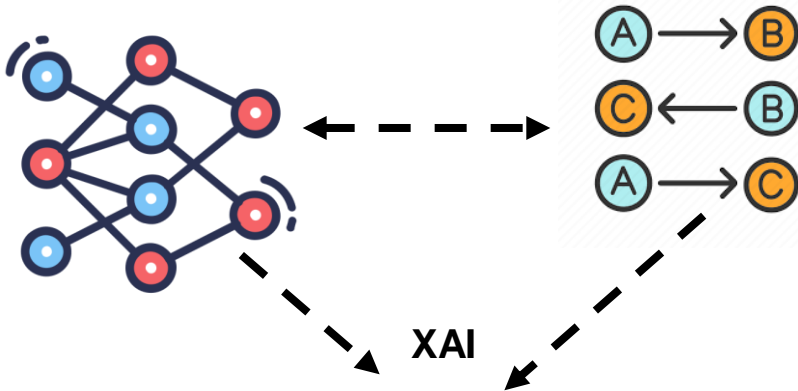
Unifying Large Language Models and Knowledge Graphs: A Roadmap
Shirui Pan, **Linhao Luo**, **Yufei Wang**, **Chen Chen**, **Jiapu Wang**, **Xindong Wu**

"White box" approach in AI

Lawyer-readable

Machine-readable

Human-readable

AI for Legislative drafting

Study on 'Drafting legislation in the era of AI and digitisation' with EU Commission – Directorate General Informatics Unit B2 – Solutions for Legislation, Policy & HR

Legal Drafting in the Era of Artificial Intelligence and Digitisation

■ 4 use-cases
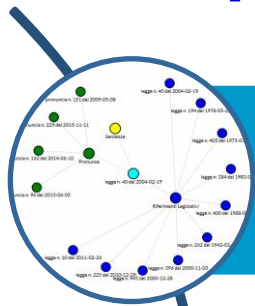
Legal Drafting supported by AI system for improving quality, effectiveness, efficacy, semantic annotation (e.g., Law as Platform)
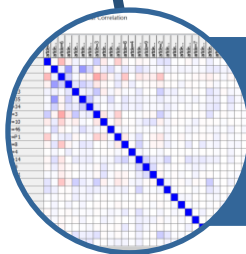
Decision support System/AI for making better the legislative process and anticipating needs of the society (e.g., same-sex marriage, end of live, etc.)
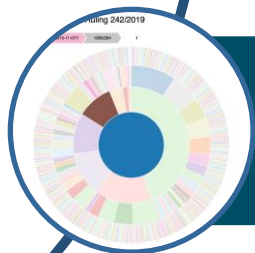
Legal System data analytics for understanding the legislative hidden knowledge (e.g., patterns, frequent errors)

Framework

Visualization/ Portals/LEOS (other editors)

Services of AI (support during drafting, classification, clustering, aggregation, correlation) - LLM

Workflow management

Advanced Ontology and Rule-base system

Extraction of the Legal Knowledge using AI

ELI/ECLI

AKOMA NTOSO – XML

4 Use-cases

- Corrigenda
- Derogations
- Digital readiness index
- Implementation Directive

Analysis of the Derogations in EU Legislation using Network Analysis

This is a visualization map for AKN derogations of the EU legislation from 2010 to 2020

2-gram distance

DEROGATION

Anatomy of a derogation

R1$_{t1}$ derogated to R2$_{t2}$

\<action\>

\<normDerogated\>

\<jurisdiction\>

\<temporalParameter\>

\<scope\>

By way of derogation from paragraphs 1 and 2, in Cyprus, Croatia, Malta and Slovenia, the amount referred to in those paragraphs may be set at a value lower than EUR 500, but not less than EUR 200 or, in the case of Malta, not less than EUR 50.

Dataset

- The dataset is composed by legislative act in the span of time 2010-2020 for a total of 15.328 documents.
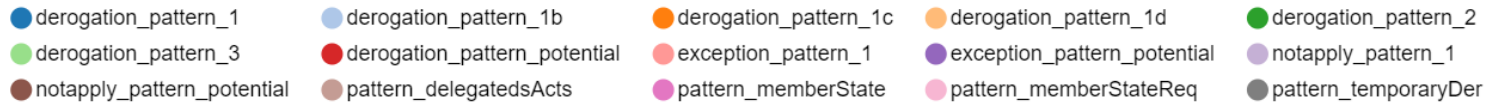
- Regulation, Directive, Implementation instruments

- The documents are converted in Akoma Ntoso in order to have the structure of the document and the context annotated

- We have extracted 13.587 partitions involved in the derogation using a preliminary taxonomy of "RegEx"

Manage the derogations: classification

Pie Chart

- ● derogation_pattern_1
- ● derogation_pattern_1b
- ● derogation_pattern_1c
- ● derogation_pattern_1d
- ● derogation_pattern_2
- ● derogation_pattern_3
- ● derogation_pattern_potential
- ● exception_pattern_1
- ● exception_pattern_potential
- ● notapply_pattern_1
- ● notapply_pattern_potential
- ● pattern_delegatedsActs
- ● pattern_memberState
- ● pattern_memberStateReq
- ● pattern_temporaryDer

Derogation connected with the Member States discovered using Deep learning

pattern_memberState   867.00

26%

6%

10%

20%

6%

11%

14%
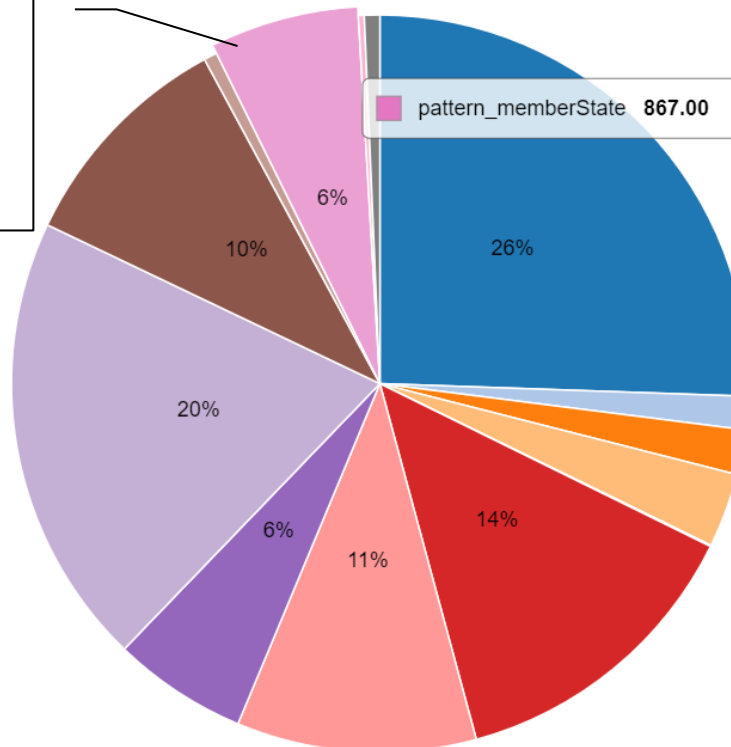
Akoma Ntoso: detection of knowledge

```xml
<alinea eId="body__art_2__al_3">
        <content eId="body__art_2__al_3__content">
            <mod eId="body__art_2__al_3__content__mod_1">
                <p>By way of derogation from the second paragraph, Member States may
                    choose not to apply the provisions of point ORO.FTL.205(e) of
                    <ref eId="ref_1" href="href="/akn/eu/act/regulation/2012-02-17/965-2012/!main/>annex_III">Annex
                    III to Regulation (EU) No 965/2012 </ref> and continue to apply the
                    existing national provisions concerning in-flight rest until<date
                        date="2017-02-17" refersTo="#derogationTime">17 February 2017</date>.</p>
            </mod>
        </content>
</alinea>
```

Legal Knolwedge extraction and Akoma Ntoso serialization

```xml
<scopeMod type="exceptionOfScope">
          <source href="body__art_2__al_3__content__mod_1"/>
          <destination
             href="/akn/eu/act/regulation/2012-02-17/965-
2012/!main/annex_III"/>
          <force>
             <date date="2014-02-20"/>
          </force>
          <duration>
             <date date="2017-02-17" refersTo="#endDate"/>
          </duration>
          <condition/>
          <domain/>
</scopeMod>
```

Distribution of the derogations classification for thematic topic using Eurovoc

https://cirsfid.gitlab.io/derograph/

Analysis of the Derogations in EU Legislation using Network Analysis

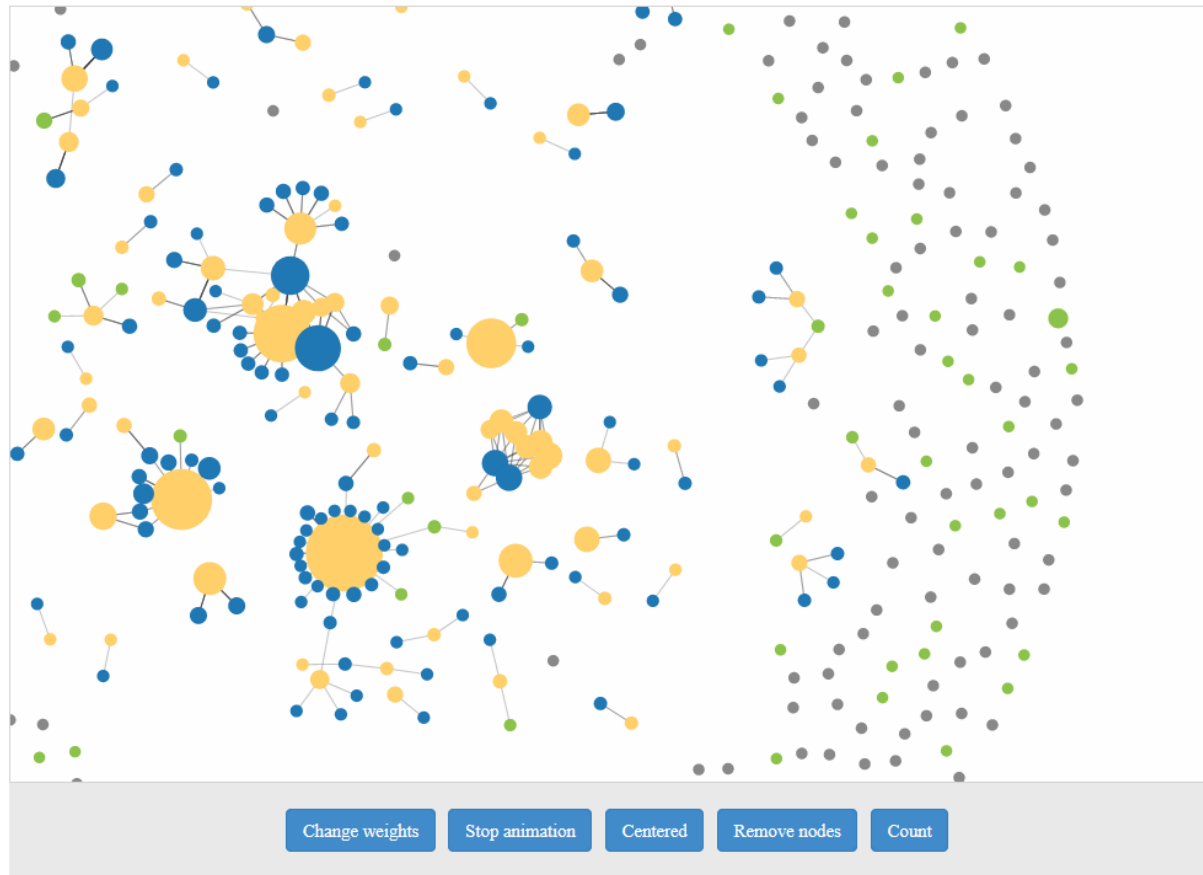This is a visualization map for AKN derogations of the EU legislation from 2010 to 2020

$$w = k * (\#ActiveDerogations + \#ReflexiveDerogations + \#PassiveDerogations)$$

DIGITAL READY

Positive list of word

Article 21

General requirements for the pharmacovigilance system master file

- 1. The information in the pharmacovigilance system master **file** required under Article 77(2) of Regulation (EU) 2019/6 shall be accurate and reflect the pharmacovigilance **system** in place.

- 2. The contractual arrangements between marketing authorisation holders and third parties concerning pharmacovigilance activities shall be clearly documented, detailed and up-to-date.

- 3.Marketing authorisation holders may, where appropriate, use separate pharmacovigilance systems for different categories of veterinary medicinal products. Each such system shall be described in a separate pharmacovigilance **system master file**.

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32021R0128

electronic identification

electronic signature

electronic seal

electronic signature

web
electronic tickets
e-book
e-reader
non-cash payment

electronic payment

digital means of exchange

file

database
wifi
digital service
digital certification
digital content

Negative list of word

«Article 4
Requirements for certificates for terrestrial animals and germinal products
1. The official veterinarian shall complete certificates for consignments of terrestrial animals and germinal products in accordance with the following requirements:

(omissis)

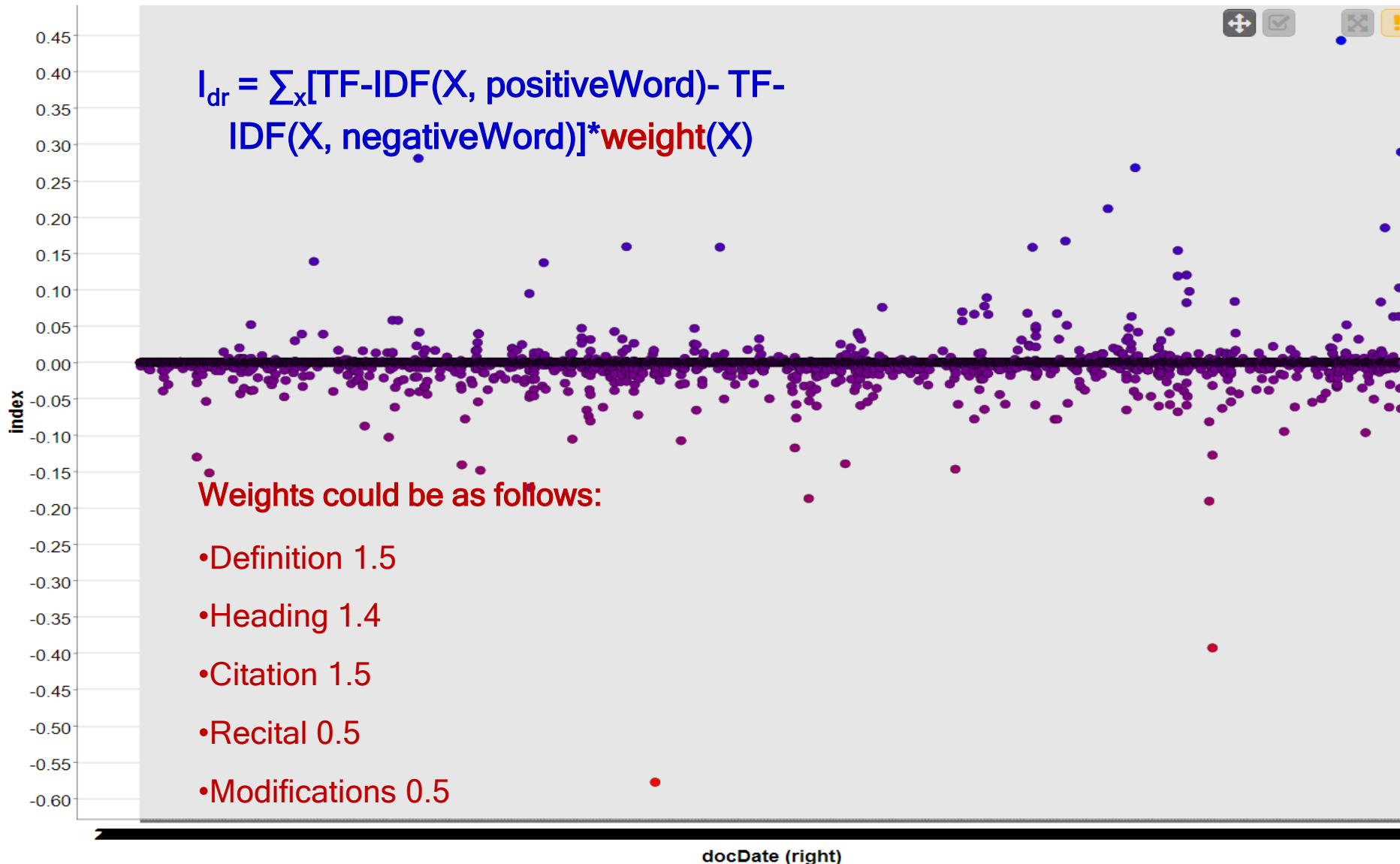*(c) the **certificate** must consist of one of the following:*
*(i) a single **sheet** of **paper**;*
*(ii) several sheets of **paper** where all sheets are indivisible and constitute an integrated whole;*
*(iii) a sequence of pages with each page numbered so as to indicate that it is a particular **page** in a finite sequence; »*

http://publications.europa.eu/resource/cellar/267982c7-9218-11eb-b85c-01aa75ed71a1.0006.03/DOC_1

Certified copy
Cheque
Courier
Stamp
Facsimile
Fax
Hard copy
In writing
Ink
Mail
Microfiche
Newspaper
Original copy
Paper
Pen
Pencil
Post
Print
Printout
Scan
Seal
Telex
Written
Person identification
Signature
Paper documentation
Paper tickets
cash payment
Digital service
Durable medium

Digital-ready index in the EU legislation – TF-IDF at article level

$$I_{dr} = \sum_{x}[\text{TF-IDF}(X, \text{positiveWord}) - \text{TF-IDF}(X, \text{negativeWord})]*\text{weight}(X)$$

Weights could be as follows:

- Definition 1.5
- Heading 1.4
- Citation 1.5
- Recital 0.5
- Modifications 0.5

docDate (right)

Relationship between the index of «digital-ready» and the normative references in the same portion
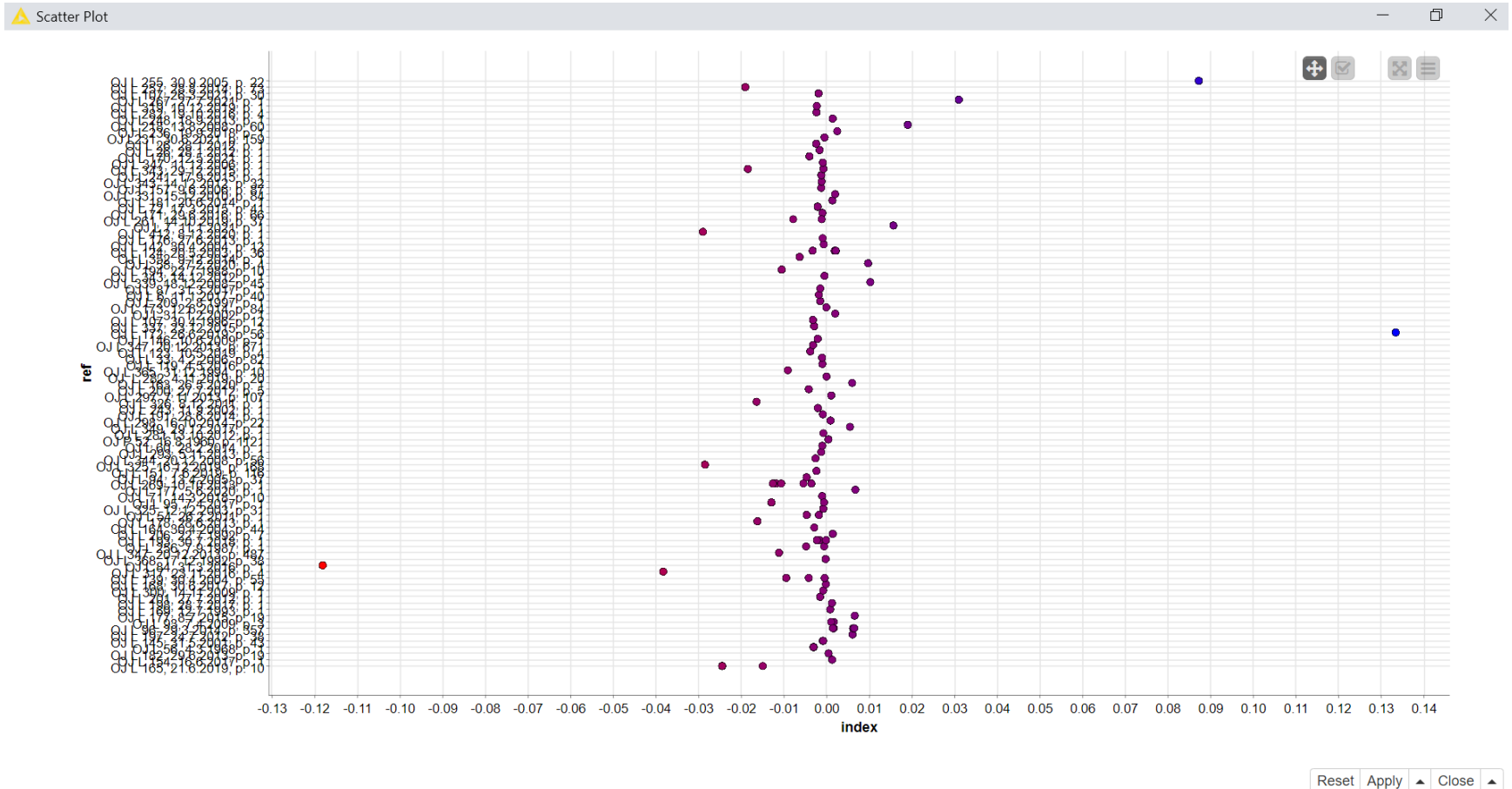
IMPLEMENTATION DIRECTIVE

Support the transposition and implementation of the Acquis

- Akoma Ntoso LegalXML creates interoperability methodology

- AI +Semantic Web + AKN support the implementation of the directive in the Member States

  - **Harmonize the definitions with the Acquis**
  - **Manage the derogations to the Acquis**
  - **Measure the deflections and similitudes**
  - Synchronize the domestic law for the future modifications of the directives
  - Comparative law approach

Similarity between Italian implementation of Directive and the EU Directive

2-gram distance
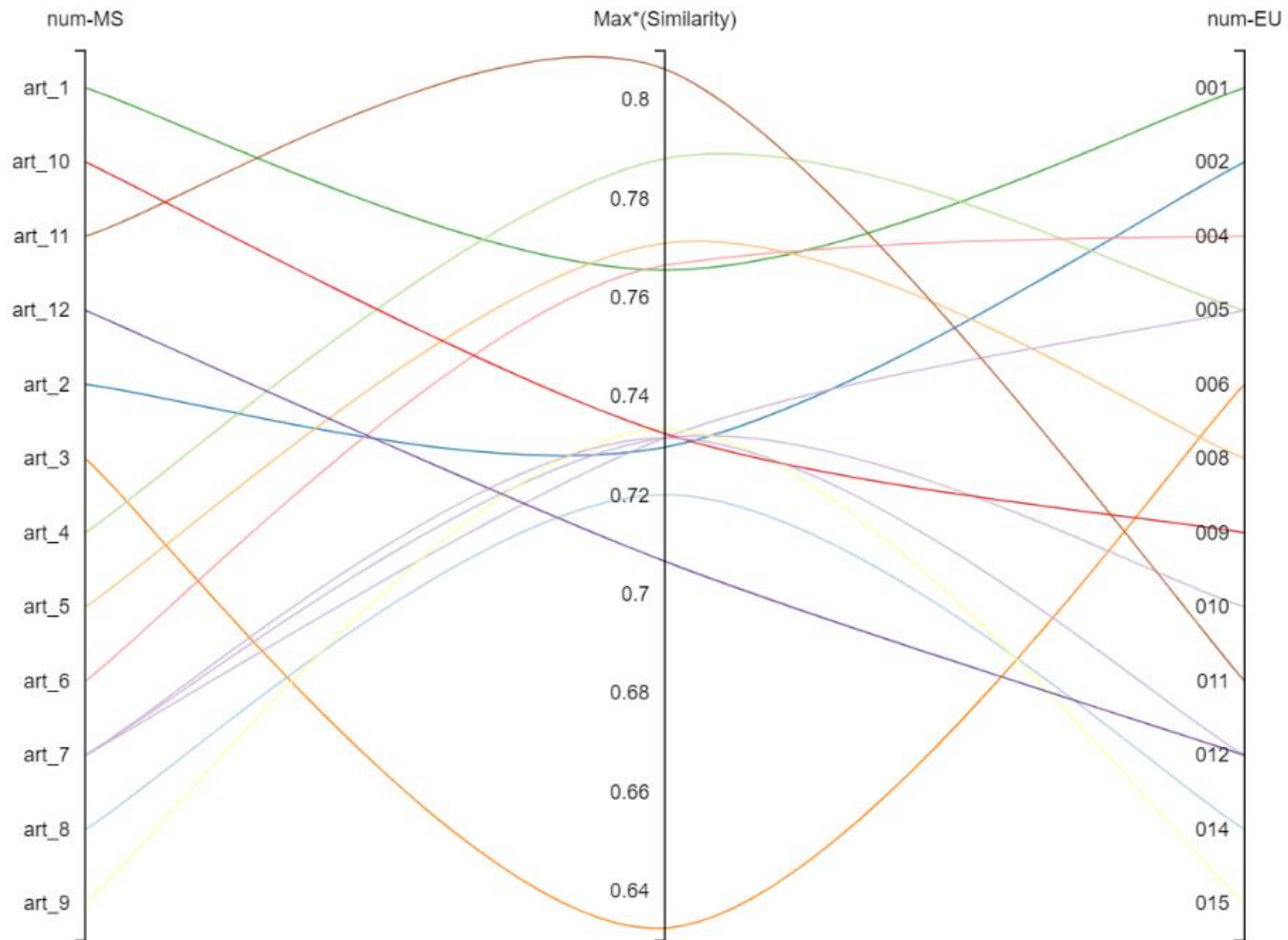
Similarity index and correlation with EU directive articles
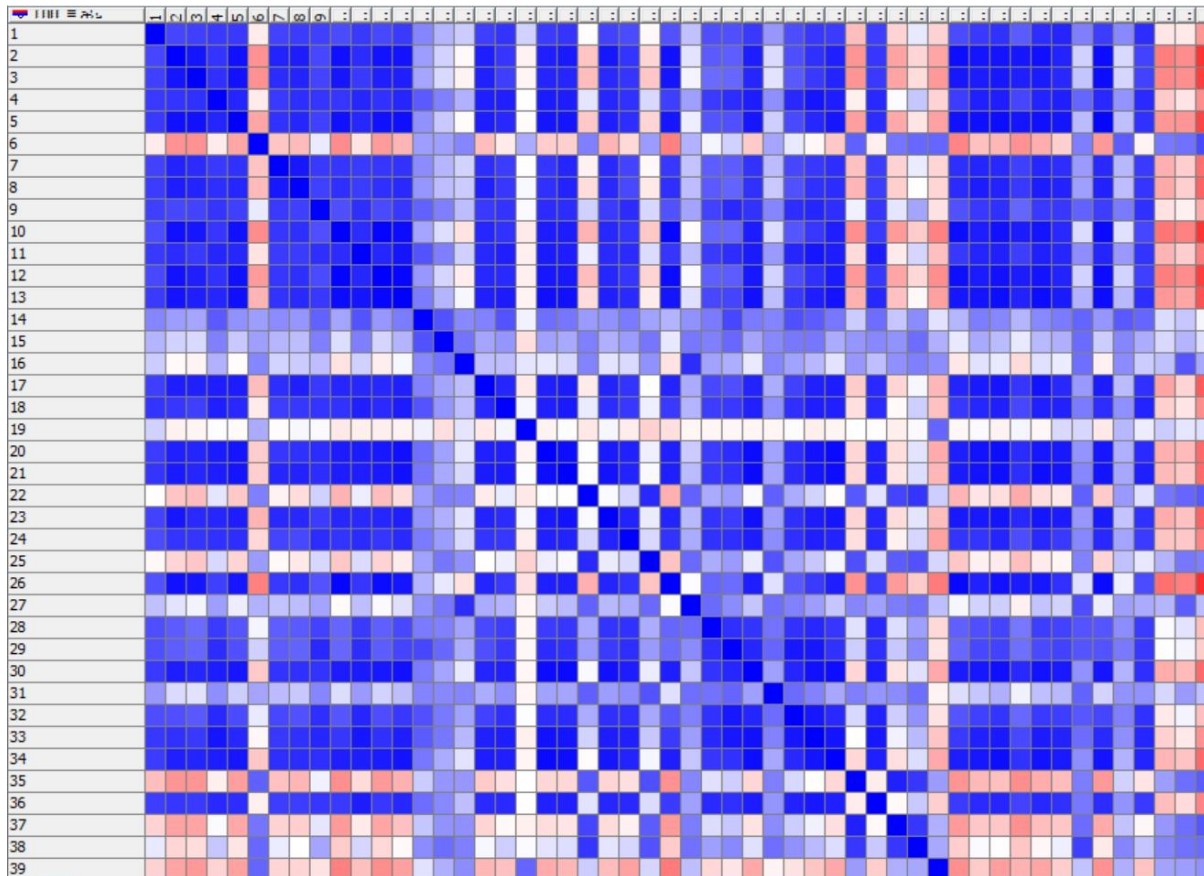
New three scenarios of integration with LEOS

- correct the syntax of the normative references
- Suggest definitions according to the pertinent topic
- extract knowledge regarding "reporting requirements"

Architecture
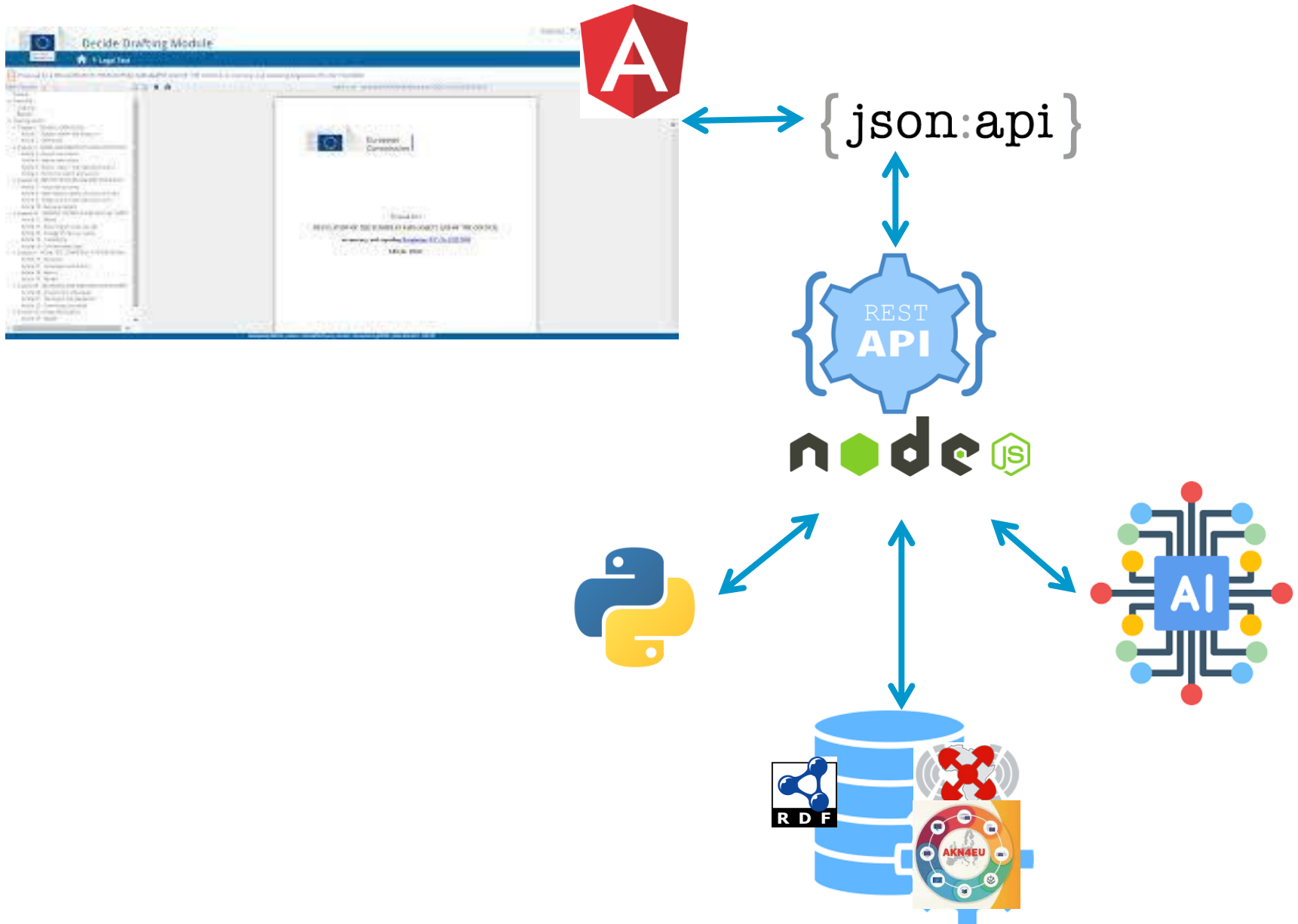
Methodology

- Use embedding techiques applied to the normative references destination
- Use temporal parameters
- Use semantic topic modeling (Eurovoc)

Reporting requirements

Action **ActionResult** **Event**

Article 6

Interim management statements

3. The Commission shall provide a report to the European Parliament and the Council by 20 January 2010 on the transparency of quarterly financial reporting and statements by the management of issuers to examine whether the information provided meets the objective of allowing investors to make an informed assessment of the financial position of the issuer. Such a report shall include an impact assessment on areas where the Commission considers proposing amendments to this Article.

http://data.europa.eu/eli/dir/2004/109/oj

Agent **Topic**

LEOS Home Support ∨ DEMO Demo EN

app.breadcrumb.home > global.breadcrumb.proposals > global.breadcrumb.proposal_view > global.breadcrumb.bill   v1.2.0 - last edited by DEMO Demo (CNECT) on 27/11/2024 11:30   Close

Save Import from OJ Exports Search   See user guidance   Enable track changes See track changes   Enable ACM search Enable drafting review

Display Track-changes ACMServices

Article 5

Request

By 2 January 2014, and every 3 years thereafter, the Commission shall publish a general report on the experience acquired as a result of the operation of the Authority and the procedures laid down in this Regulation.

Article 6

1. The gate keepers shall submit to the European Commission, the European Council and the European Parliament by the 31 January every year from 2025 onwards a report on the actions undertaken by them in fighting fake news and misinformation along with a trend analysis.

Article 7

Request

ACM | Annotations & document notes

Search **Drafting Review** Annotations & document notes

INFOS:

Action : publish

Action Result : a general report on the experience acquired as a result of the operation of the Authority and the procedures laid down in this Regulation

Addresser : the_commission

Paragraphe Id : _art_2__para_1

Period Of Time : 2 January 2014

Is Part Of in rdf:RDF/rrmv:Request/dcterms:isPartOf:

test

Download RDF response   Download Akoma Ntoso with RDF

Help | Privacy Statement | Developed by DIGIT.A3 | Version: 5.0.3.1 | Revision: LEOS Open Source | Date: 2024-08-08 15:10 CEST

Extraction and Representation

3. The **Commission** shall provide a **report** to the **European Parliament** and the **Council** by **20 January 2010** on the **transparency of quarterly financial reporting and statements by the management** of issuers to examine whether the information provided meets the objective of allowing investors to make an informed assessment of the financial position of the issuer. Such a report shall include an impact assessment on areas where the Commission considers proposing amendments to this Article.

EXTRACTION

VISUALIZATION

MAPPING RRMV

REPRESENTATION

INTEGRATION
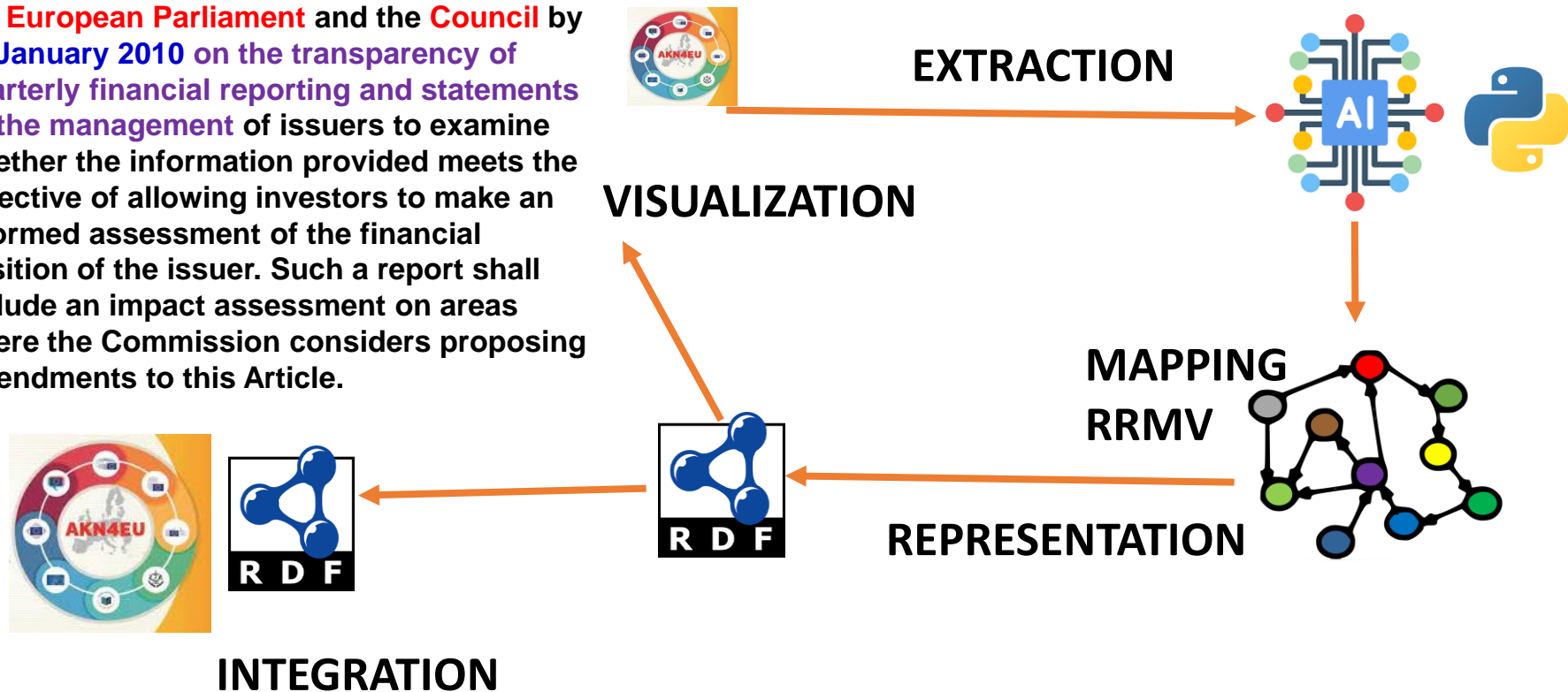
Monitoring and Measuring the Policy

Measuring

Monitoring

Obbligations

Legal Text

Machine-readable metadata
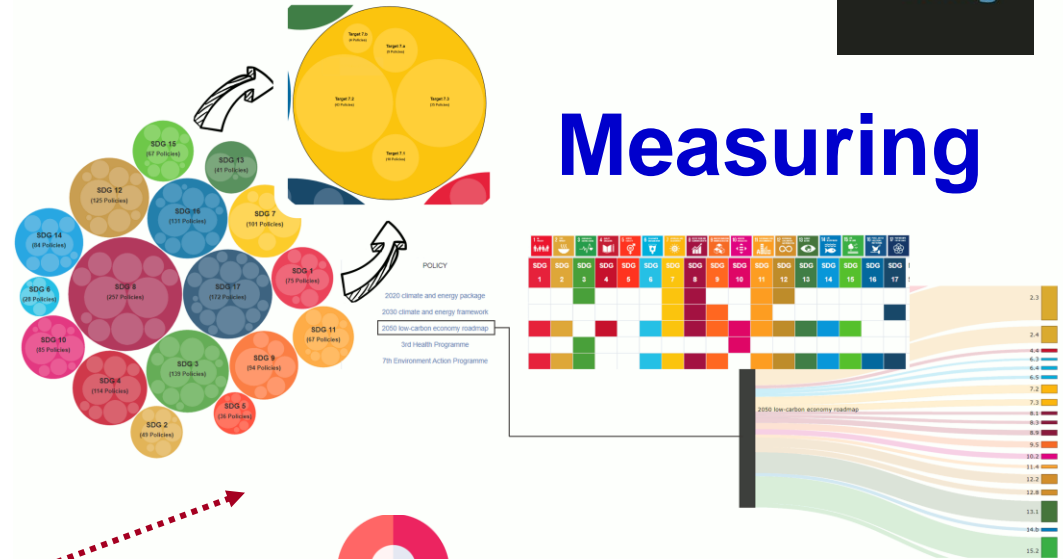
Integration

LegalRuleML – business logic of the Norms (using legal ontologies)

Use of BPMN for connecting the Norms with the eGOV services
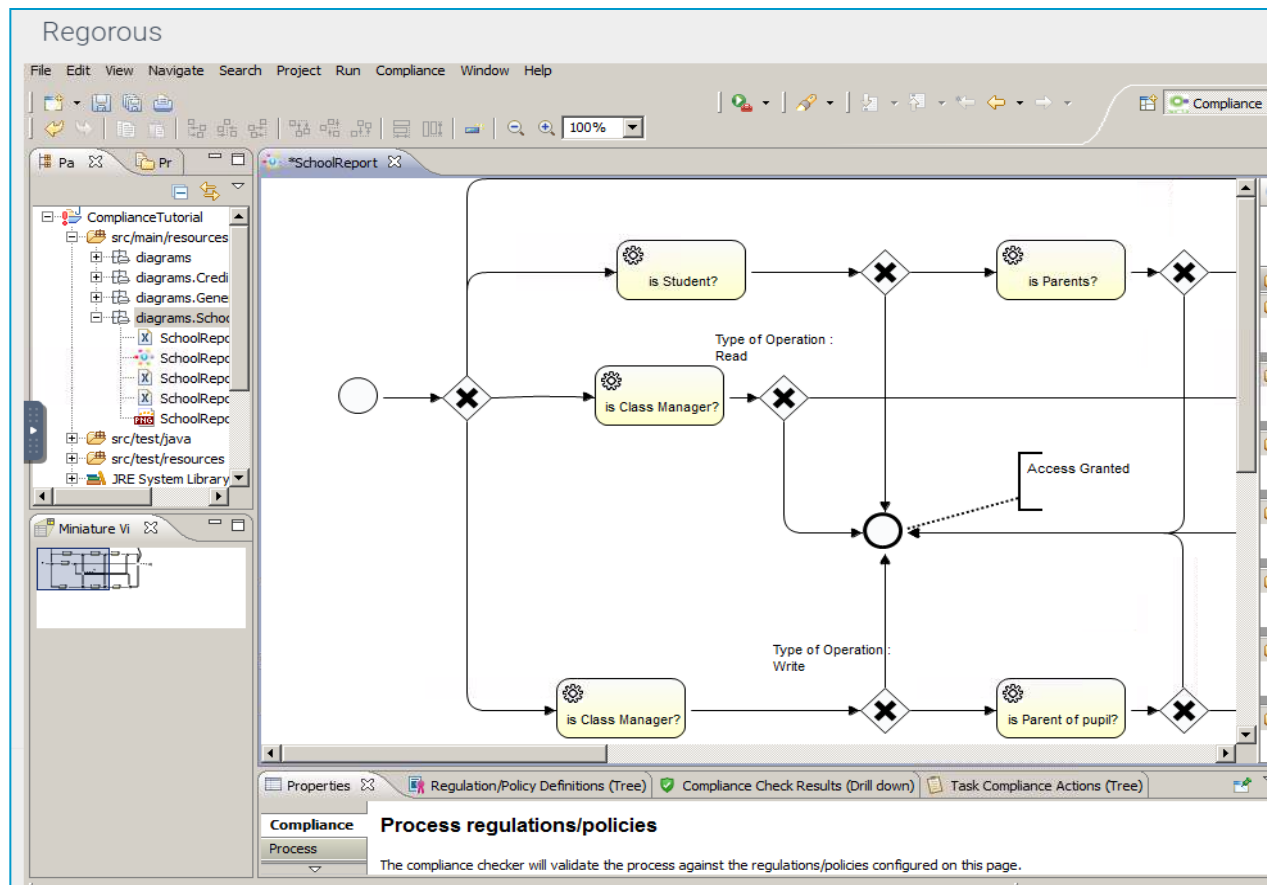
Conclusions

- Standard like AKN provides good annotated corpora for AI applications

- AI without semantics and structure is problematic (e.g., hallucination)

- RAG, embedding, KG can help

- Transparency, explicability and accountability are crucial for Parliaments (e.g., democratic principles)

- User interface for a dialogue with end-user is essential for not crystallized in the code the Law

- Legitimacy and *Rule of Law* should be included *by-design* in the AI projects

thank you
for your attention

Monica Palmirani – monica.palmirani@unibo.it