



HYPERMODELEX



Hybrid AI for eLegislation

Prof. Monica Palmirani – University of
Bologna, CIRSIFID-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

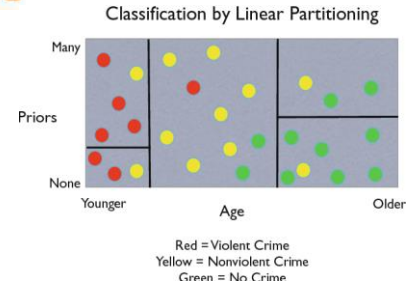
Different goals of AI in Legislative Drafting

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



```
pragma solidity ^0.4.17;

contract SimpleStorage {
    uint storedData;

    function set(uint x) public {
        storedData = x;
    }

    function get() public view returns (uint) {
        return storedData;
    }
}
```



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»

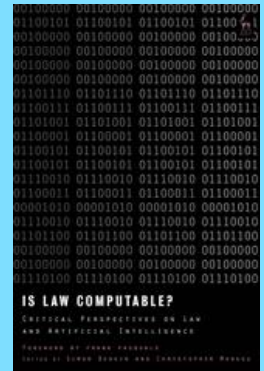
The screenshot shows the top of a webpage with the title "CRACKING THE CODE" and subtitle "RULEMAKING FOR HUMANS AND MACHINES". It features logos for @OPSIGOV, OPSI (Observatory of Public Sector Innovation), and OECD. Below the logos is the NSW Government logo and the text "digital.nsw". A navigation bar includes "Digital Transformation", "Policy", "Design System", "Get Involved", and "Blog". The main content area has the heading "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 PALMIRANI¹, Francesco SOVRANO², Davide LIGA³, Salvatore SAPIENZA⁴ and Fabio VITALI⁵

¹CIRSFID-ALMA-AL, University of Bologna
²DISI, University of Bologna



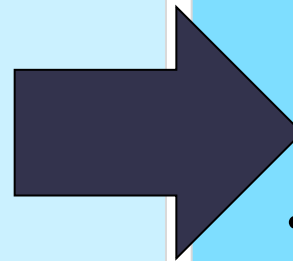
Legal Theoretical Framework

- Normativity and legitimacy in smart legal order
- Interpretation and legal theory using **computational linguistics approach**
- Explicability & Transparency **using HCI**

From code to text

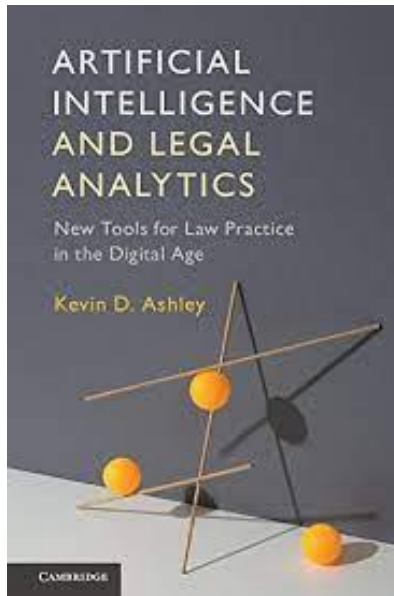
Several critical issues

- *Computational legalism*
- Democratic risks
- Ethical concerns



AI and Legislation Domain: critical analysis

- 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



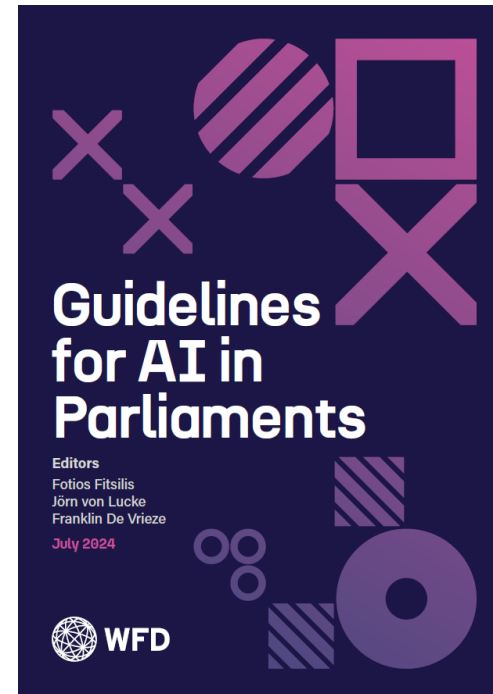
Klaus Günther

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
- Bias, 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)





Digital-ready policies



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*



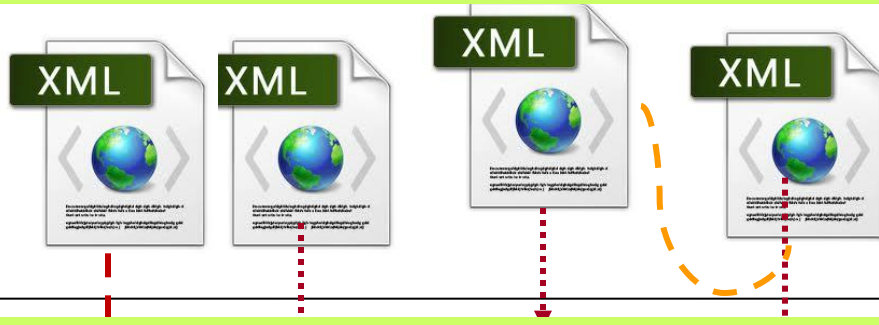
6. *Digital-ready drafting*



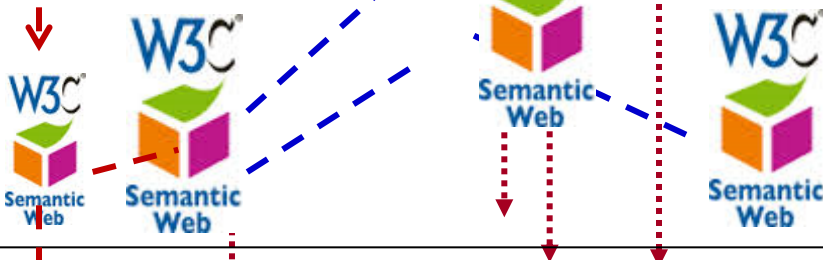
Enabler:
Multidisciplinary teams

Legal Knowledge Modelling – Law as Code

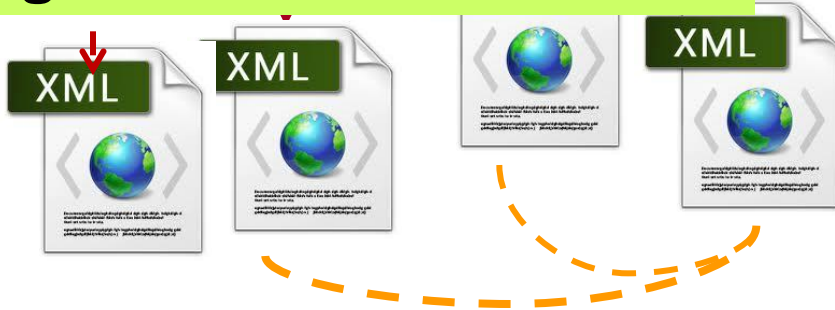
Legal document in XML - context



Legal Ontology – semantic level



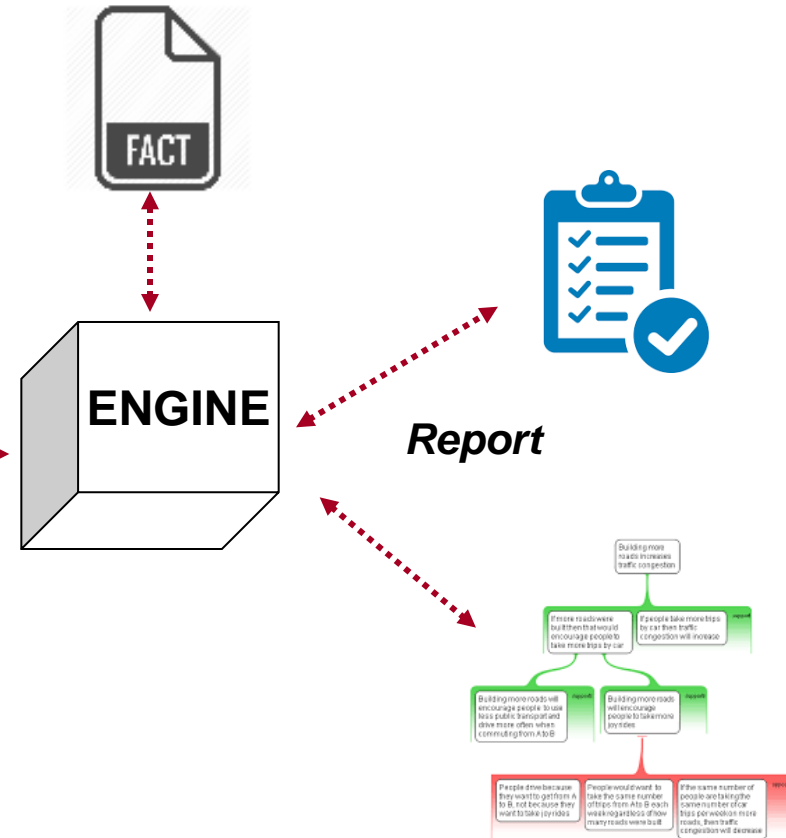
Logic Rules – deontic level



Argumentation/Justification

Services

- Definizione dei goal

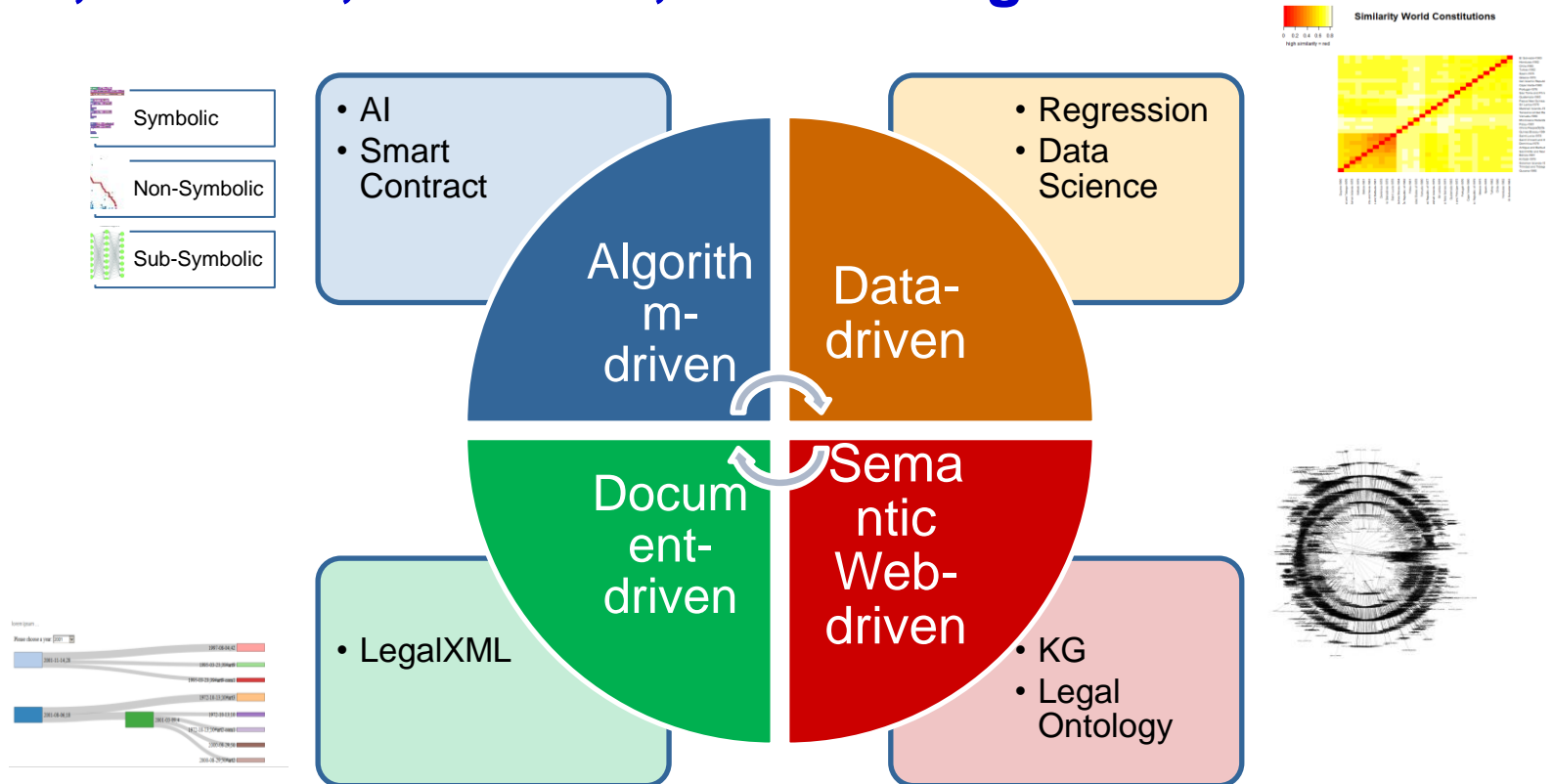


Different goals of AI in Parliaments

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

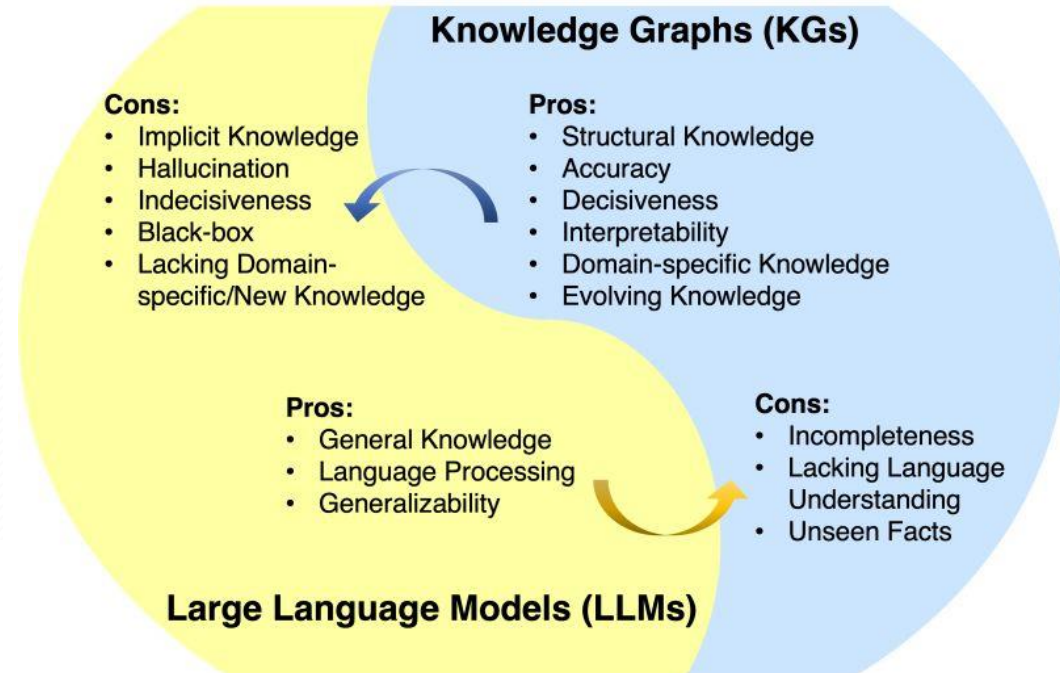
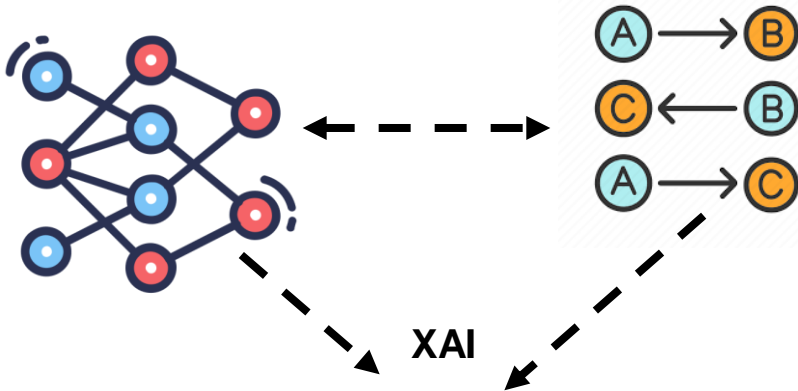
Content, Context, Semantic, Processing



Neuro-symbolic

Sub-Symbolic AI

Symbolic AI



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

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You must agree to our Terms of Service to continue using EasyChair.

You can **download** these Terms of Service by clicking on "Download". To agree to these terms, tick the box below and click on "Continue". If you **disagree** with these Terms [click here to log out](#).

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EasyChair Terms of Service

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1.1 EasyChair Ltd ("we" or "us" or "EasyChair Ltd"), via its online web service EasyChair ("EasyChair" or "EasyChair Web Site") <https://www.easychair.org> provides services that allow users:

- a) to manage document submission, reviewing, publishing, program generation, content management, registration, user management, email management and monitoring, and accounting for conferences, workshops, journals, books, special issues and any other events or publications;
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- a) "you" includes you and that entity, and
- b) you represent and warrant that you are an authorized representative of the entity with the authority to bind the entity to these Terms, and that you agree to these Terms on the entity's behalf.

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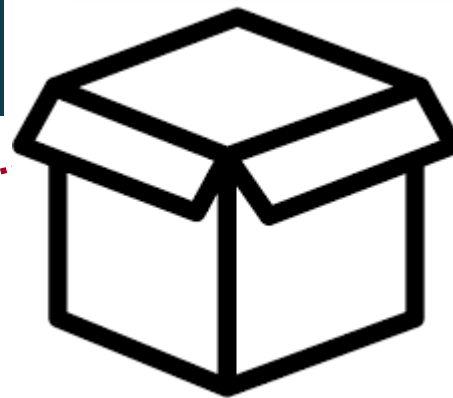


AKOMA NTOSO

Architecture for Knowledge-Oriented Management of African Normative Texts using Open Standards and Ontologies

OASIS LegalXML

LegalRuleML



What are your rights in respect of your personal data?

Your right of data access

8.1. You are entitled to receive a copy of your personal data that is in our possession (your right of data access).

Your right to erasure and rectification

8.2 You may request the deletion of personal data or the correction of inaccurate personal data (your right to erasure and rectification). Please note that we may keep certain information concerning you, as required by law, or when we have a legal basis to do so (e.g., our legitimate interest to keep the platform safe and secure for other users).

Your right to object to processing

8.3 You have the right to object at any time (i) to the processing of your personal data for the purpose of direct marketing, or (ii) to the processing of your personal data for other purposes on grounds relating to your particular situation (your right to object to processing). Please note that in the latter case, this right only applies if the processing of your personal data is based on our legitimate interest.

Your right to restriction to processing

8.4 You have the right to restrict the processing of your personal data (your right to restriction of processing). Please note that this only applies if (i) you contested the accuracy of your personal data and we are verifying the accuracy of the personal data; (ii) you exercised your right to object and we are still considering, as foreseen by the applicable law, whether our legitimate grounds to process your personal data in that case override your interests, rights and freedoms; or (iii) your personal data has been processed by us in an unlawful way but you either oppose the erasure of the personal data or want us to keep your personal data in order to establish, exercise or defend a legal claim.

Lawyer-readable

Machine-readable

Human-readable



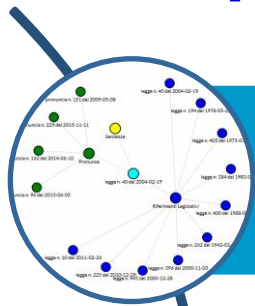
AI for Legislative drafting

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

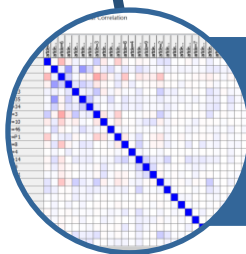


Legal Drafting in the Era of Artificial Intelligence and Digitisation

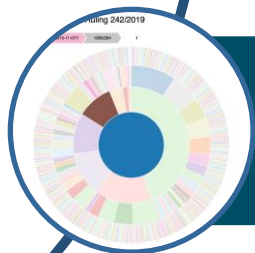
■ 4 use-cases



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

DEROGATION

Anatomy of a derogation

$R1_{t_1}$ derogated to $R2_{t_2}$

<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.

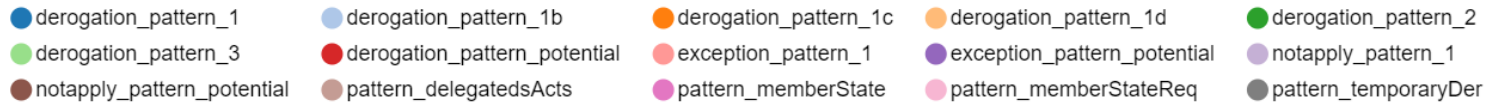
Dataset

- 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”**

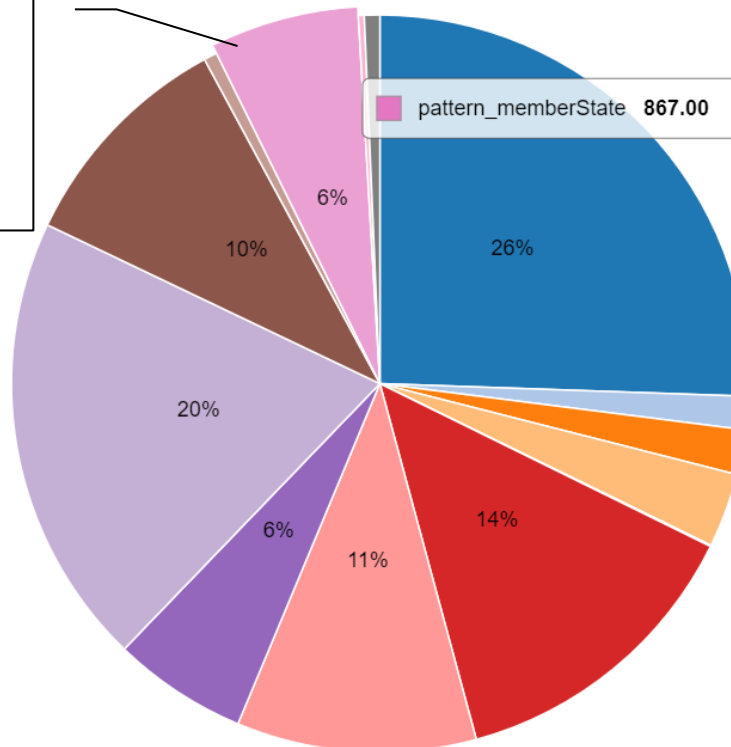
Study on "Drafting legislation in the era of AI and digitisation"

Manage the derogations: classification

Pie Chart



Derogation connected with the Member States discovered using Deep learning



Akoma Ntoso: detection of knowledge

```
<alinea eld="body__art_2__al_3">
  <content eld="body__art_2__al_3__content">
    <mod eld="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 eld="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 Knowledge extraction and Akoma Ntoso serialization

```
<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>
```


<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

Eurovocs:

Places

Duration:

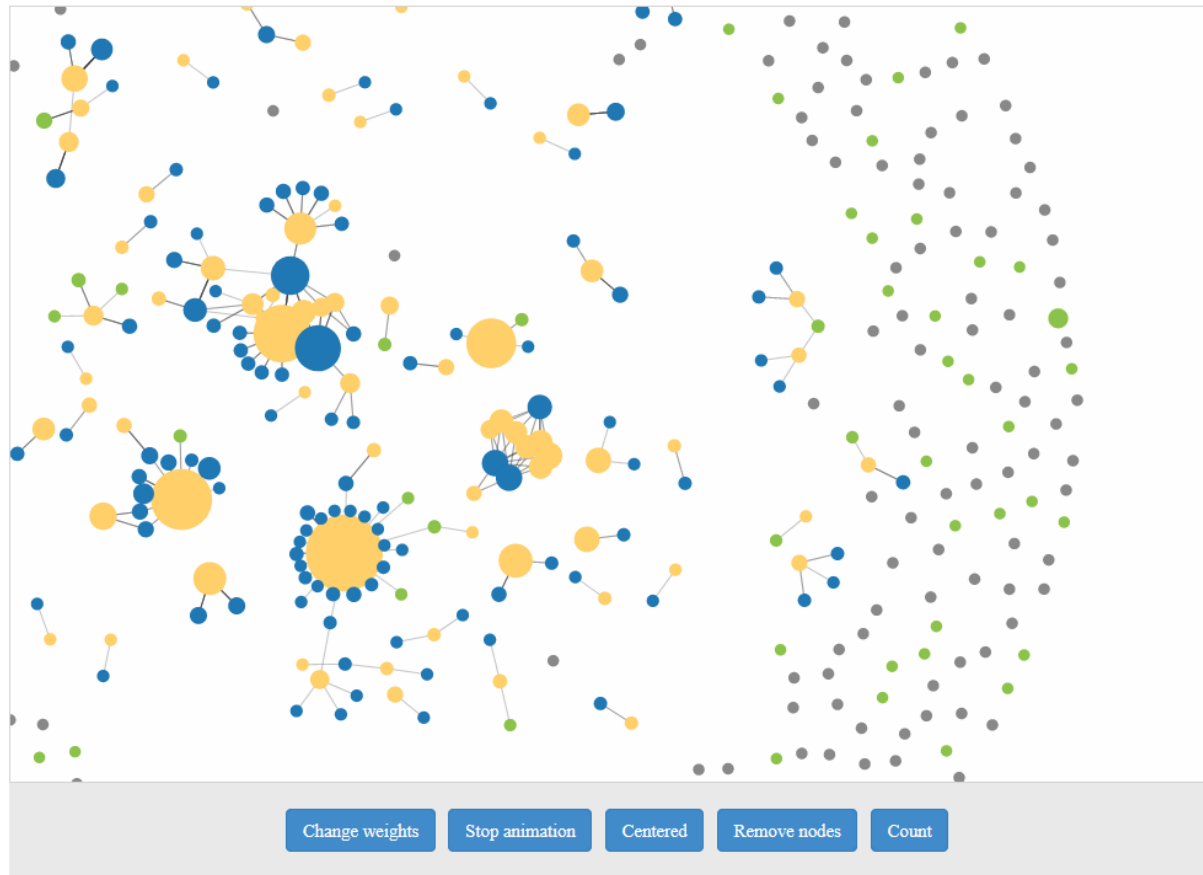


Conditions:

Domains:

Match all filters (narrow results)

Update



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

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.

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:

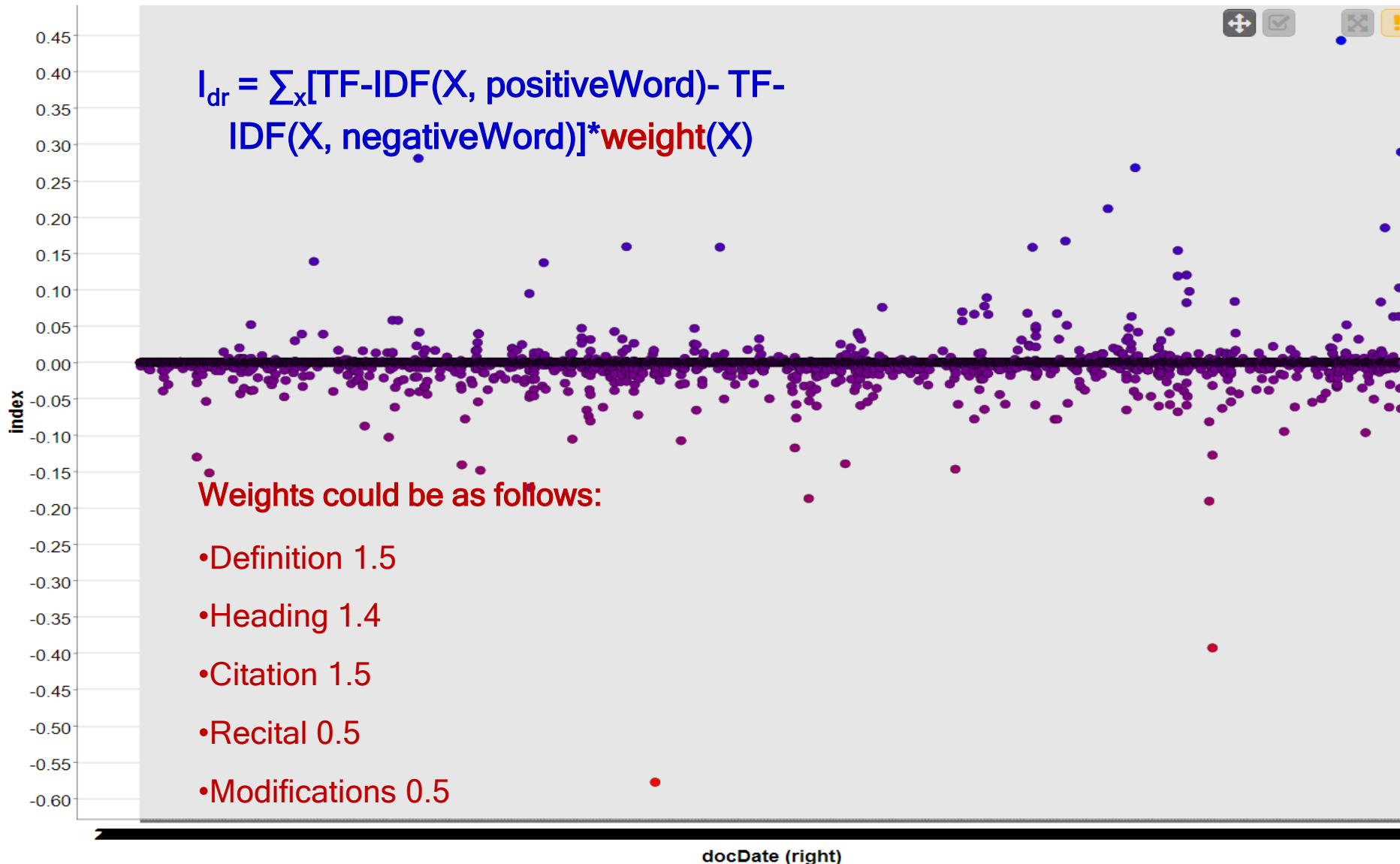
*(i) a single sheet of **paper**;*

*(ii) several sheets of **paper** where all sheets are indivisible and constitute an integrated whole;*

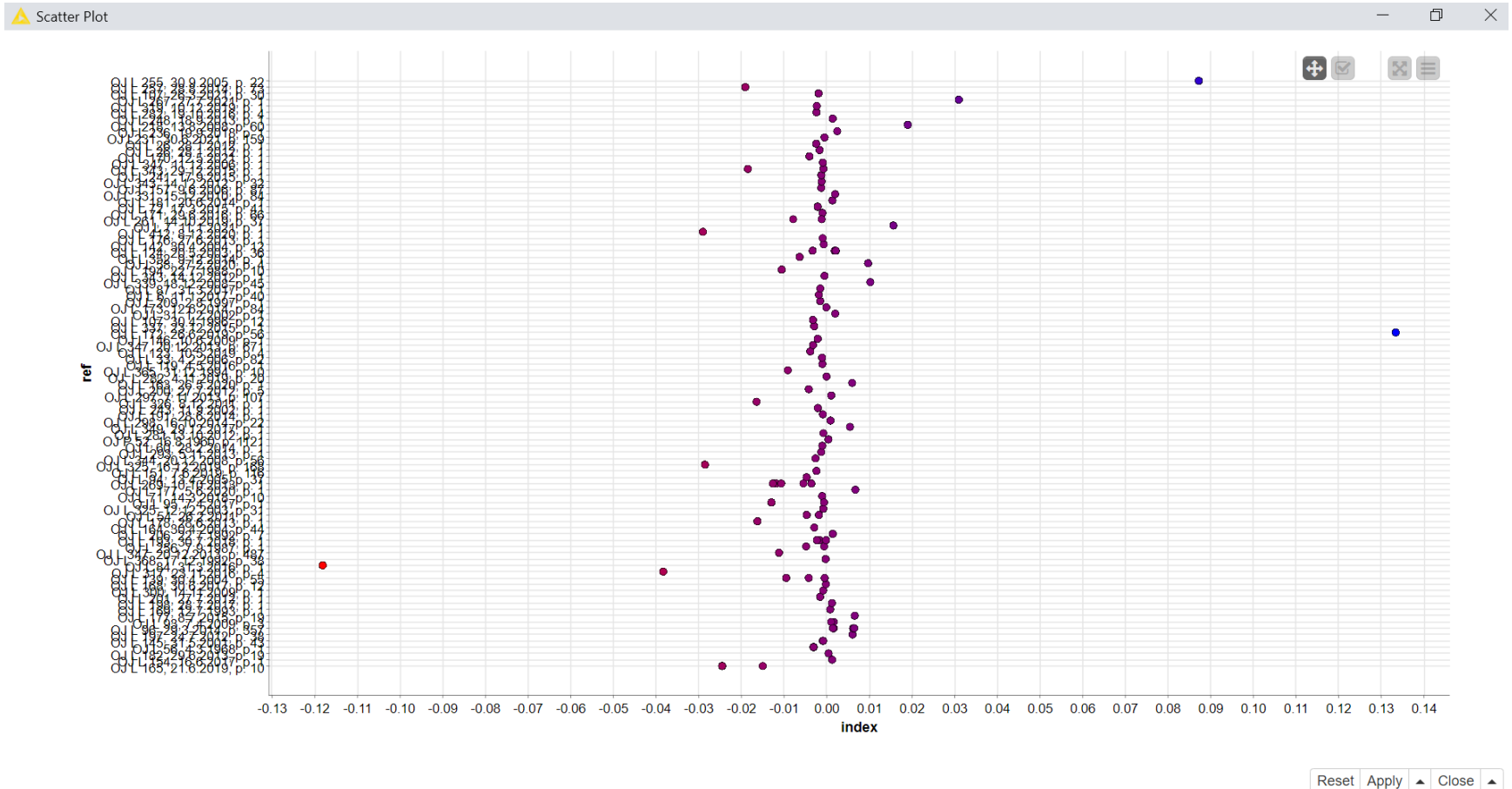
(iii) a sequence of pages with each page numbered so as to indicate that it is a particular page in a finite sequence; »

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



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



IMPLEMENTATION DIRECTIVE

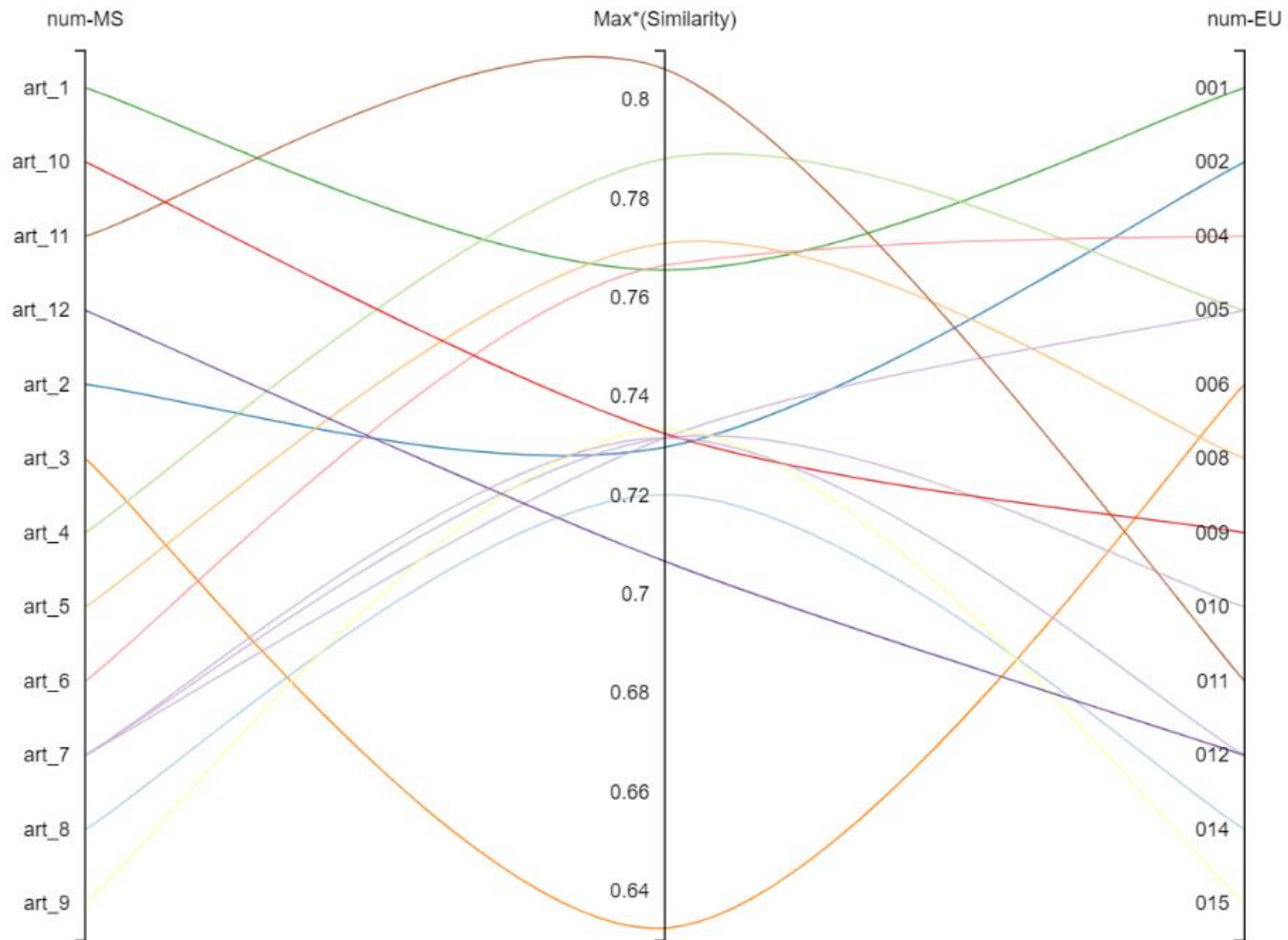
Support the transposition and implementation of the Acquis

- 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

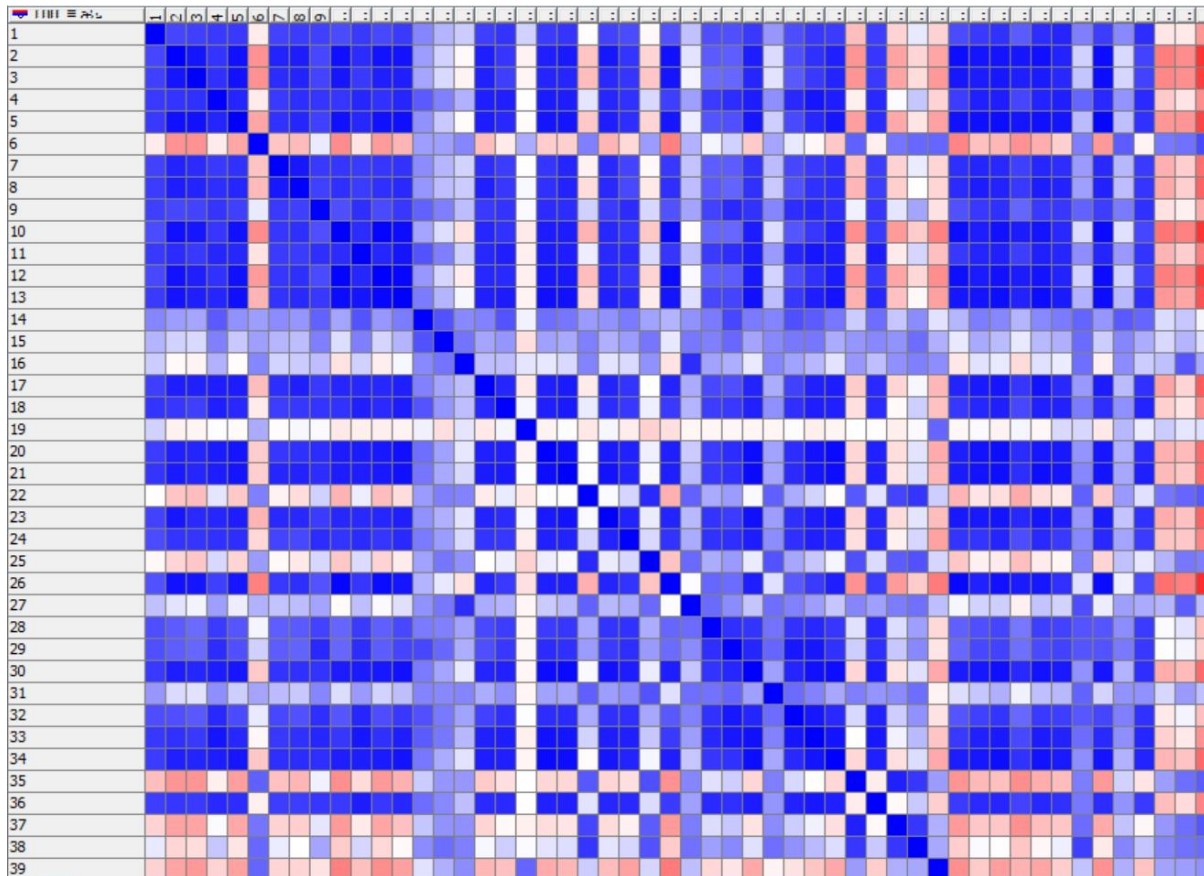
Study on "Drafting legislation in the era of AI and digitisation"

Similarity between Italian implementation of Directive and the EU Directive

2-gram distance



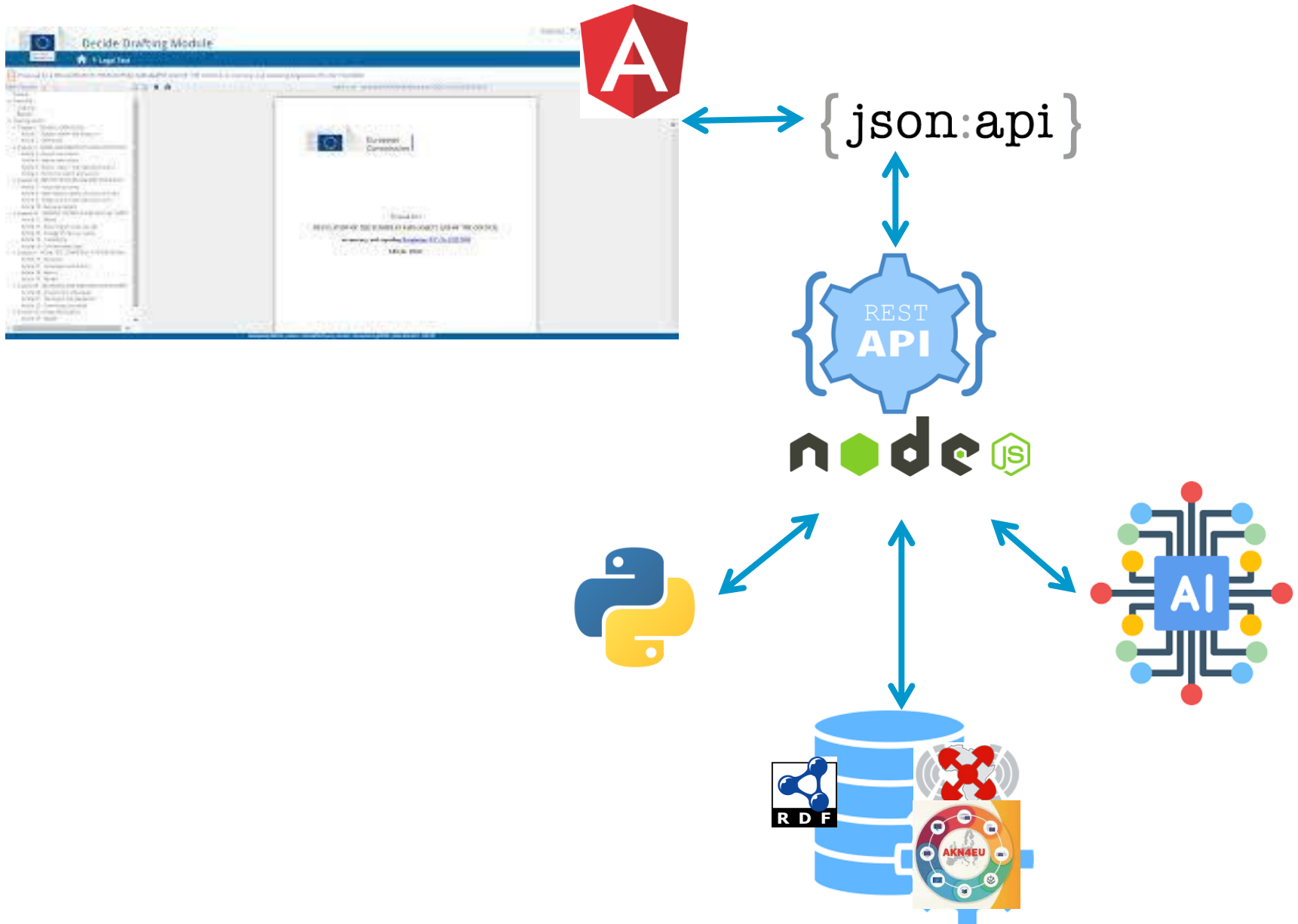
Similarity index and correlation with EU directive articles



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

The screenshot displays the LEOS (Legal Editor) interface. At the top, there is a blue header with the LEOS logo, navigation links (Home, Support), and a user profile (DEMO Demo). Below the header, a breadcrumb trail shows 'Home > Workspace > Proposal View > Legal Act'. The main content area displays a draft legislative act titled 'REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on XYZ'. The document text includes sections for 'THE EUROPEAN PARLIAMENT AND OF THE COUNCIL OF THE EUROPEAN UNION', 'having regard to the Treaty on the Functioning of the European Union', and 'after transmission of the draft legislative act to the national Parliaments'. A right-hand pane titled 'ACM | Annotations & document notes' is open, showing a search bar and a list of annotations, including one about 'personal data' and another about 'data' related to truck parking areas. A bottom toolbar contains buttons for 'Copy response', 'Download response', and 'Download full Akoma Ntoso'. The interface also includes a navigation pane on the left, a search bar, and various tool icons like 'Save', 'Import from OJ', and 'Exports'.

Reporting requirements

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.

Action

ActionResult

Event

Agent

Topic

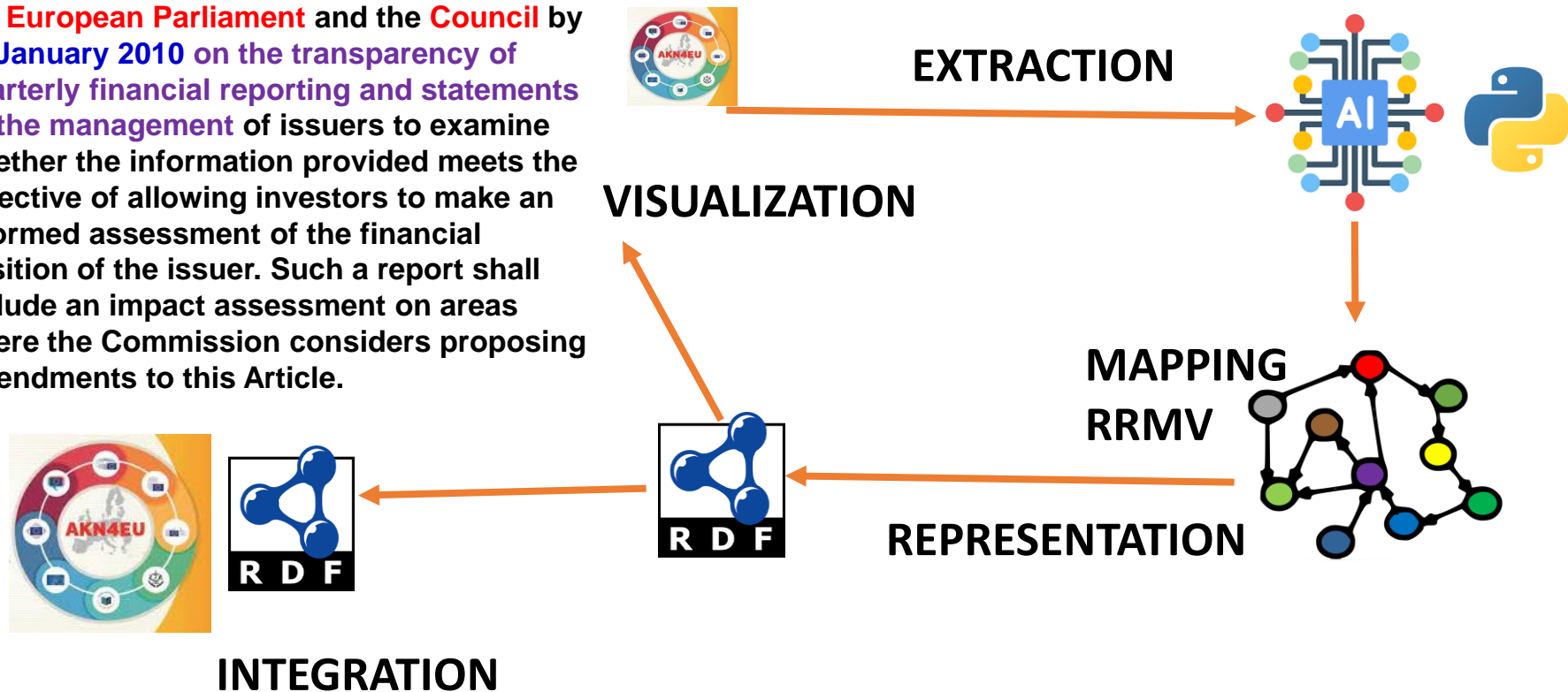
<http://data.europa.eu/eli/dir/2004/109/oj>

The screenshot displays the LEOS web application interface. At the top, there is a navigation bar with the LEOS logo, 'Home', and 'Support' menu. The main content area is divided into several sections:

- Header:** 'app.breadcrumb.home > global.breadcrumb.proposals > global.breadcrumb.proposal_view > global.breadcrumb.bill' and 'v1.2.0 - last edited by DEMO Demo (CNECT) on 27/11/2024 11:30'.
- Toolbar:** Includes 'Save', 'Import from OJ', 'Exports', 'Search', and various editing tools like bold, italic, and text color.
- Document Content:** Shows 'Article 5 Request' and 'Article 6' with text: '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.' and '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.'
- Right Panel (ACM | Annotations & document notes):** Contains a 'Drafting Review' tab with 'INFOS:' section listing: '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', and 'Period Of Time : 2 January 2014'. Below this is 'Is Part Of in rdf:RDF/rrmv:Request/dcterms:isPartOf:' and 'test'.
- Footer:** '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.



Monitoring and Measuring the Policy



AKOMA NTO

Architecture for Knowledge-Oriented Management of African Normative Texts using Open Standards and Ontologies

Testo

Informazioni sul documento

Procedimento

Sintesi del documento

Salvare nei "miei elementi"

Link aggiornato

Link permanente

Scaricare la nota

Segui questo documento

Indice

Nascondi le versioni consolidate

12/08/2022

01/11/2019

Atto giuridico

Notazioni sui valori numerici contenute in conformità con le Direttive 2009/137/CE e 2010/261/UE non si applicano ai infringements di Articoli 13 and 14 di this Regulation.

CHAPTER IX
REVIEW

Article 29
Reports and review

1. Within 36 months of the date of entry into force of the delegated act adopted by the Commission pursuant to Article 4(9), the Commission shall, after consulting ESMA, submit a report on the effectiveness, efficiency and proportionality of the obligations laid down in this Regulation to the European Parliament and to the Council, together with any appropriate proposals. That report shall include, in particular, an overview of similar reporting obligations laid down in third countries taking into account work at international level. It shall also focus on the reporting of any relevant transactions not included in the scope of this Regulation, taking into account any significant developments in market practices, as well as on the possible impact on the level of transparency of securities financing operations.

For the purposes of the report referred to in the first subparagraph, ESMA shall, within 24 months of the date of entry into force of the delegated act adopted by the Commission pursuant to Article 4(9), and every three years thereafter, or more frequently where significant developments in market practices arise, submit a report to the European Parliament, to the Council and to the Commission on the efficiency of the reporting, taking into account the appropriateness of single-side reporting, in particular in terms of reporting coverage and quality as well as reduction of reports to trade repositories, and on significant developments in market practices with a focus on transactions having an equivalent objective or effect to an SFTR.

2. Following completion of, and taking into account, work at international level, the report referred to in paragraph 1 shall also identify material risks related to the use of SFTRs by credit institutions and listed companies and analyse the appropriateness of providing for additional disclosure by those entities in their periodical reports.

Obligations

LegalRuleML

Legal Text



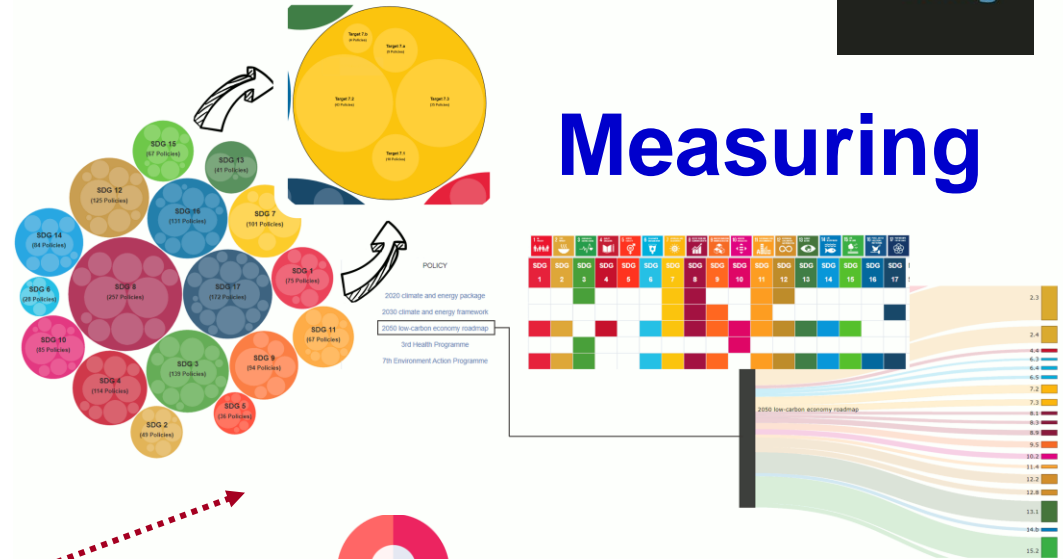
Machine-readable metadata



Monitoring



Measuring



Integration

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

NTT DATA

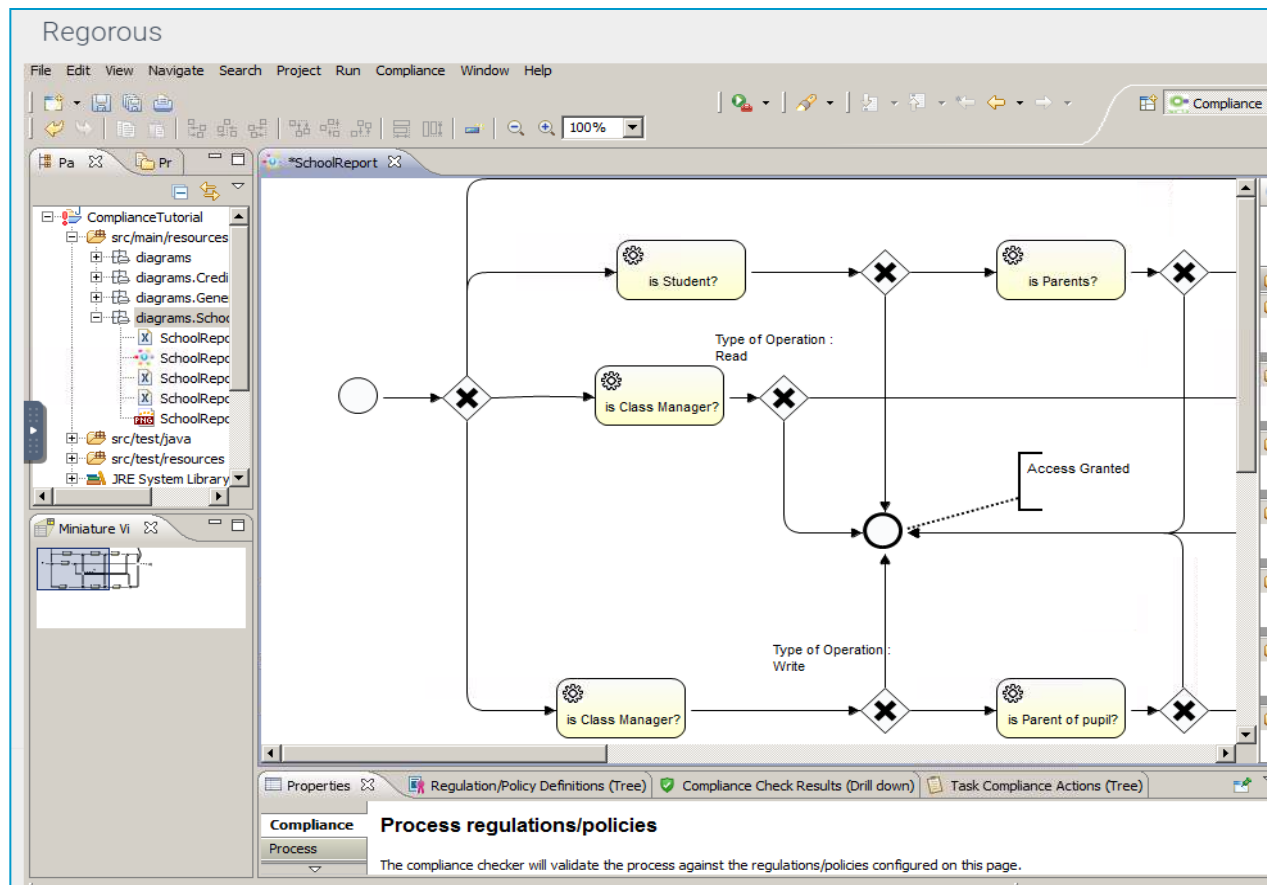
The screenshot displays a web-based interface for editing legal documents and their corresponding LegalRuleML. The browser address bar shows the URL: `menslegis.augeos.it/yii/domain/GDP/...`. The interface is divided into several sections:

- Document editor:** Shows the text of a legal document. The **Preface** section includes the document title "REGULATION (EU) 2016/679 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL" and the date "27 April 2016". The **Body** section contains **Article 8**, which discusses conditions for child's consent in relation to information society services. A paragraph states: "Where point (a) of Article 6(1) applies, in relation to the offer of **Tern** information society services directly to a **Tern** child, the **Tern** processing of the personal data of a child shall be lawful where the child is **Tern** at least 16 years old. Where the child is below the age of 16 years, such processing shall be lawful only if and to the extent that consent is given or authorised by the holder of parental responsibility over the child."
- LegalRuleML preview:** Shows a visual representation of the document's logic. It features a **Prescriptive** rule structure:
 - Rule:** A container for the logic.
 - If:** A conditional block containing:
 - And:** A logical connector for multiple conditions.
 - Atom:** A block containing a **Rel** (relation) `atLeast16YearsOld` and a **Var** (variable) `X`.
 - Atom:** A block containing a **Rel** (relation) `informationSocietyService` and a **Var** (variable) `Y`.
 - Then:** A block containing:
 - Atom:** A block containing a **Rel** (relation) `lawfulConsentSigned` and two **Var** (variables) `X` and `Y`.

At the bottom of the interface, there are buttons for **Edit metadata**, **Delete**, and **Store**. The status bar at the bottom left shows the path: `Path: act > en`.

Use of BPMN for connecting the Norms with the eGOV services

NTT DATA



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**

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