



HYPERMODELEX



AI4LEGS LEGAL-INFORMATICS APPROACHES TO LMS & LAW IN LEGISLATION





IAAIL



AI and Law
M. Palmirani

NLP&LLM
M. Corazza

HCI&XAI
F. Vitali

**Ethics and AI
ACT**
S. Sapienza

Demo
Publication Office of EU
UNIBO

Discussant
G. Governatori,
CQUniversity, AU



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FOUNDATIONS OF AI IN LEGAL PRACTICE: Legal Theory, Methods, Applications

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CIRSIFD-ALMA AI, Department of
Legal Studies, University of Bologna,
Italy

ECAI 2025 – University of Bologna
Day 1 - October 25, 2025



Different goals of AI in Legislative Domain

Task for the legislative offices	Linguistic Translation	Quality Checking	Assist of consolidation	Assist of Amendment
Tasks for the member of the parliaments	Assist in the Definitions	Smart Legislative Drafting of the references	Semantic annotation	Classification/ clustering
Tasks for the democratic debates	Creation of executive summary	Analysis of impact	Analysis of effectiveness	Policy Checking
Tasks for the citizens	ChatBot	Smart Search Engine	Conversion al Query	Creation of executive summary



AI-based solutions for legislative drafting in the EU

Summary report

Fotis Fitsilis Hellenic Parliament

Table 3 - Grouping of priority smart functionalities in technology clusters.

SF Cluster	Technology	SF
I	Advanced Language Editing and Correction	#9-#10-#12-#13
II	Named Entity Recognition	#3
III	Semantic Similarity	#11-#14-#15-#20
IV	Natural Language Generation	#26
V	Information Extraction	#19

zeppelin university

Approaching the Integration of Large Language Models in the Parliamentary Workspace

Enhancing Parliamentary Processes with LLMs

4th Global Conference on Parliamentary Studies
Reinventing Democracy for the 21st Century, Athens, 13.06.2025

Jörn von Lucke

The Open Government Institute
Zeppelin University Friedrichshafen, Germany



Misusage of AI

US lawyer sanctioned after being caught using ChatGPT for court brief

Richard Bednar apologized after Utah appeals court discovered false citations, including one nonexistent case

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

WORLD NEWS

Brazilian city enacts an ordinance that was secretly written by ChatGPT

Lawyer apologizes for fake court citations from ChatGPT

[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

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
- **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



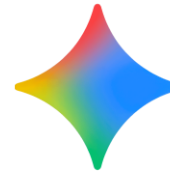
The current and authoritative definition of "**food**" in EU legislation is found in **Article 2 of Regulation (EC) No 178/2002**, also known as the *General Food Law*. It states:

"Food (or foodstuff) means any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be ingested by humans. 'Food' includes drink, chewing gum and any substance, including water, intentionally incorporated into the food during its manufacture, preparation or treatment.

'Food' shall not include:

1. "feed;"
2. "live animals unless they are prepared for placing on the market for human consumption;"
3. "plants prior to harvesting;"
4. "medicinal products (as defined by Directives 65/65/EEC and 92/73/EEC);"
5. "cosmetics (per Directive 76/768/EEC);"
6. "tobacco and tobacco products (as per Directive 89/622/EEC);"
7. "narcotic or psychotropic substances (under the 1961 and 1971 UN Conventions);"
8. "residues and contaminants."

Give me the last version of the definition of food in the EU Legislation



Gemini

- ◆ The current, foundational definition of "food" in EU legislation is found in **Regulation (EC) No 178/2002** of the European Parliament and of the Council (the General Food Law Regulation).

The definition, as set out in **Article 2** of that Regulation, is:

"'food' (or 'foodstuff') means any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be ingested by humans.

'Food' includes drink, chewing gum and any substance, including water, intentionally incorporated into the food during its manufacture, preparation or treatment.

'Food' shall not include:

- (a) feed;
- (b) live animals unless they are prepared for placing on the market for human consumption;
- (c) plants prior to harvesting;
- (d) medicinal products within the meaning of Directives 2001/83/EC and 2001/82/EC;
- (e) cosmetics within the meaning of Directive 76/768/EEC;
- (f) tobacco and tobacco products;
- (g) narcotic or psychotropic substances within the meaning of the United Nations Single Convention on Narcotic Drugs, 1961, and the United Nations Convention on Psychotropic Substances, 1971;
- (h) residues and contaminants."

Note: The references to the Directives on medicinal products and cosmetics have been updated by subsequent legislation.

Insertion in 25/05/2017

(i) medical devices within the meaning of Regulation (EU) 2017/745 of the European Parliament and

Article 2

Definition of ‘food’

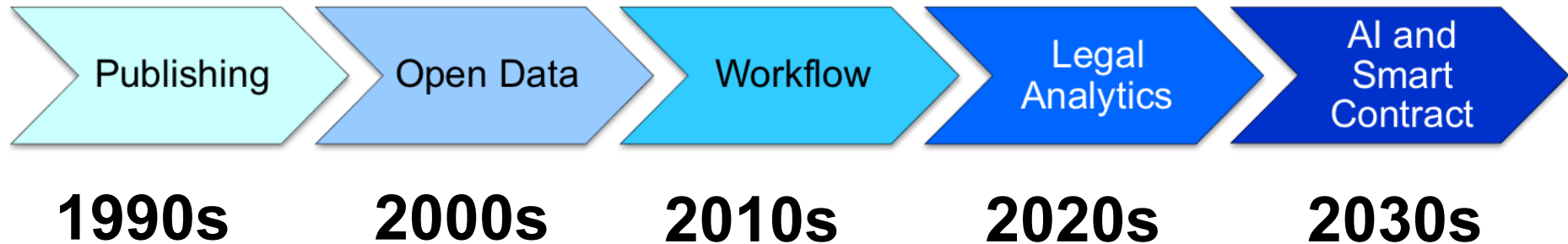
For the purposes of this Regulation, ‘food’ (or ‘foodstuff’) means any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be ingested by humans.

‘Food’ includes drink, chewing gum and any substance, including water, intentionally incorporated into the food during its manufacture, preparation or treatment. It includes water after the point of compliance as defined in Article 6 of Directive 98/83/EC and without prejudice to the requirements of Directives 80/778/EEC and 98/83/EC.

‘Food’ shall not include:

- (a) feed;
- (b) live animals unless they are prepared for placing on the market for human consumption;
- (c) plants prior to harvesting;
- (d) medicinal products within the meaning of Council Directives 65/65/EEC (¹) and 92/73/EEC (²);
- (e) cosmetics within the meaning of Council Directive 76/768/EEC (³);
- (f) tobacco and tobacco products within the meaning of Council Directive 89/622/EEC (⁴);
- (g) narcotic or psychotropic substances within the meaning of the United Nations Single Convention on Narcotic Drugs, 1961, and the United Nations Convention on Psychotropic Substances, 1971;
- (h) residues and contaminants;
- (i) medical devices within the meaning of Regulation (EU) 2017/745 of the European Parliament and of the Council (⁵).

eLegal evolution



AI and Law

Logic programming – Symbolic AI

Semantic Web & Knowledge Representation

ML, Classification, clustering, NLP, prediction

Legal data analytics

Blockchain & Smart Contract

LLM, RAG, GenAI **multimodal**

Agentic AI

Neuro-Symbolic

CRACKING THE CODE

RULEMAKING FOR HUMANS AND MACHINES

@OPSIGOV

OPSI

Office of
Public Sector Innovation

OECD
BEST PRACTICES FOR DIGITAL GOVERNANCE



digital.nsw

Digital Transformation

Policy

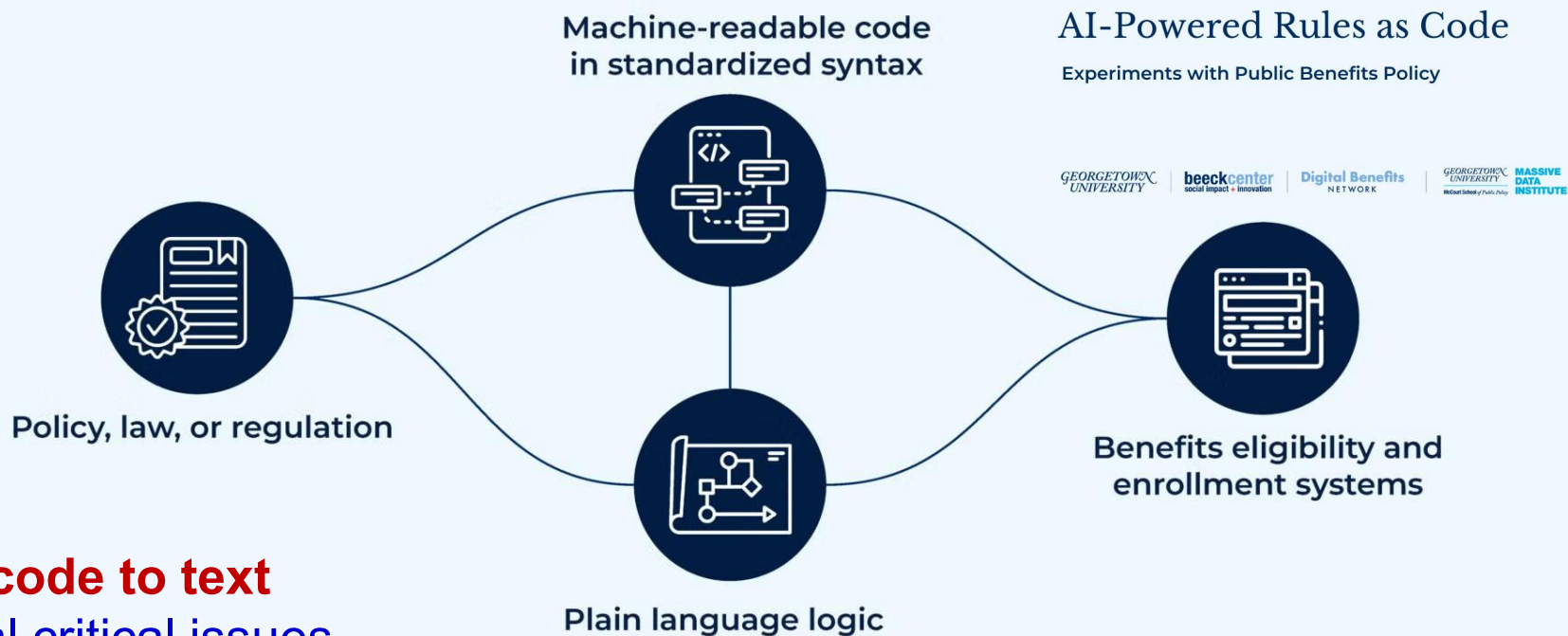
Design System

Get Involved

Blog

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

Benefits Eligibility Rules as Code



From code to text

Several critical issues

- Democratic risks
- *Computational legalism* (Hildebrandt 2021)
- Crystallization of the law

Sources: beeckcenter, social impact + innovation and the Massive Data Institute, Georgetown University, 2025

GEORGETOWN
UNIVERSITY

beeckcenter
social impact + innovation

Digital Benefits
NETWORK

GEORGETOWN
UNIVERSITY
McCourt School of Public Policy

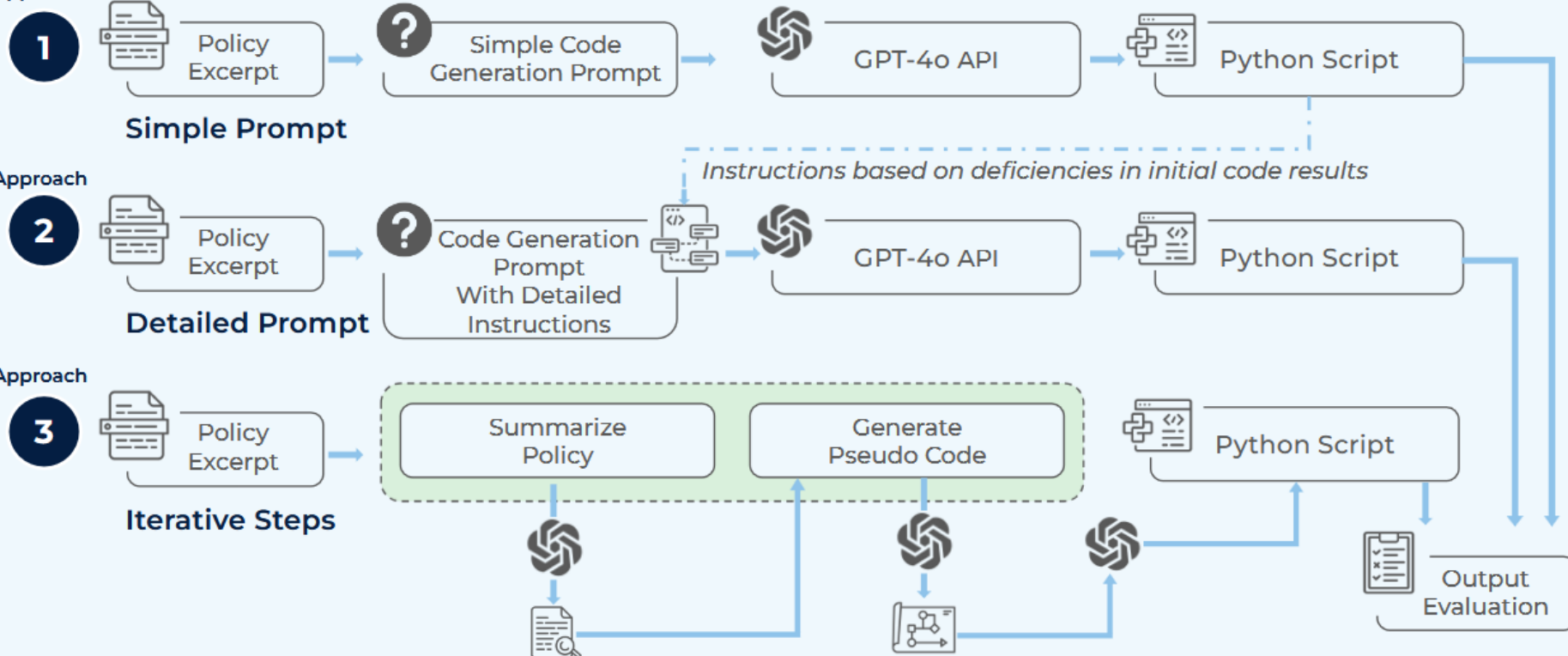
MASSIVE
DATA
INSTITUTE

Experiment #4 – generate code&text using LLM

Design

Generate code using simple and detailed LLM prompts and iterative steps

Approach



Source: Beeck Center for Social Impact + Innovation and the Massive Data Institute, Georgetown University, 2025

Experiment 4 Results Summary

Generate code using simple and detailed LLM prompts and iterative steps

Performance of Designs Across Criteria

Criteria	Design 1 <i>Simple Prompt</i>	Design 2 <i>Detailed Prompt</i>	Design 3 <i>Iterative Prompts</i>
Variable Identification	Partial	Good	Good
Input Handling	Poor	Partially good	Poor
Output Correctness	Incorrect	Partially correct	Incorrect
Decision Making	Poor	Partially good	Poor (mechanical)
Logical Consistency	Poor	Improved	Partially consistent
Rule Coverage	Partially covered	Improved	Partially covered
Code Execution	Runs (unstable)	Runs (Improved)	Doesn't run

- At a high level, the detailed prompt design was the most successful.
- Summarized policy guidance for code generation reduces code errors.
- Modular design is particularly important in LLM workflows.

Source: Beeck Center for Social Impact + Innovation and the Massive Data Institute, Georgetown University, 2025

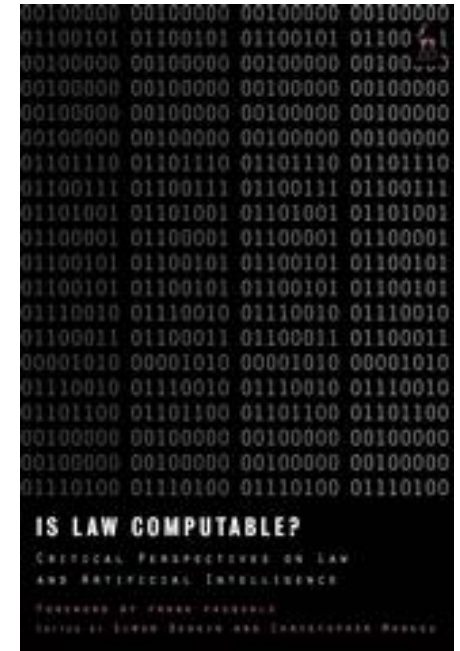
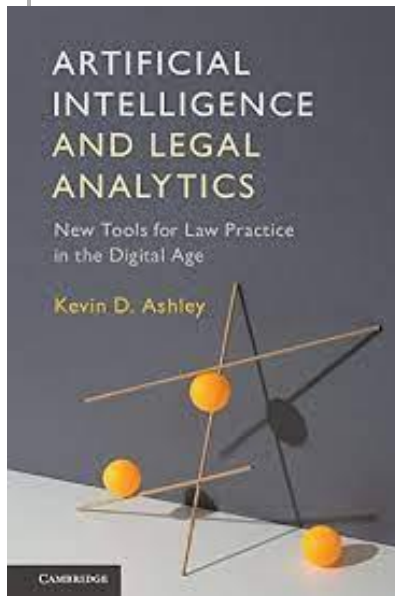


“Our experiments highlight that LLMs can support different parts of the Rules as Code pipeline, but a **human in the loop** and rich databases containing relevant, up-to-date policy excerpts are essential to facilitate the use of this technology”

“When AI models provide **incorrect information**, they often do so in a **confident tone**, which can mislead those without subject expertise.”

AI and Legislation Domain: critical issues

- Law is **not only rules** (e.g., principles and values).
- Norms have been adapted according to the **evolution of the society – dynamic model**
- Norms are sometimes intentionally **vague** for implementing flexibility and interpretations (hermeneutic, open text)
- **Prediction** based on the past should be mitigated to the new events (computational legalism, Hildebrandt 2021)
- **Autonomy** and transparency are pillars of normativity (Günther 2021)
- The “**right of disobey**” as a moment of creativity of new norms and to reinforce the normativity



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

Words or code first? Is the legacy document or a code statement the better starting point for complexity-reducing legal automation?

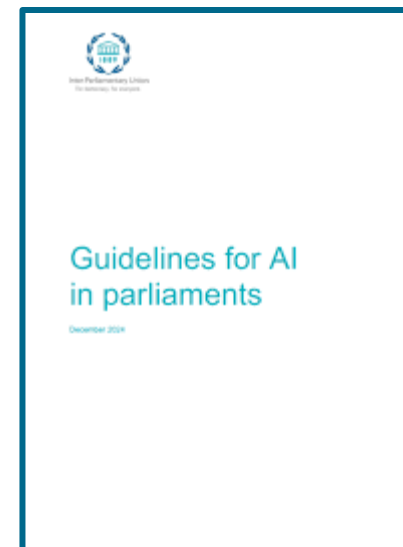
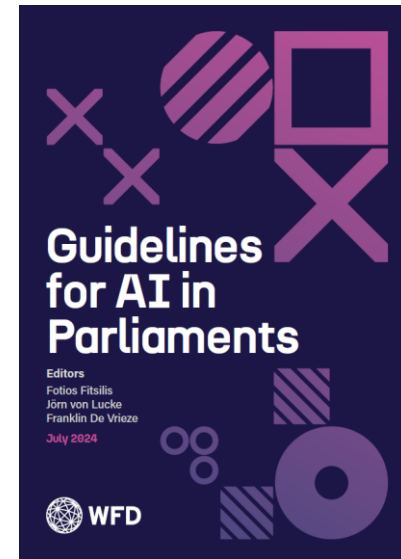
Goodenough OR, Carlson PJ. 2024 Words or code first? Is the legacy document or a code statement the better starting point for complexity-reducing legal automation? *Phil. Trans. R. Soc. A* **382**:20230160. <https://doi.org/10.1098/rsta.2023.0160>

Oliver R. Goodenough^{1,2,3} and Preston J. Carlson⁴

- “There are cases where the **words-first approach**, either through translation or the direct application of LLM style artificial intelligence, may be preferable as a matter of dealing with legacy documentation. Going forward, however, we believe that a **code-first approach**, intelligently developed and deployed, holds the greater promise for allowing society to grasp the many benefits – including complexity management – that can flow from effective legal automation.”

Critical issues in Parliament

- **Provenance of the legal sources**
- Data/Platform sovereignty and security
- **Explicability, Transparency, Accountability**
- Bias, Discrimination, Risk assessment
- **Parliamentary Autonomy**
- **Separation of Powers**
- Integrity of democratic processes (e.g., rules of law)
- Free Mandate (e.g., not depending on the technology)
- Continuity of Power (e.g., blackout)





Digital-ready policies

Digital
Ready
Policy
Making



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



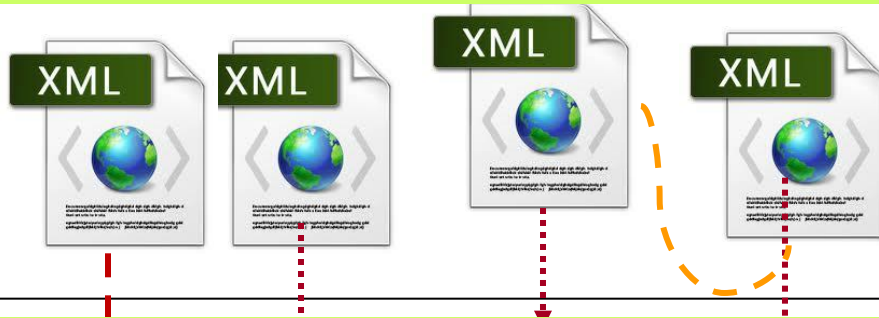
Legal Drafting in the Era of
Artificial Intelligence and
Digitisation

Directorate-General for
Informatics
Solutions for
Legislation, Policy &
HR

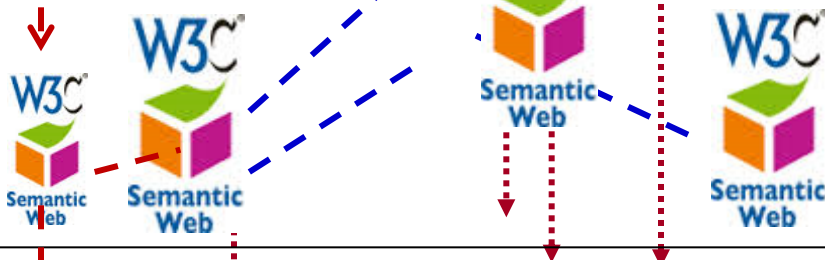


Legal Knowledge Modelling – Law as Code

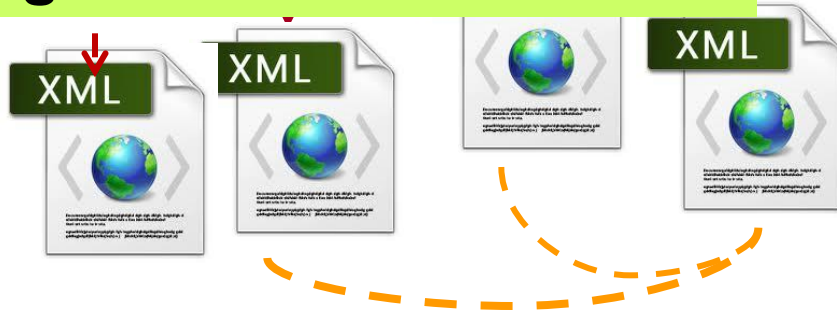
Legal document in XML - context



Legal Ontology – semantic level

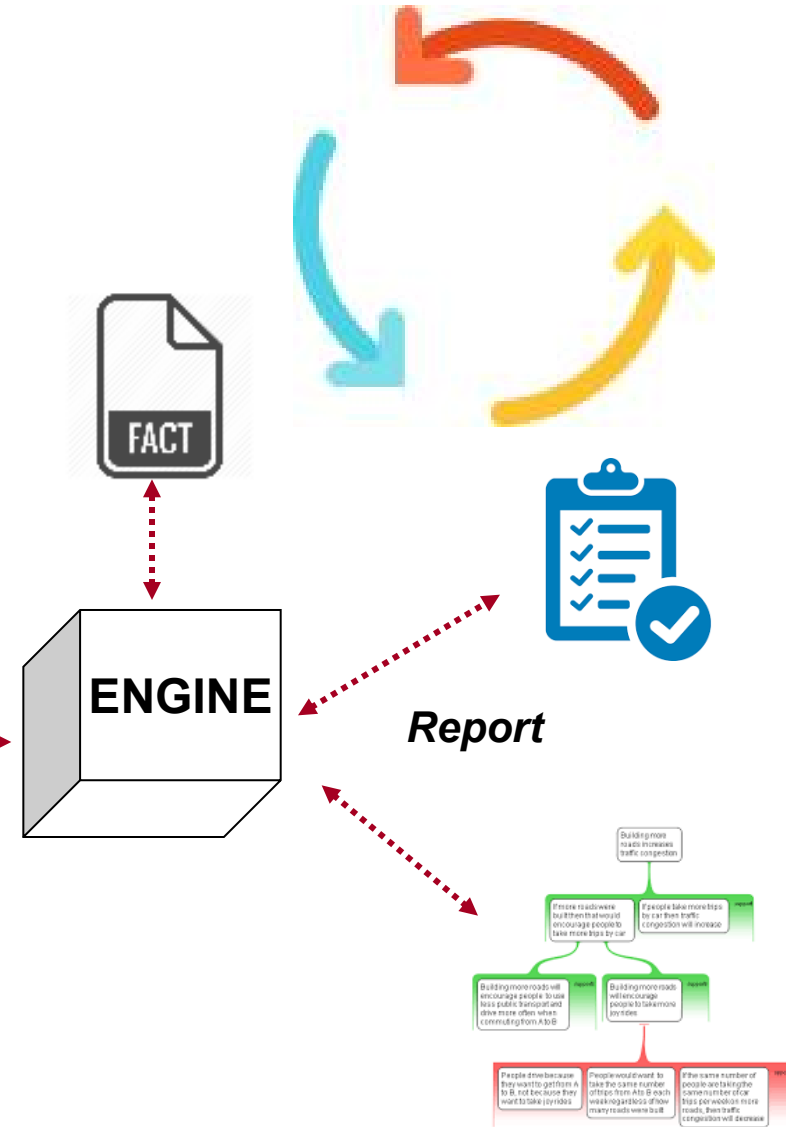


Logic Rules – deontic level



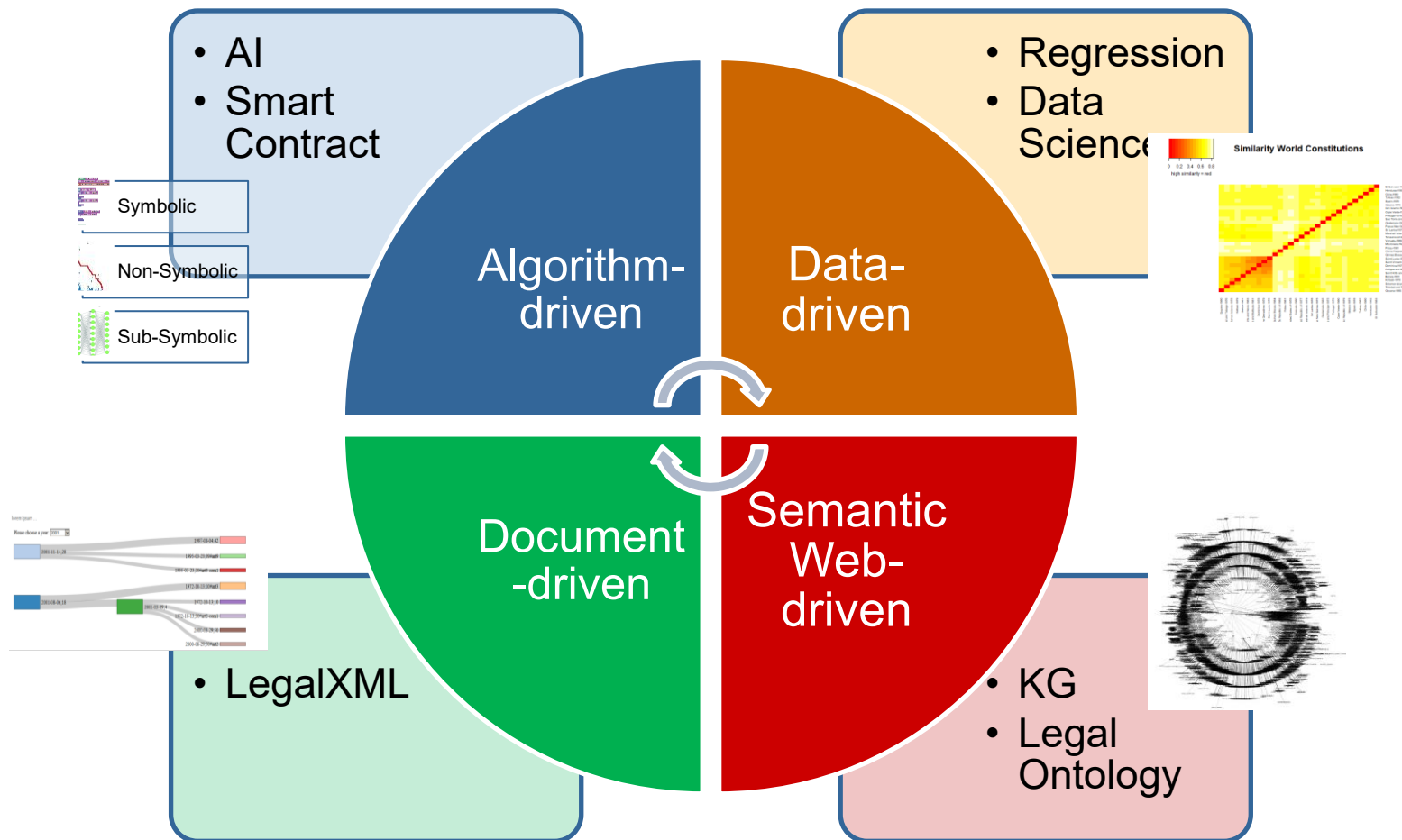
Argumentation/Justification

eGov Services



Hybrid AI for the Legal Domain

Content, Context, Semantic, Processing

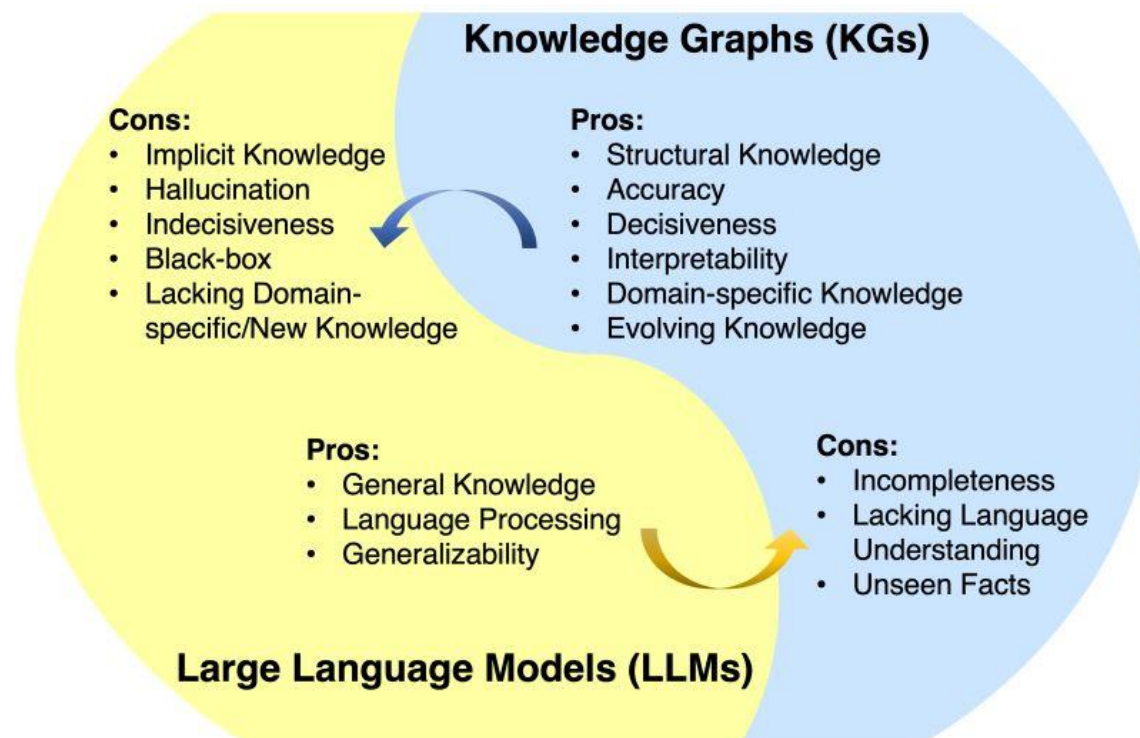
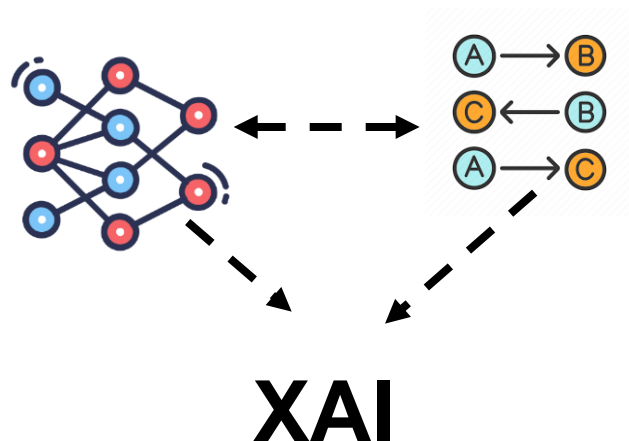


Neuro-Symbolic

Sub-Symbolic

AI

Symbolic AI



“White box” approach in AI

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☒ I agree to these Terms of Service

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b) to publish papers, articles, preprints, slides, presentations, videos, teaching material, programs of events, calls for papers and volumes and collections thereof;

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1.2 If you use the Service on behalf of a company, organisation, or other entity, then:

a) “you” includes you and that entity, and

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AKOMA NTOSO

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

OASIS LegalXML

LegalRuleML



Lawyer-readable



Machine-readable



Human-readable



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.

Success stories of Akoma Ntoso OASIS

- Senate of Brazil (AKN in Portuguese, acts, bills, point-in-time)
- Library of Congress of Chile (bill and debates)
- European Parliament (bill and amendments)
- Publication Office of EU
- EU Commission
- Kenya Law Report (xml standard for document management)
- South Africa Laws.Africa
- US Code Consolidation service (code management)
- UK legislative.gov.uk (access to legislation and LOD)
- Hong Kong City State (xml standard for document management)
- Federal Chancellery of Switzerland (publication in gazette)
- **FAO pilot cases on standards and Basic Texts**
- **WHO – all the resolutions and decisions**
- Parliament of Albania
- Senate of Italy (bill publication in open data)
- Regione Emilia-Romagna, Toscana, Bolzano, Liguria, etc.



AT4AM for All

LegisPro^{web}
Web-Based Legislative Editing

Lime

SimpLEX

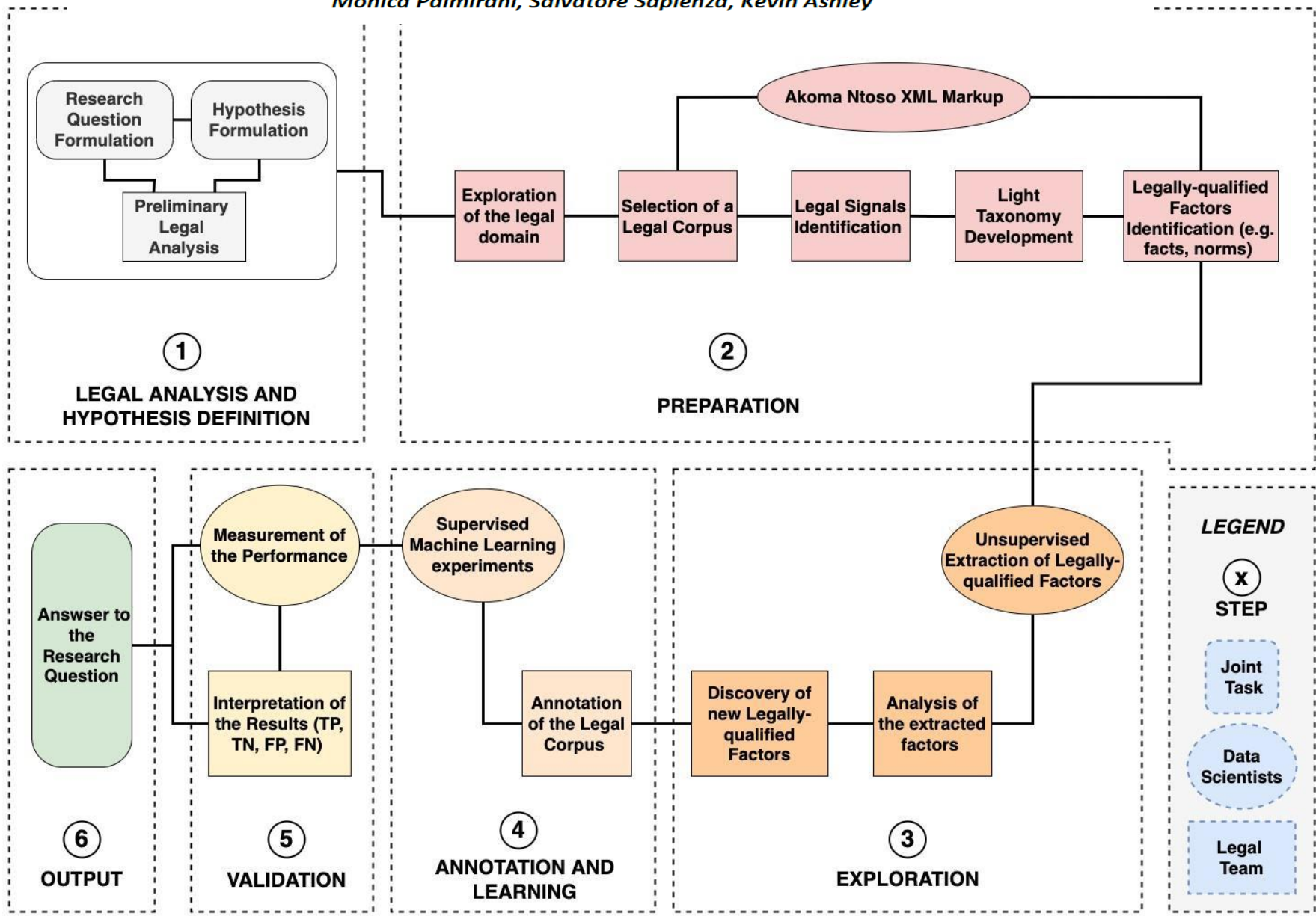


 Akoma Ntoso for the United Nations System

Guidelines for the mark-up of UN normative, parliamentary and judicial documents

A Hybrid Artificial Intelligence Methodology for Legal Analysis

Monica Palmirani, Salvatore Sapienza, Kevin Ashley*



Conclusions

- **Methodology** based on the theory of law is fundamental
- Legal domain hypothesis and **problem-solving approach**
- *Rule of Law* included *by-design*
- Autonomy, Transparency, **Explicability** and Accountability are crucial for Parliaments
- **Hybrid AI**: LegalXML, RAG, embedding, KG, QA, Agentic AI, legal reasoning can mitigate the critical issues
- **HCI and UX** interface for a dialogue with the end-user is essential for Human-in-the-loop, Human-on-the-loop, XAI
- **Agentic AI** helps to create a virtuous loop, and it is not so longer necessary to have **code-first or words-first approach**

**Nothing is more
practical than a
good theory.**

Ludwig Boltzmann



thank you
for your attention

*Monica Palmirani -
monica.palmirani@unibo.it*