

Artificial Intelligence in Law: Trends and Experience

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Third Information Security Education Day (ISED)
April 28, 2017

About the Speaker

- Background: **Software Requirements, Regulatory Compliance**
- Senior Scientist, SnT / UL (**2012 - present**)
- Scientist,
Simula Research Laboratory, Norway (**2009 - 2012**)
- Visiting Researcher,
University College London, UK (**2009**)
- PhD in Computer Science,
University of Toronto, Canada (**2008**)



About the Talk

- Focus will on **technical aspects**
- Ethical implications not covered
 - AI limitations will be briefly mentioned

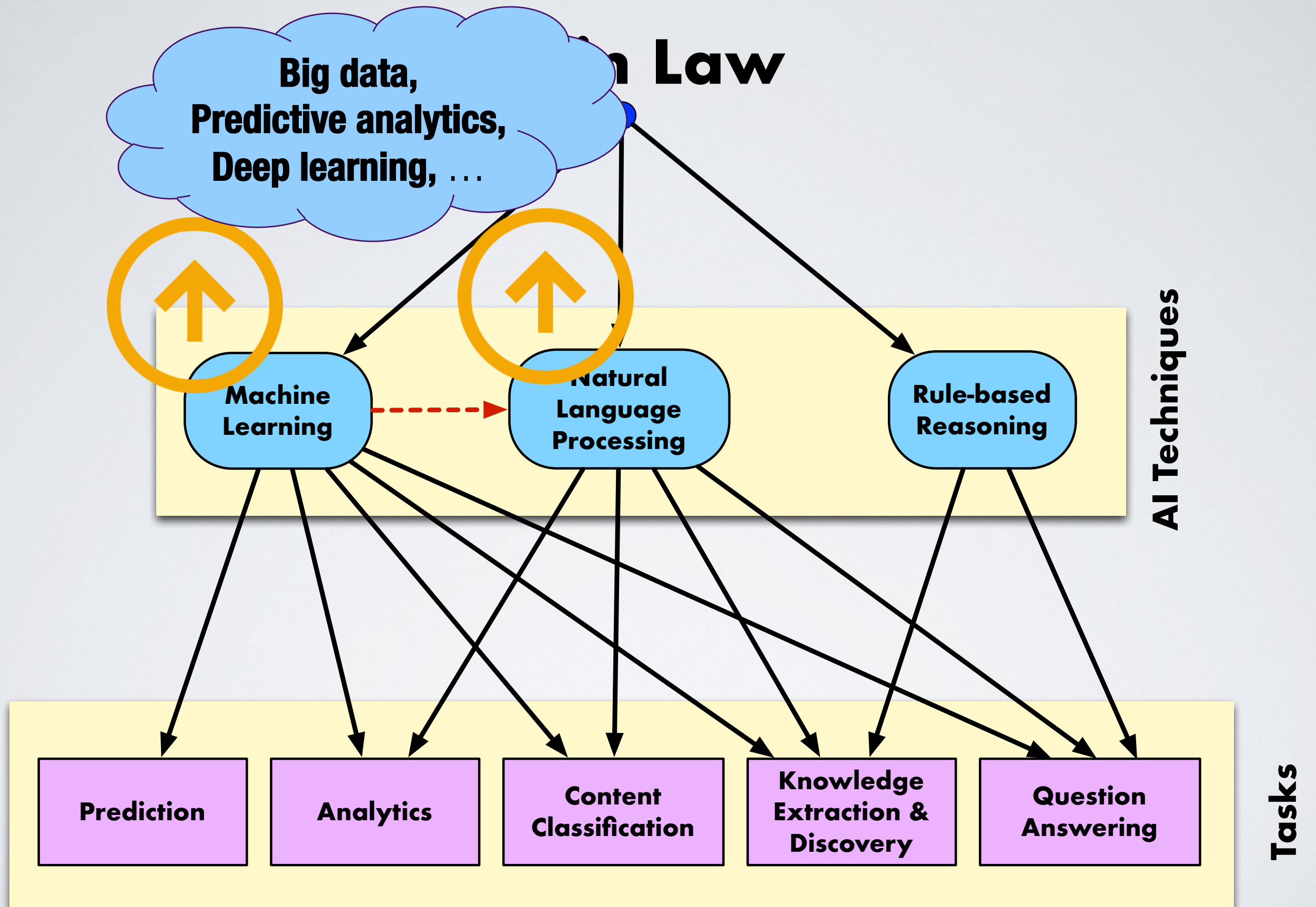


Agenda for this presentation:

- Overview of AI in Law
- Emerging trends in Legal Compliance Tech
- Practical experience from projects



AI in Law: A Whirlwind Tour



The Tides have Turned

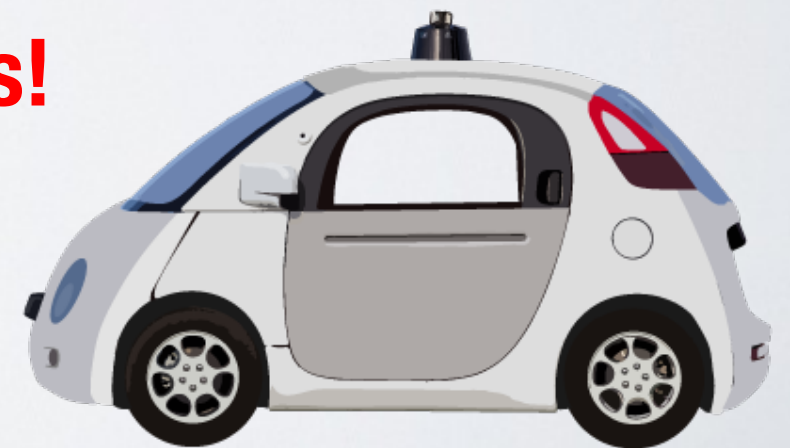


Geoffrey Hinton accepting the 2016 IEEE/RSE James Clerk Maxwell Medal for pioneering and sustained contributions to machine learning

“The crazy approach is winning”

BUT

- **Machine Learning (ML) relies critically on training data**
 - Biased/incomplete training → Biased/incomplete results
- **Results from many ML algorithms are opaque**
 - Outcomes are not readily justifiable (going against due diligence)
- **Training not a replacement for rules and norms!**
 - Do you want your car to learn the traffic rules on the road?



Rule-based AI here to stay

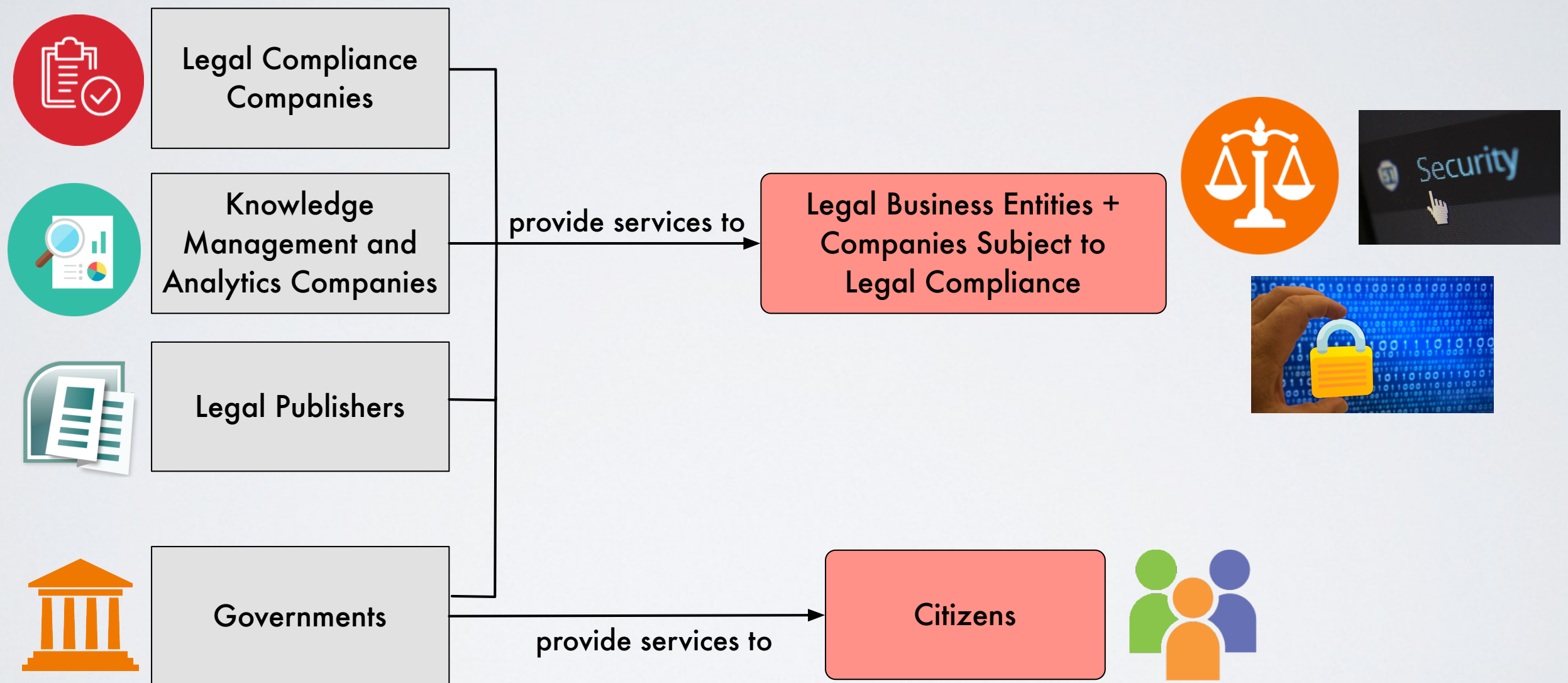
- Rule-based AI no longer the “only kid on the block” but will thrive and continue to play an important role
- Business process automation critically depends on rules
 - For example, eGovernment IT applications
- ML and NLP can facilitate the extraction of rules
- The way rules are represented nevertheless needs to improve
 - ... to cover the **knowledge gap between legal and IT experts**

Hype but not only ...

- Lot of hype about ML and NLP, but not all of it is hype
- Seeing through the hype can be difficult
- **IT professionals can help, BUT ONLY IF** they understand the business context and needs of the legal profession
- **Fostering interaction between legal and IT experts is key**
- Disruptive technologies are emerging, like it or not
- **Not joining the band wagon will almost certainly mean falling behind**

What is on the horizon?

Legal Tech Value Chain



Services

- Audits and legal advisory
- Identifying artifacts that need to be reviewed for compliance after a change in laws and standards
- Automated generation of legally-compliant documents (compliance by construction)
- Auto-completion of legal forms

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Govt.



Publishing



Legal Comp.



KMA

Emerging Applications (1/3)

- **Intelligent search (for information relevant to compliance)**



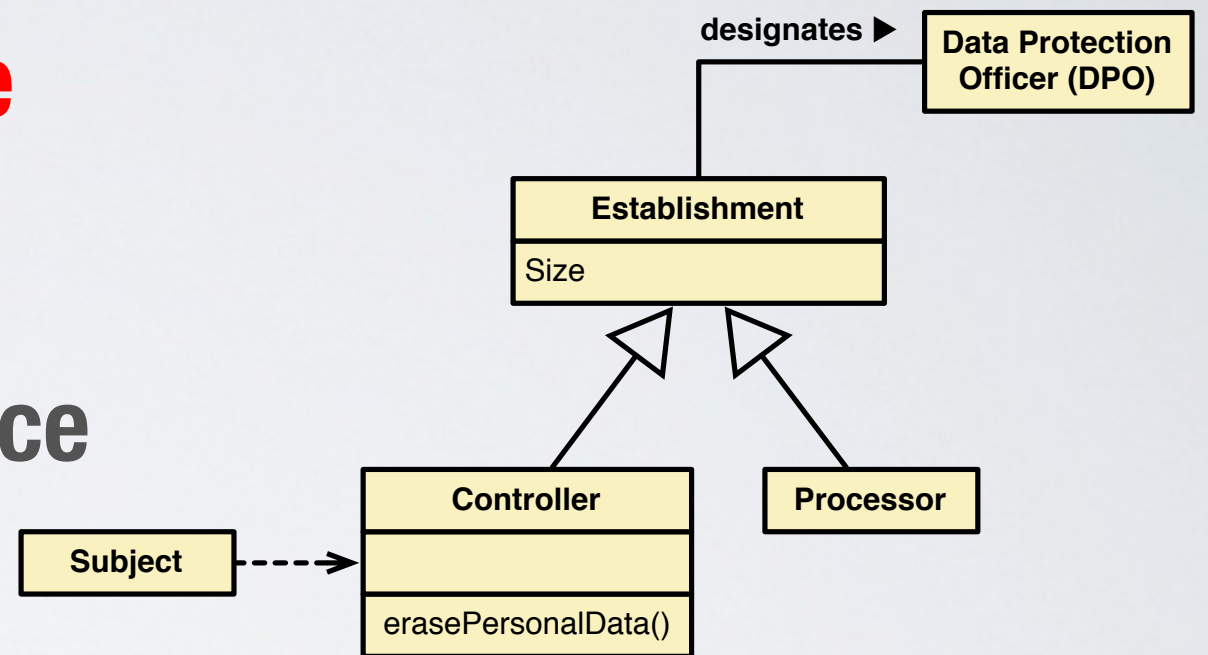
The Secret Rules of Modern Living: Algorithms, BBC (2015)

Emerging Applications (2/3)

- **Legal metadata extraction**
 - Identification of the structure and semantics of legal provisions
- **Continuous compliance monitoring**
 - Identification of drifts and deviations from normal practice
- **Legal prediction**
 - Litigation risk prediction
 - Court outcome prediction

Emerging Applications (3/3)

- **Transparency and due diligence**
 - Electronic capture of legal interpretations and compliance evidence



- **Automated support for change impact analysis**
 - The way changes affect other legal documents
 - The way changes affect the satisfaction of business goals and policies

From the Trenches: Project Experience



Context

- Collaborative research projects with:
- **SCL**: Central Legislation Department
- **ACD**: Tax Authority
- **CTIE**: Government's IT Centre



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Digital
Lëtzebuerg



Fonds National de la
Recherche Luxembourg

Acknowledgements

SnT

- **Lionel Briand**
- **Nicolas Sannier**
- **Ghanem Soltana**
- **Morayo Adedjouma**

Govt. of Luxembourg

- **John Dann**
- **Thierry Prommenschenkel**
- **Ludwig Balmer**
- **Marc Blau**
- **Anne-Catherine Ries**
- **Jean-Paul Zens**

Project 1

Metadata Extraction (SCL)

- **Lack of human resources for annotating the plethora of existing legal texts with metadata**
- Metadata is important prerequisite for machine analyzability
- Problem applies to virtually any government and jurisdiction
- **Existing solutions are almost entirely manual**
 - ... and further, the results are imprecise

Comparison

Without AI

With AI

Article 713 [En savoir plus sur cet article...](#)

Modifié par [LOI n°2016-1087 du 8 août 2016 - art. 109](#)

Les biens qui n'ont pas de maître appartiennent à la commune sur le territoire de laquelle ils sont situés. Par délibération du conseil municipal, la commune peut renoncer à exercer ses droits, sur tout ou partie de son territoire, au profit de l'établissement public de coopération intercommunale à fiscalité propre dont elle est membre. Les biens sans maître sont alors réputés appartenir à l'établissement public de coopération intercommunale à fiscalité propre.

Si la commune ou l'établissement public de coopération intercommunale à fiscalité propre renonce à exercer ses droits, la propriété est transférée de plein droit :

1° Pour les biens situés dans les zones définies à l'article L. 322-1 du code de l'environnement, au Conservatoire de l'espace littoral et des rivages lacustres lorsqu'il en fait la demande ou, à défaut, au conservatoire régional d'espaces naturels agréé au titre de l'article L. 414-11 du même code lorsqu'il en fait la demande ou, à défaut, à l'Etat ;

2° Pour les autres biens, à l'Etat.

Article 714 [En savoir plus sur cet article...](#)

Créé par Loi 1803-04-19 promulguée le 29 avril 1803

Il est des choses qui n'appartiennent à personne et dont l'usage est commun à tous.

Des lois de police règlent la manière d'en jouir.

Art. 2. (L. 13 mars 2009) En matière civile et commerciale, personnelle ou mobilière et en matière immobilière, il est compétent en dernier ressort jusqu'à la valeur de 2.000 euros, et à charge d'appel jusqu'à la valeur de 10.000 euros.

Le taux de compétence est déterminé par la seule valeur du montant principal, à l'exclusion des intérêts et frais.

Art. 3. (L. 25 juin 2004) Par dérogation à l'article précédent, il connaît en dernier ressort jusqu'à la valeur de 1.250 euros et à charge d'appel à quelque valeur que la demande puisse s'élever:

1° des actions pour dommages faits, soit par les hommes, soit par les animaux, aux champs, fruits et récoltes; des actions relatives à l'élagage des arbres et haies, et au curage soit des fossés, soit des canaux servant à l'irrigation des propriétés ou au mouvement des usines;

2° des actions concernant les vices rédhibitoires des animaux domestiques;

3° de toutes les contestations entre bailleurs et preneurs relatives à l'existence et à l'exécution des baux d'immeubles, ainsi que des demandes en paiement d'indemnités d'occupation et en expulsion de lieux occupés sans droit, qu'elles soient ou non la suite d'une convention;

4° des contestations relatives à la réparation des dommages causés à la propriété superficielle par l'exploitation des mines, minières et carrières.



Shallow metadata ←



Cross reference not
handled systematically ←



Extremely tedious



Requires expensive resources



Detailed, accurate metadata



Adherence to standardized
metadata schemas



Reduced manual effort

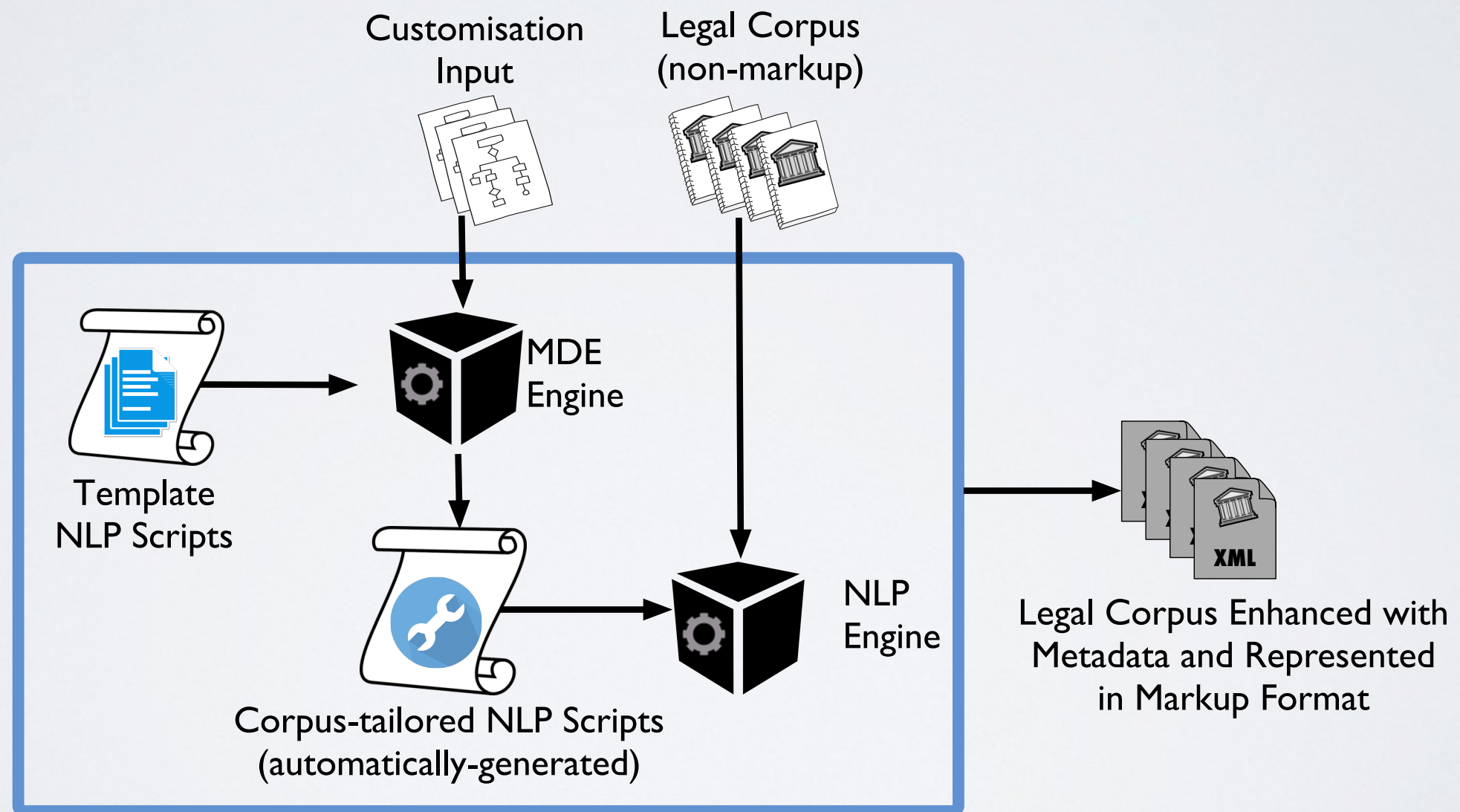


Cost-effective use of expertise

Our Solution: ARMLET



- **Toolbox for legal metadata extraction**



Application to Luxembourg Codes

	High-level divisions							Sub-article divisions				Total
	Part	Book	Title	Chap.	Sec.	Subsec.	Art.	Par.	Alinea	L/N/D	CRs	
Civil Code	3	3	36	131	154	43	2316	33	3474	361	997	7551
Commercial Code	0	4	21	14	12	0	261	14	489	85	232	1132
Penal Code	0	2	11	86	46	0	671	64	1094	471	912	3357
Code of Criminal Procedure	0	3	15	33	36	7	529	542	1315	325	1065	3870
New Code for Civil Procedure	2	11	90	19	42	30	1322	206	2316	342	821	5201
Total	5	23	173	283	290	80	5099	859	8688	1584	4027	21111

Results for Structural Metadata

- **>20,000** structural markup elements
- Including **>5000** articles and **>100** cross references
- **~91%** of generated codes are **fully correct**
- **~8%** of codes need **tweaks** (often minor)
- **5 codes** need to be **manually inserted**



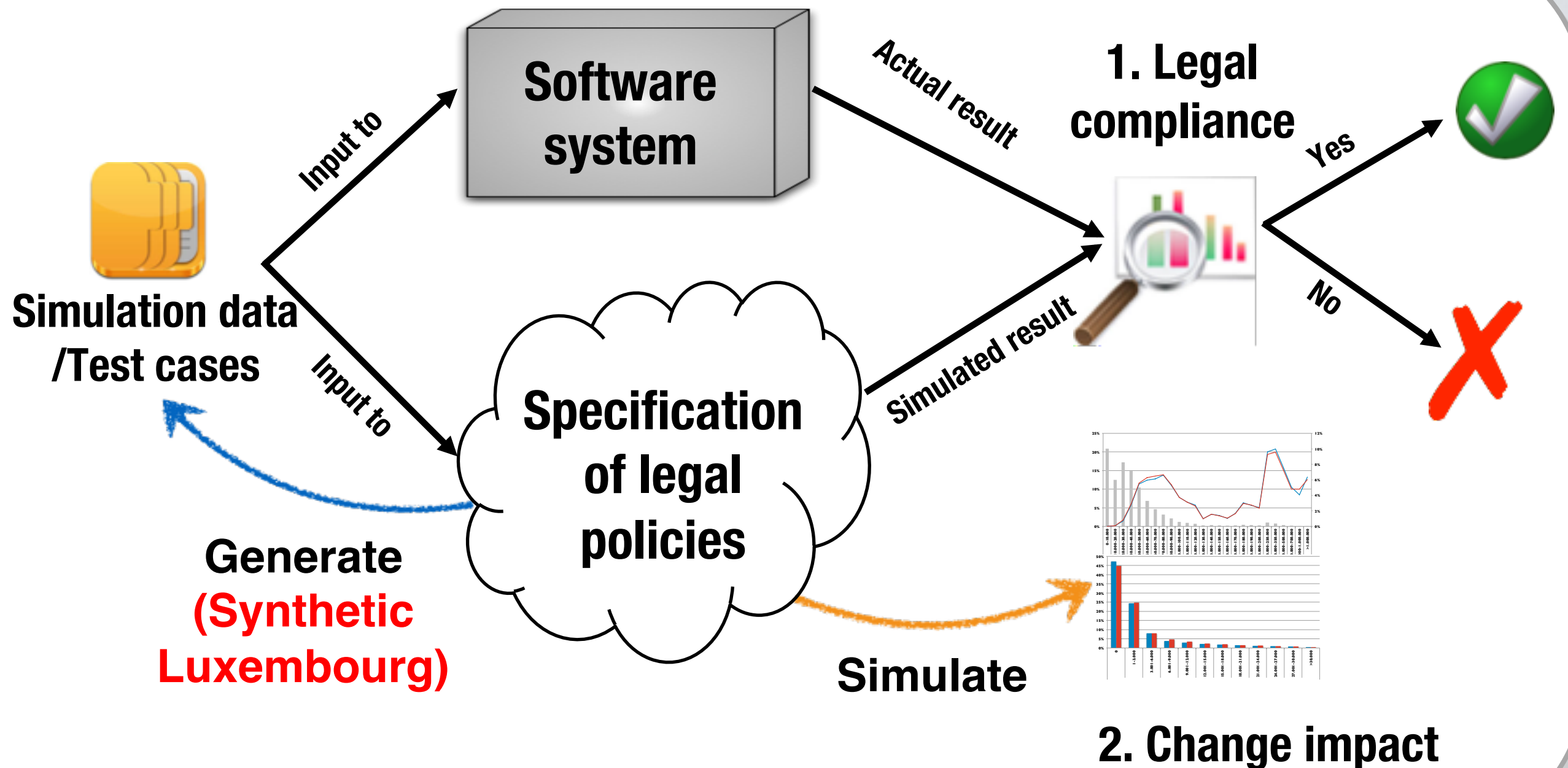
The five codes have been already published on Legilux!

Next Steps

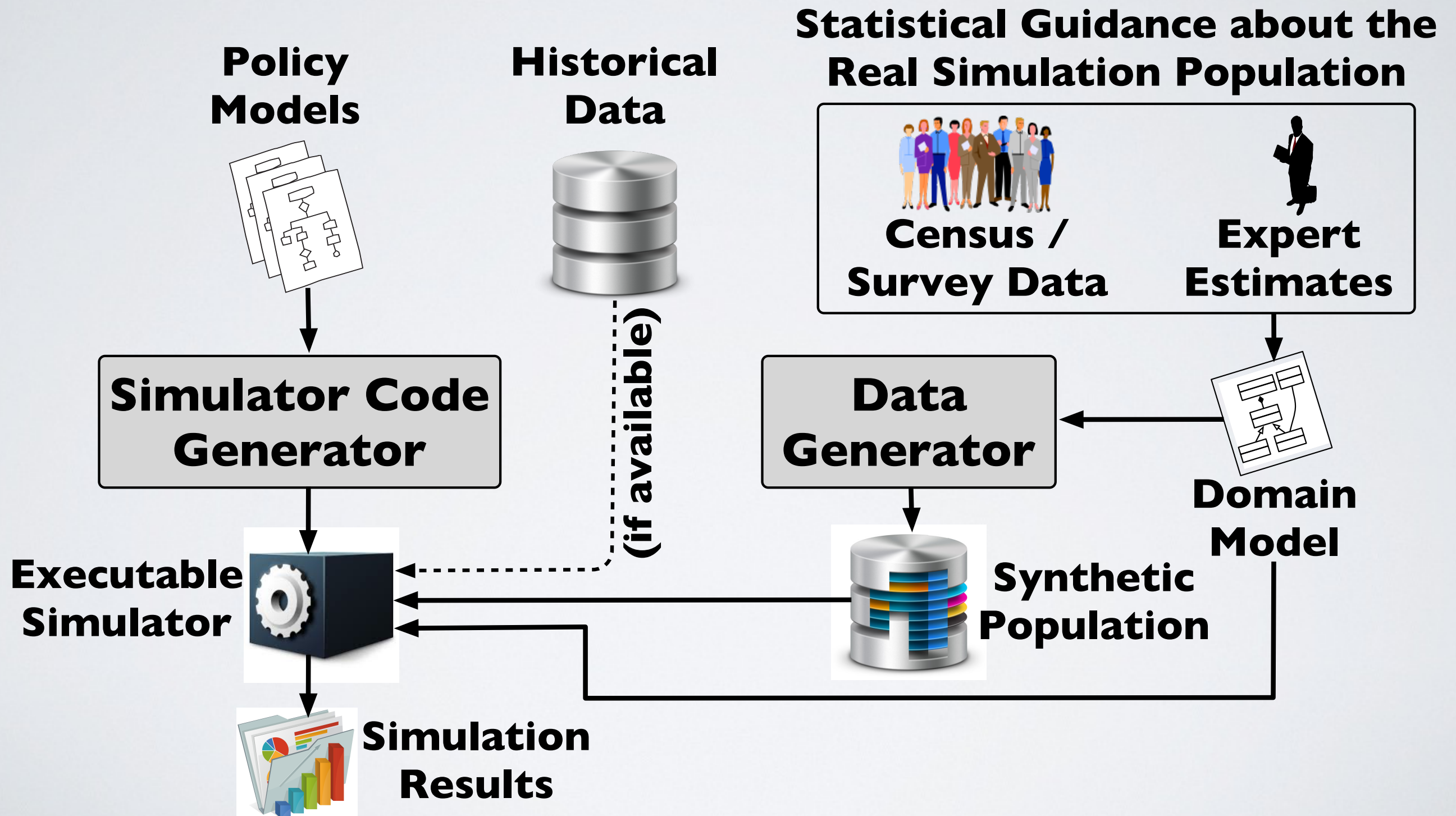
- **Ongoing research with SCL on semantic metadata**
 - **Conditions, consequences, modalities (rights, permissions, obligations), interpretation, case law**
- **Turning ARMLET into a mature product**

Project 2

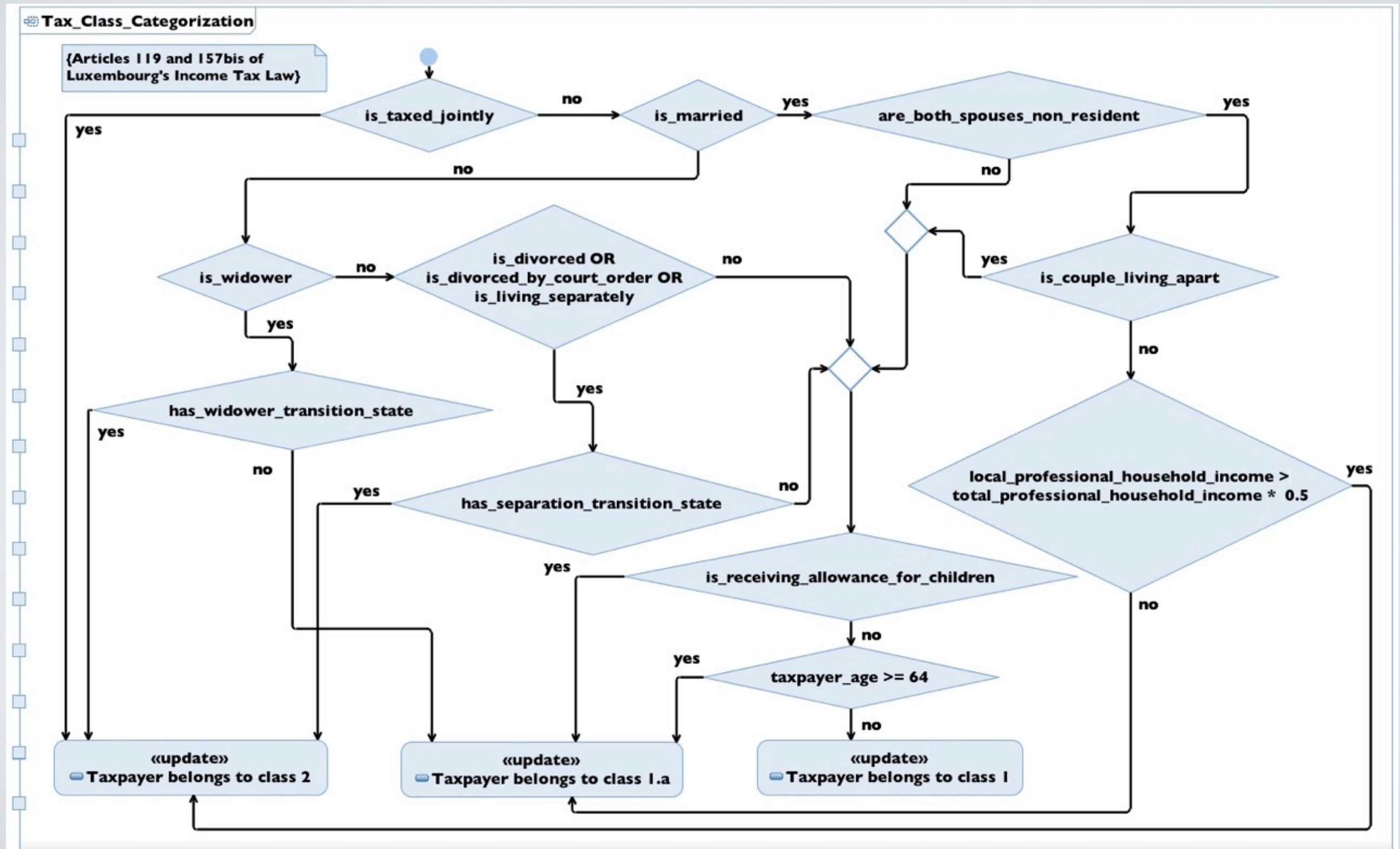
Policy Simulation (ACD, CTIE)



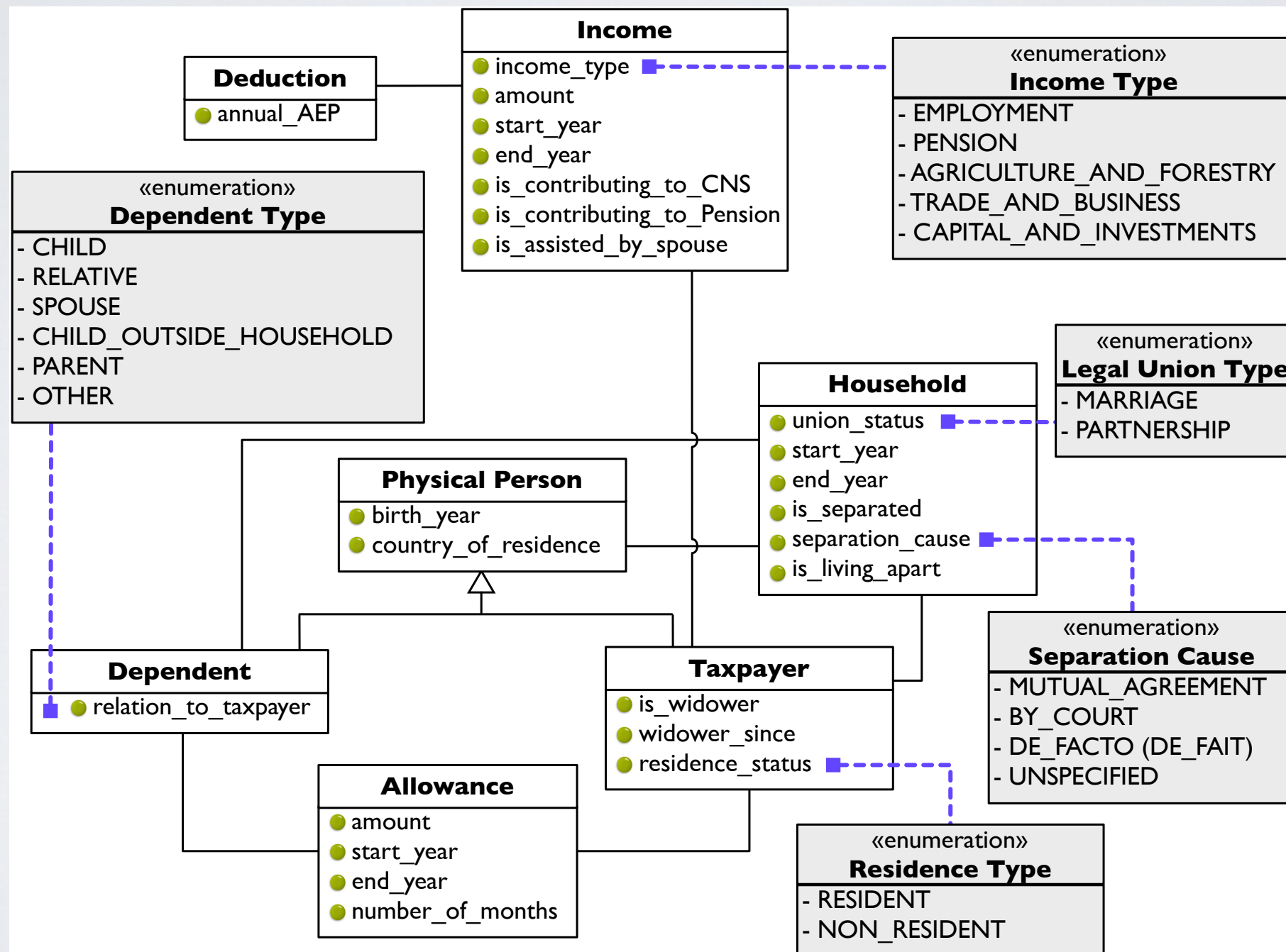
Approach



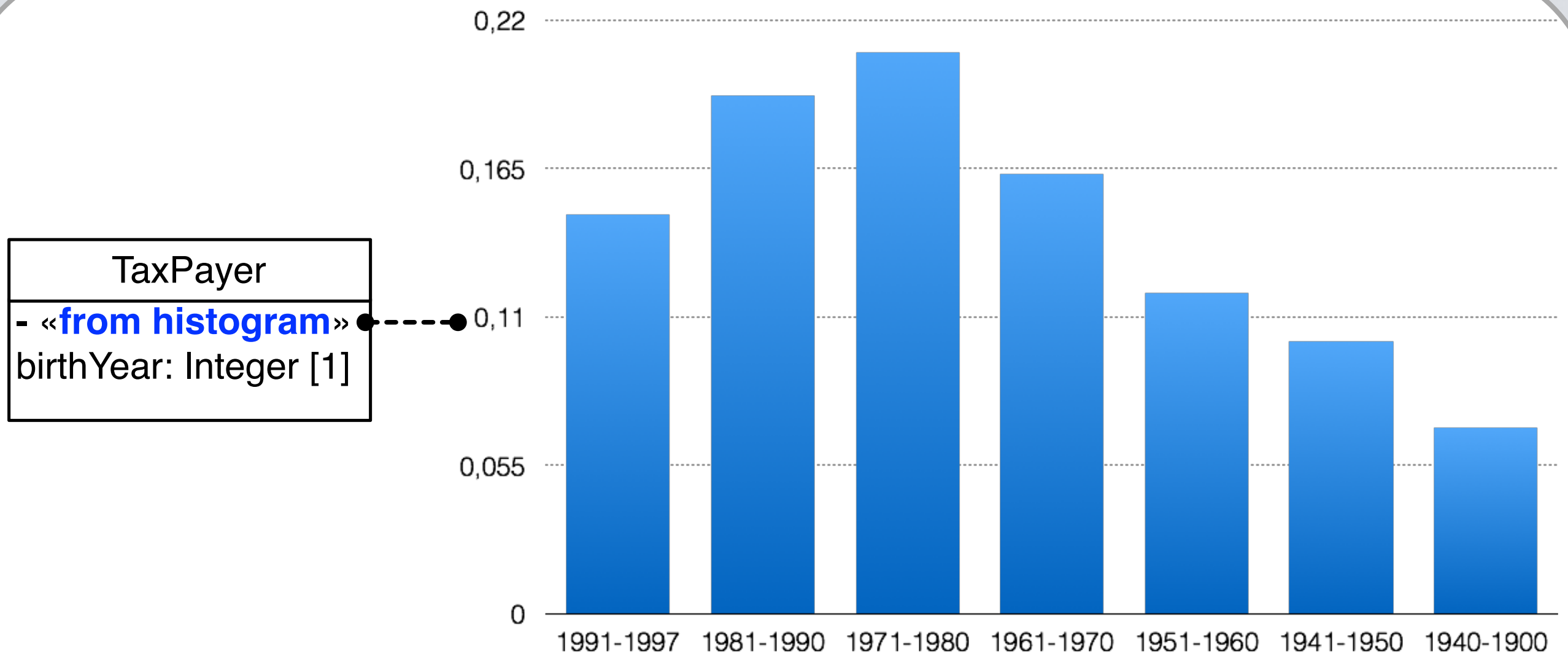
Example Policy Model



Domain Model for Personal Income Taxes (Withholding)



Modeling Population Characteristics

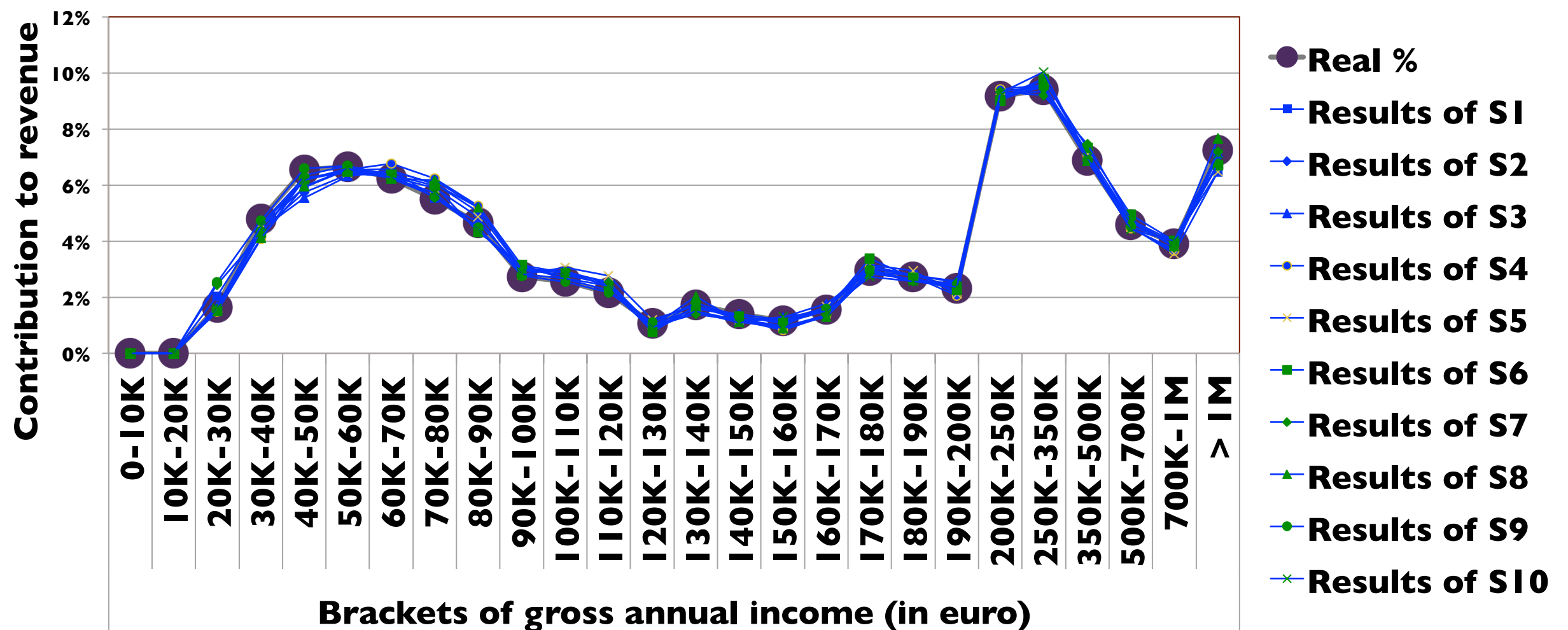


Source: STATEC, Luxembourg



Fidelity of Policy Models and Synthetic Population

- Ran the simulator over 10 synthetic populations



- Results are closely in line with available tax statistics

Change Impact Analysis

- Used the simulator to predict the impact of a proposed policy change: **abolishment of joint taxation**
- Impact on distribution of tax classes
- Impact on household taxes
- Impact on Government revenue
- Detailed report (targeted at legal professionals) available



Next Steps

- **Applying the simulation approach in other domains**
 - Social security, healthcare, corporate taxes
- **Developing more advanced AI functions**
 - **Example:** Prediction of undesirable situations such as loop holes and violation of operating principles

Concluding Remarks

Outlook

- **Role of AI in law is to provide analytical assistance and cut mundane work in regulatory compliance activities**
- **Reduction of effort will allow IT and legal professionals to concentrate their scarce time on what matters the most**
- **As far as regulatory compliance goes, the function of IT and legal professionals is unlikely to be disruptively changed anytime soon, BUT**
 - **The way these professionals access and use legal knowledge is already undergoing disruptive change**

Keeping Up to Date

Examples:

- Thomson Reuters Digests
- Stanford's CODEX
(<http://codex.stanford.edu>)
- Computational Legal Studies Blog
(<https://computationallegalstudies.com>)



Computational Legal Studies™

Thank You!

Questions?