Law Making Environment
Model driven semantic drafting and annotation of legislative sources

ITTIG-CNR
http://www.ittig.cnr.it

LME project
http://nir.ittig.cnr.it/lme
LME: CNR module

- Department / Dipartimento: ICT
- Project / Progetto: Data mining, Ontologie e Web Semantico
- Commessa / Commessa: Knowledge Discovery and Data Mining
- Module / Modulo: Model Driven Legislative Drafting

- design of prototypes of innovative applications for orders of Public Administration to ITTIG (e.g. XML Legislative Editor 2003)
  progettazione di applicazioni prototipali per commesse della PA all’ITTIG (e.g. editore legislativo XML, 2003
Legal Information and Communication Technology:

- Applications to be used in legal processes (legislative, judicial, administrative)
  
  Applicazioni informatiche da usare nei processi giuridici (legislativo, giurisprudenziale, amministrativo)

Legal Knowledge Engineering:

- Modeling legal process and concepts to be used as applications components
  
  Modellazione di processi e di concetti giuridici, per inserirli utilmente in applicazioni informatiche (LICT)
Automation of legislative information: two approaches

Automazioni nell’informazione legislativa: due approcci

- **Data Knowledge Extraction (ex post)**
  - Dal documento alla conoscenza
  - Drafting (Semantic mark up)

- **Self Explaining Documents (ex ante)**
  - Dalla conoscenza al documento
  - Meta Drafting (Model driven legislative drafting)

Some data have particular relevance and some producers have enough resources to be able to highlight and integrate authentically (ex ante) the knowledge contained in them. This is the case of legislative sources. Hence the ex ante solution is more convenient.

Certi dati hanno particolare rilevanza e certi produttori abbastanza risorse da poter evidenziare e integrare autenticamente (ex ante) la conoscenza in essi contenuta. E’ il caso delle leggi. Qui la soluzione ex ante è più conveniente.
Epistemological promiscuity: indiscriminately mixing epistemological knowledge concepts and rules and domain knowledge in ontologies (Breuker and Hoekstra)

Modeling thematic profile of the laws
(static - ontological - semantic)
Entity: \(< What \ is \ it \ >\)
Entità: \(< Cosa \ è \ >\)

An ontology is a set of terminological definitions built around a taxonomic back-bone, while a framework is an assembly of concepts or types of knowledge that reflect recurrent patterns of use.

Modeling regulatory profile of the laws
(dynamic - epistemological - pragmatic)
Process: \(< How \ to \ do \ it \ >\)
Processo: \(< Come \ si \ fa \ >\)
CHAPTER II
OBLIGATIONS RELATING TO THE CONTROLLER
Article 7 (Notification)

1. <Obligation> <addressee> A <def> controller</def> <addresssee> <condition> intending <key>to process</key> <key>personal data</key> falling within the scope of application of this Act</condition> shall have <action> <key>to notify</key> <counterpartie> the <def> Garante</def> thereof, </counterpartie> thereof, </action> ... <Obligation>
LME: Introduction

- Semantic Mark Up: towards self-explaining legal texts
- Meta drafting: legal drafting support based on knowledge
Modeling legislative texts contents, as metadata, in two steps:

1. modeling dispositions (formal theory of the Disposition Argument model)
2. concept modeling (dispositions contents) such as thesauri, ontologies (ontoPrivacy - light ontology)
The Model of Dispositions
Formal/structural profile (standard NiR project)
- Law as a set of Articles (Articolato)
- considers a law text as made up of divisions (article, paragraph, etc.);
  describes the physical structure of a document;

Functional, semantic, pragmatic profile (Biagioli, 1997)
- Law as a set of Rules (Disposto)
- considers a legislative text as composed by elementary components called provisions (fragment of a regulation);
  it can be described by the Model of Provisions, in terms of provision types and their arguments;
- describes the logical structure of a document.
Article 7 (Right to Access Personal Data and Other Rights)

1. A data subject shall have the right to obtain confirmation as to whether or not personal data concerning him exist, regardless of their being already recorded, and communication of such data in intelligible form.
A legal text is a set of legislators provisions expressed in natural language

E.g.:
Fragment F of law N states a definition
Fragment F of law N is a fragment of type *definition*

We are after a theory of provisions which can offer a sufficiently structured set of meta-data!
## Dispositions: Constitutive

<table>
<thead>
<tr>
<th>Class</th>
<th>Disposition</th>
<th>Arguments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>definition</strong></td>
<td>term</td>
<td>definiendum</td>
</tr>
<tr>
<td></td>
<td>procedure</td>
<td>definiens</td>
</tr>
<tr>
<td><strong>creation</strong></td>
<td>establishment</td>
<td>addressee</td>
</tr>
<tr>
<td></td>
<td>organization</td>
<td>addressee</td>
</tr>
<tr>
<td><strong>attribution</strong></td>
<td>power</td>
<td>addressee</td>
</tr>
<tr>
<td></td>
<td>liability</td>
<td>counterpart</td>
</tr>
<tr>
<td></td>
<td>status</td>
<td>activity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>object</td>
</tr>
</tbody>
</table>
### Dispositions: Regulative

<table>
<thead>
<tr>
<th>Class</th>
<th>Disposition</th>
<th>Arguments</th>
</tr>
</thead>
<tbody>
<tr>
<td>action</td>
<td>right</td>
<td>addressee</td>
</tr>
<tr>
<td></td>
<td>duty</td>
<td>addressee</td>
</tr>
<tr>
<td></td>
<td>prohibition</td>
<td>addressee</td>
</tr>
<tr>
<td></td>
<td>permission</td>
<td>addressee</td>
</tr>
<tr>
<td>remedy</td>
<td>redress</td>
<td>addressee</td>
</tr>
<tr>
<td></td>
<td>violation</td>
<td>addressee</td>
</tr>
<tr>
<td>Class</td>
<td>Disposition</td>
<td>Arguments</td>
</tr>
<tr>
<td>-------------</td>
<td>---------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>application</td>
<td>inclusion</td>
<td>partition</td>
</tr>
<tr>
<td></td>
<td>exclusion</td>
<td>partition</td>
</tr>
<tr>
<td>modification</td>
<td>abrogation</td>
<td>partition</td>
</tr>
<tr>
<td></td>
<td>insertion</td>
<td>partition</td>
</tr>
<tr>
<td></td>
<td>substitution</td>
<td>partition</td>
</tr>
</tbody>
</table>
Many different theories of provisions are equally possible. There is no ultimate one.

Applications have the last word on the most appropriate one (the proposed ones are now under experimentation in LME)

However, we propose here a method which is independent of any concrete theory of dispositions that might be assumed!
Tables should be substituted by a formalism
Reasoning within the formalism should be tractable
Description Logic!
Widely used by the semantic web (OWL)
Well investigated meta-properties (e.g., complexity)
Tailored to represent the type of logical relations introduced in the tables above (e.g. being sub-type of; having an argument)

DL form a family of formalism for representing and reasoning with knowledge. The three main notions of DLs are: 

- **individual** representing object in the domain,
- **concepts**, describing set of individuals,
- **roles** binary relations between individuals.
## LME: Formalizing the theory of provisions

### Dispositions: Regulative

<table>
<thead>
<tr>
<th>Class</th>
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</tr>
</thead>
<tbody>
<tr>
<td>action</td>
<td>right</td>
<td>addresssee counterpart action object</td>
</tr>
<tr>
<td>duty</td>
<td></td>
<td>addresssee counterpart action object</td>
</tr>
<tr>
<td>prohibition</td>
<td></td>
<td>addresssee counterpart action object</td>
</tr>
<tr>
<td>permission</td>
<td></td>
<td>addresssee counterpart action object</td>
</tr>
<tr>
<td>remedy</td>
<td>redress</td>
<td>addresssee counterpart effect action</td>
</tr>
<tr>
<td>violation</td>
<td></td>
<td>addresssee counterpart penalty action</td>
</tr>
</tbody>
</table>

| action □ remedy □ action remedy □ remedy □ remedy □ action □ action □ action □ addresssee. T □ counterpart. T □ action. T □ object. T |

Carlo Biagioli, Fabrizio Turchi  
LME - Law Making Environment
<table>
<thead>
<tr>
<th>Correlation of type <em>Implicit rules</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. (obligation, addressee (k)) ⇔ (right, counterpart (k))</td>
</tr>
<tr>
<td>2. (obligation, counterpart (k)) ⇔ (right, addressee (k))</td>
</tr>
<tr>
<td>3. (obligation, action (k)) ⇔ (right, action (k))</td>
</tr>
<tr>
<td>4. (obligation, object (k)) ⇔ (right, object (k))</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Correlation of type <em>Complementary rules</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. (violation, addressee (k)) ⇔ (obligation, addressee (k))</td>
</tr>
<tr>
<td>2. (violation, action (k)) ⇔ (obligation, action (k))</td>
</tr>
<tr>
<td>3. (violation, object (k)) ⇔ (obligation, object (k))</td>
</tr>
</tbody>
</table>
Correlation weight $W_c$:

$$W_c = \frac{\sum_{i=1}^{N} A_i}{N}$$

$N =$ number of arguments involved in the correlation

$$A_i = \frac{Ck_i}{Tk_i}$$

$Ck_i =$ number of common keywords between $A_i$ and $A'_i$ involved,

$Tk_i =$ number of keywords of $A_i$
LME: Semantic Markup

Meta Data Semantic Markup
LME: implementation of the semantic markup

- Bottom up strategy
  1. from legal texts to knowledge
  2. manual strategy
  3. automatic or semi-automatic strategy

- Top down strategy
  1. from knowledge to legal texts
LME: Markup strategies

- no interpretation
- lightweight interpretation
- multiple markup:
  the dispositions belonging to the Change top class (Derogations and Modifications), are dispositions acting on the other provisions belonging to the Rule top class. Therefore derogations can be doubly marked up, as derogations and as provisions of the same type of the derogated provision.
<table>
<thead>
<tr>
<th>Liability</th>
<th>art.22 par.2</th>
<th>Activity</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Addressee</td>
<td>Public body</td>
</tr>
<tr>
<td>Permission</td>
<td>art.22 par.3</td>
<td>Action</td>
<td>Processing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Addressee</td>
<td>Public body</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Object</td>
<td>Sensitive date, juridical data</td>
</tr>
<tr>
<td>Procedure</td>
<td>art.22 par.4</td>
<td>Action</td>
<td>Processing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Addressee</td>
<td>Public body</td>
</tr>
<tr>
<td>Duty</td>
<td>art.22 par.4</td>
<td>Action</td>
<td>Updating</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Addressee</td>
<td>Public body</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Object</td>
<td>Sensitive date, juridical data</td>
</tr>
</tbody>
</table>
metaSearch: I.R. relied on semantic markup
Query: data controller (titolare) obligations regarding the data subject (interessato)

Result Set: article 52, paragraph 4 (first result set)

Expansion: implicit obligations, that is rights correlated by semantic relation

Demo query
Query: obligations about the assignment (cessione) of personal data

Result Set: article 16, paragraph 1 (first result set)

Expansion: violations, that is violations correlated by syntactic relation (explicit reference inserted by the legislator)

Same expansion: violations, that is violations correlated by semantic relation (without reling on an explicit reference)

Demo query
**Query**: data subject rights concerning the personal data communication data

**Result Set**: article 7, paragraph 1 (first result set)

**Expansion**: exceptions, that is exceptions correlated by semantic relation

**Demo query**
MetaPlan
Mark-up is obtained by means of a set of meta-data that classify natural language fragments of the text.

Meta-data do not stand alone, they are part of a network of (logical relationships with one another). They form a structured set.

If the mark-up is ex-post, the hidden structure of the text becomes explicit (in terms of those meta-data).

If the mark-up is ex-ante, the structure of the meta-data is directly inherited by the to-be-compiled draft. The structure of the meta-data is imposed on the text.

A well-structured set of meta-data guarantees a well-structured draft.
The Meta-Drafting planning module aims at turning over the traditional drafting process, providing facilities to firstly express the semantics of a legislative text, in terms of the functional profile, and only in a second phase, to organize the semantic components in a well-suited formal structure.
LME: metaPlan targets

• A semi-automatic rules builder based on Natural Language Processing (NLP generational type approaches)

• Finally we will get the following real results:
  1. prior formulation of authentic meta data
  2. automatic generation of titles partitions
  3. automatic construction of the text structure
  4. generation of fragments of provisions, if complex
  5. generation of whole provisions if simple.