Law, Social Intelligence, nMAS and the Semantic Web: An Overview

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Abstract. This introduction presents the principles and fundamentals of the AICOL scientific initiative and in particular the main contributions of the current volume, underlining the interdisciplinary approach and the variety of adopted methodologies.

Keywords: AI & Law, social intelligence, legal theory, complex systems, Semantic Web, legal ontologies, nMulti-Agent Systems.

1 Presentation

The outcomes from AICOL IV/V are compliant with different kind of objectives. Firstly, the aim is to introduce and develop models of legal knowledge, concerning its organization, structure and content, especially in order to promote mutual understanding and communication between different legal systems and cultures. By achieving more precise models of legal concepts —from multilingual dictionaries to taxonomies and legal ontologies, namely formal models of legal conceptualization— we intend to enhance our comprehension of legal cultures, identifying their commonalities and differences. Moreover, by increasingly profiting from computer support in managing legal knowledge, we aim at both drawing on convergences and bridging differences for deeper understanding of today's legal challenges.

Secondly, focus is on the comparison of multiple formal approaches to the law, supporting both internal and the external viewpoints on legal phenomena: logical models, cognitive theories, argumentation frameworks, graph theory, complexity theory, cybernetics, game theory, etc. The purpose is to stress possible convergences in the realm of, say, conceptual structures, argumentation schemes, emergent

behaviors, learning evolution, adaptation, simulation, and more. By promoting a fruitful interaction between some of the most relevant contributions to AI research on contemporary legal systems, attention is drawn to the most recent research in the field, e.g., the use of sentiment analysis in crowd-sourcing for anticipating geopolitical crises, e-discovery in legal firms and tribunals, gamification in legal environment, and so forth.

Thirdly, AICOL addresses the ways in which the current information revolution impacts on basic pillars of today's legal and political systems, in such fields as e-democracy, e-government, transnational governance, etc. What is at stake concerns changes and developments that occur at a rapid pace, as the law transforms itself, in order to respond and progress alongside the advances of technology. Consider some canonical representations, such as Hans Kelsen's idea of the law as a set of rules enforced through the menace of physical sanctions: "if A, then B" [1]. Whilst the ubiquity of the internet has magnified the troubles with the enforcement of the law, the legitimacy of the state's action is contested, as states claim to unilaterally regulate extraterritorial conduct by imposing norms on individuals who have no say in the decisions affecting them. In addition to the traditional hard and soft law-tools of governance, such as national rules, international treaties, codes of conduct, guidelines, or the standardization of best practices, it is no surprise how the new scenarios of the information revolution increasingly suggest that the dynamics of current societies can be governed through codes, architectures, and AI systems, so as to embed legal rules and safeguards into technology.

In this new socio-technological context, issues of legal reasoning, concepts, sources of the law, different meanings of complexity have to be taken into account. As to the models of legal knowledge and formal approaches to the law, special attention should be paid to that which Seth Lloyd, drawing on research by Charles Bennett in the 1980s and, furthermore, Ray Solomonoff and Gregory Chaitin in the 1960s, dubs as "logic depth" [2]. Here, the subject matter appears increasingly complex as the quantity of information grows and its theoretical compression decreases, in order to represent such object via a computer program. Then, the notion of complexity which refers to some formal approaches to the law that aim to address the emergence of spontaneous orders, e.g., work in social intelligence and crowd-sourcing, should be traced back to seminal research by Friedrich Hayek and the very difference between deliberate human arrangements and unintentional orders [3]. What makes this side of the law specifically complex has to do with the ways in which only the dynamics of social interaction, rather than the master plan of legislators and policy makers, can achieve satisfactory results in several fields of today's legal systems. Remarkably, this is also the opinion of several experts in information and communication technology (ICT)-law, that conceive the internet as a "self-governing realm of individual liberty, beyond the reach of government control" [4].

Finally, some facets of this latter research in spontaneous orders, much as work in legal theory and on how the information revolution affects current legal and political systems, suggest a further notion of complexity. Think about some crucial concepts, as responsibility, enforcement, validity, representation, deliberation, and more, and how they are changing. As a consequence of complexity, finding the right balance

between, say, "representation and resolution, while implementing the agreement to agree on the basis of ethical principles that are informed by universal human rights, is a current major challenge for liberal democracies in which ICTs will increasingly strengthen the representational side" [5]. From this latter point of view, we may say that the more an issue is complex, the more it affects, or impacts on, the whole infrastructure and environment of the system with which we are dealing.

Clearly, such challenges can be properly tackled at the previous levels of complexity. Whereas the profound transformation of such concepts as, say, democracy and representation, challenges the system as a whole, it also affects models of legal knowledge as well as formal approaches to the law. Therefore, the level of complexity does not hinge on whether focus is on the different ways in which legal reasoning, or legal concepts, or the sources of the system, work. Rather, what is crucial is how we address such issues, according to a given problem. Thus the multiple topics addressed in the AICOL meetings and their results are here presented in connection with four main parts, stemming from the broader conceptual ones and ending up with the specific field of crowdsourcing and ODR: (i) Social Intelligence and Conceptual Legal Models, (ii) Legal Theory, Normative Systems and Software Agents, (iii) Semantic Web Technologies, Legal Ontologies and Argumentation, (iv) Crowdsourcing and Online Dispute Resolution (ODR).

2   The Quest for Social Intelligence

As it is classically defined in social and cognitive psychology, *social intelligence* can be conceived as the mental ability to understand the motives, emotions, intentions and actions of other people and to motivate and influence the behavior of (groups of) people. Still, this definition does not focus specifically on the artificial, technical, cultural, economic and political interfaces that the emergence of Web 2.0 and 3.0 fosters and anchors.

Collective intelligence is one of the most intriguing dimensions of the so-called "social web" *emotional intelligence* —the ability to produce and use empathy— is another one. And we can figure out that economic and institutional organizations are also related to this formula: "Social Intelligence is all about understanding and combining Social Media (Networking) and Business Intelligence".[1] These different aspects, which are present as information processing, can be modeled for institutional design combining the result of empirical findings, technical languages, and formal representations.

This volume aims to discuss how social intelligence approaches can shed light on AI and law, legal theory, argumentation, conflict resolution, the semantic web, and normative multi-agent systems. This can be done in all steps of the legal process — drafting, contracting, judging— and all uses of social and legal norms —applying, arguing, implementing, and enforcing the law. Besides, there is an ongoing discussion about modeling the evolving concept of law within the new environment of the

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[1] http://www.scoop.it/t/social-intelligence

Internet of Things and the new governance and ethical challenges faced by such institutions as the EU (data protection, security, identity, etc.).

Three myths have to be faced. The first is the belief that individual and collective knowledge are different in nature. The second is that artificial agents never will reach the level of complexity of human beings. The third is that only humans can be legally ruled, for law is a special way of existence of regulatory systems.

Admittedly, individual and collective behavior show different features, although the comprehension of social intelligence means understanding individual intelligence. However, a multi-agent notion of social intelligence suggests that we should go beyond the individual level of analysis. Therefore, social intelligence includes both the objective effects of social action and the cognitive properties of individual and social action, much as the relationships between the two [6].

Modeling from this theoretical perspective, several consequences follow for the legal design and shaping of both artificial and natural societies. Perhaps the most important consequence is that legal and institutional designs are not only a way to figure out an autonomous realm of norms, but a theoretical way of understanding how normative, institutional and legal systems emerge and work interactively in social and artificial contexts.

Moreover, along with the developments of the Cloud, the Internet of Things and the new stages of the Semantic Web, we are all living in a *hybrid* and *intertwined* world, in which it makes no sense making a divide between a virtual and non-virtual reality. Social contexts are interactively shaped. In the words of Castelfranchi [7]: "No collective action would be possible without shared and/or ascribed mental contents. (...). Our social minds for social interactions are coordination artifacts and social institutions". It is clear that legal models and legal theory cannot be set apart.

3   Normative Systems, Software Agents

Quite recently, Pablo Noriega, Julian Padget, Harko Verhagen, and Mark d'Inverno [9] have proposed a general tripartite view that highlights the interplay between the institutional models that prescribe the behavior of participants, the corresponding implementation of these prescriptions and the actual performance of the system. Among the main challenges for the development of Artificial Socio-Cognitive Systems they expressly mention the *synergy* with philosophy of law —and, we might add, legal theory:

> A systematic study of ASCS will most likely require the convergence of several disciplines. The topic of social coordination is currently being inspected (within the Sintelnet project) from different standpoints: games, social simulation, analytical sociology, cognitive and social psychology, formalisms for informal phenomena, crowd-based applications, institutional theory and philosophy of law. These activities are already fostering collaborations with a strong synergistic component. This experience points in the direction of new academic communities that are likely to spawn conferences and periodic publications and eventually develop curricula and training.

This is a shared vision. Some time ago, Boella, van der Torre and Verhagen [9] set ten challenges for normative Multi-Agent Systems (nMAS) being developed towards this interactive direction. There are further proposals. Gordon, Governatori and Rotolo [10] have focused on requirements for rule interchange languages following the normative structure of core legal theory. Others, mainly authors committed to agreement technologies, are opening up the field to contracting, negotiating and decision-making theories [11].

With the Web of Data, attention to legal details and regulatory constraints are increasingly a broad research topic. Some, e.g. Espinosa and Fornés [12], have surveyed the state of the art on the intersection between privacy and MAS. They have classified the risks regarding the information-related activities that these studies aim to prevent in terms of information collection, information processing, and information dissemination.

We can assume these legal components as external constraints coming from the outer environment: on this basis, privacy, data protection and security constitute an inescapable challenge for the design of institutions and regulatory models. Yet, from the inner point of view, non-standard deontic logic and legal argumentative reasoning appear crucial to integrate all these different aspects into a coherent and consistent stance. This twofold side of the problem is also at stake with recent developments of the Semantic Web.

4   Semantic Web Developments

The Semantic Web has entered into a new stage due to the need for semantic linked data developments. The so-called 5 Star Linked Open Data settled by Tim Berners-Lee [13] refers, according to W3C, to an incremental framework for deploying data. The 5 Star Linked Data system is cumulative, and each additional star presumes the data meets the criteria of previous steps. We reproduce here for the sake of clarity this already well-known scheme [14]:

☆ Publish data on the Web in any format (e.g., PDF, JPEG) accompanied by an explicit Open License (expression of rights).
☆☆ Publish structured data on the Web in a machine-readable format (e.g., Excel instead of images).
☆☆☆ Publish structured data on the Web in a documented, non-proprietary data format (e.g., CSV, KML instead of Excel).
☆☆☆☆ Publish structured data on the Web as RDF (e.g. Turtle, RDFa, JSON-LD, SPARQL) using URIs to identify things.
☆☆☆☆☆Link your data to other people's data to provide context.

According to the ongoing research carried out by the W3C, Star Linked Open Data includes an Open License (expression of rights) and assumes works as publications on the public Web [14]. But we should notice that this opening to the public space of published data and metadata immediately raises legal problems in private and

commercial law —licensing, patents, intellectual and industrial property.— much as concerning the relationship with global markets and global governance. This means that the notion of *public* space is at stake too.

Very likely, the opportunity to choose the specific way of publishing will contribute to the redefinition of this notion. Open source cannot be confused with public space, and the regulation of data and the protection of citizens are deeply intertwined. Rights, institutions and governance are the different dimensions for a new legal framework in which different jurisdictions collide. Again, the connection between law and the Semantic Web constitute an inescapable new challenge for the community that can be grasped either from an external or from an internal point of view.

Law has been usually taken into account by Semantic Web developers as a requirement or preliminary condition for web services and regulatory ontologies. Accordingly, languages for expressing rights (Rights Expression Languages, i.e. REL, plus ODRL, ODRL-S, MPEG-21...), privacy, identity, authentication, integrity, security, and trust, legally or institutionally oriented, are increasingly a hot topic in the Web of Data [15]. However, the technicalities of such languages as REL, ODRL, etc., are not simply neutral. Rather, they contribute to transform and reshape the meaning of the rights and interests assumed as preliminary conditions or requirements for the development of the Semantic Web.

5   On the Content of this Volume

This new volume of the AICOL-Workshops addresses the issues put forward in the former sections. As already stated, and for the sake of clarity, we have divided the papers into four main sections: (i) Social Intelligence and Legal Conceptual Models, (ii) Legal Theory, Normative Systems and Software Agents, (iii) Semantic Web Technologies, Legal Ontologies and Argumentation, (iv) Crowdsourcing and Online Dispute Resolution (ODR). It should be noticed that these categories are not discrete: several papers can fit into the nMAS section and into the Semantic Web part as well, for they build up ontologies or delve into semantic languages. This only shows the close relations between them.

5.1   Social Intelligence and Legal Conceptual Models

Ugo Pagallo addresses the sources of law, and connects some features of the information revolution to social intelligence and to some legal mechanisms to avoid lack of protection (burdens of proof, duty of knowledge, and limits to the use of self-enforcing technologies). Stemming from a broad legal perspective, Fernando Galindo advocates for interdisciplinary approaches in the making of ICT regulations. He raises the specific problem of the consequences of the introduction of Smart Cities and design of services that will constitute the infrastructure of those Cities. These two contributions stress the need for a flexible understanding of the way legal norms and rules should be conceived, applied and eventually enforced in these new

environments. The paper by Eleonora Bassi, David Leoni, Stefano Leucci, Juan Pane, and Lorenzino Vaccari, in the context of the Trentino Open Data Project, proposes a semantic open source stack to preserve data protection and privacy rights for publishing anonymised deliberations edited with the NormeinRete software for government open data.

Following the same line of arguments, Pompeu Casanovas and John Zeleznikow stress the importance of ethical principles —mainly fairness— for Online Dispute Resolution. They raise the comparative question of the synergy and structural coincidence between general information principles in several fields (privacy, data protection, linked open data...), stemming from the related notion of Semantic Web Regulatory Models. Then, the paper by Andrea Ciambra and Pompeu Casanovas suggests a way of building composite indicators to test the institutional strengthening of such models.

5.2   Legal Theory, Normative Systems and Software Agents

The second section points at the connection between legal theory, normative systems and software agents. As already shown, one of the urgent issues to be solved is how to technically connect legal conceptual models, deontic logic and normative Multi-agent Systems (nMAS).

The first two papers raise the issue of dynamicity and time in legal theory. They both focus on legal normative knowledge. Monica Palmirani and Luca Cervone state that modifications in legal norms create a very intricate network of citations, not always easy to be tracked and properly accessed. They are providing a theoretical model based on indexes for measuring the complexity of each modificatory action, and they set as well a diagram system to visualize indexes of the resultant legal order per year and document. The authors have created an active impact indicator per document, to reveal the dynamic complexity introduced by modificatory actions in the legal order. Similarly, Michał Araszkiewicz asserts in his paper that the meta-information concerning admissibility of certain changes to legal systems and, specially, to constitutional principles, should become a standard element of databases of statutory legal knowledge. This proposal is presented as a contribution to the theory of hybrid legal knowledge systems, encompassing both rule-based and case-based elements, and tracing its roots back to some previous works already carried out in the tradition of AI & Law modeling.

The remaining three papers are centered on software agents. Taking inspiration from some existing models coming from socio-legal and social object theories, Alessio Antonini, Cecilia Blengino, Guido Boella and Leendert van der Torre tackle the inner relation between legal norms, principles and roles. They set a social ontology to represent entities related to normative systems to be encased into Eunomos, a norm management system to facilitate the spotting and management of legal content using legal statutes or cases. The next paper, by Guido Boella, Silvano C. Tosatto, Sepideh Ghanavati, Joris Hulstijn, Llio Humphreys, Robert Muthuri, André Rifaut, and Leendert van der Torre, introduces Eunomos, along with LEGAL-URN. The former processes the normative content of texts and legal documents.

The latter, factors in legal requirements as part of strategic business planning. The combination of both systems is able to technically reconstruct, reason and cope with the problem of business regulatory compliance, which is one of the classic problems in legal theory.

The last paper of this section is a legal one. Attention is drawn to the analysis of criminal liability of software agents. Pedro Freitas, Francisco Andrade and Paulo Novais consider several solutions (i.e. Perpetration-via-Another Liability Model, Natural-Probable-Consequence Liability Model, Direct Liability Model), to conclude that the inner conceptual structure of criminal law gains benefit from the challenge raised by software agents.

5.3   Semantic Web Technologies, Legal Ontologies and Argumentation

The third section of the volume deals with the development of the Semantic Web, the construction of legal ontologies, and their use in legal argumentation and in the regulation, interoperability, management and monitoring of web services and linked data.

Knowledge acquisition, first. Natural Language Processing (NLP) provides an array of techniques and tools to be applied to legal corpuses and databases. The paper by Makoto Nakamura, Yasuhiro Ogawa, and Katsuhiko Toyama, aims at the production of a Japanese legal terminology for translators, with proper explanations and accessible citations. Surface pattern recognition, extraction of legal terms and definitions, XML tagging, and annotation are used. The paper shows some experimental results on the proposed methodology.

In the second contribution to the Semantic Web framework, Marcelo Ceci presents a formalization of legal concepts and argumentation patterns occurring in judicial decision making. In praise of this objective, he uses a set of metadata associated with judicial concepts and an ontology library. He is currently combining the features of WBL2 with description logics and defeasible rules in the framework of Carneades argumentation graphs. The paper depicts the reasoning path and legal interpretations carried out by the judge in a specific case.

The third paper of this section, by Elie Abi-Lahoud, Leona O'Brien, and Tom Butler, addresses the problem of regulatory compliance, not from the normative system point of view —as faced by Boella and van der Torre in this same volume— but from the ontological perspective. Authors show the existing need of representing the legal knowledge of the complex field of financial documents and regulations, leaning on ontologies. They identify a list of challenges to be faced that require human subject matter expertise in their understanding. It is suggested the use of Semantics of Business Vocabulary and business Rule (SBVR), supported by a series of examples from a completed experiment on a piece of regulation from the US Bank Secrecy Act.

The last contributions to this section consist of ontological applications to solve interoperability problems in two main EU Projects. Enrico Francesconi, Ginevra Peruginelli, Ernst Steigenga, and Daniela Tiscornia introduce the CODEX Project. This project concerns file and exchange cross-border legal procedures between all the

European states. The authors offer an overview of the e-Delivery platform architecture. The latter is a Large Scale Pilot project in the domain of e-Justice, to help citizens, professionals and administrations with an easier access to transnational justice. The second EU Project, CAPER, has the aim to provide interoperability to European Law Enforcement Agencies (police) so as to foster fast and secure exchange of information to fight organized crime. Jorge González-Conejero, Rebeca Varela-Figueroa, Juan Muñoz-Gómez, and Emma Teodoro present the European LEAs Interoperability Ontology (ELIO), which models the structure of legal crimes according to the Europol taxonomy, and the knowledge directly gathered from LEAs.

5.4   Crowdsourcing and Online Dispute Resolution (ODR)

Among the most thrilling areas in social technology during the past five years are those concerning citizen participation and democratization mechanisms. The volume closes with two contributions from the well-settled field of ODR, and two further papers from the emergent field of crowdsourcing.

Context, environment, ambiance, offer the first key. Paulo Novais, Davide Carneiro, Francisco Andrade, and José Neves, look at the function of sensitive-context technology and its importance for conflict resolution and ODR. They address the issue of improving the communication layer of the framework, by including contextual information that is meaningful for the conflict management and the resolution process. Josep Suquet, Pompeu Casanovas, Xavier Binefa, Oriol Martínez, Adrià Ruiz, and Jordi Ceballos present the prototype of CONSUMEDIA, an ODR platform with some functionalities such as the recognition of emotions in the mediation room that might enhance the professional work of mediators.

The third paper of Marta Poblet, Esteban García-Cuesta and Pompeu Casanovas addresses the different definitions of crowdsourcing and offers a review of the state of the art platforms applied in the different phases of disaster management. A model based on a taxonomy of crowdsourcing roles and tasks is suggested.

Last, but not least, Nuno Luz, Nuno Silva and Paulo Novais propose a method to define a set of ground rules for the assisted construction of workflow definition ontologies from domain ontologies. That is, a method for the construction of micro-task workflows from legal domain ontologies.

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