

ARTIFICIAL INTELLIGENCE AND LAW

Hugo C. Hoeschl; Vânia Barcellos

E-Gov, Juridical Intelligence and Systems Institute – Ijuris

Keywords: Artificial Intelligence (AI); Natural Intelligence (NI), Law; Information of Technology

Abstract: This article intends to make an analysis of the intersection between Artificial Intelligence (AI) and Natural Intelligence (NI) and its application in the scope of Right. The impact caused by the Information Technology, methodologies and techniques used by the main systems developed in the last years and which the elements for the development of intelligent applications in the legal domain, with the aim of demonstrating the capacity to manipulate the knowledge properly and, being so, systemizing its relations, clarifying its bonds, to evaluate the results and applications. There is a real need of new tools that conciliate the best of AI and NI techniques, generating methods and techniques of storage and manipulation of information, what will reflect on law and justice.

1. INTRODUCTION

According to Carnelutti [7] “to discover the rule of legal constructing, science does not have, of course, other ways beyond the senses and intelligence. Intelligence is nothing but the capacity to learn, to apprehend or to understand, to interpret and, mainly to adapt the factual situations. On the one hand, we have all this systematization of Law, using NI, its evolution, its technical, historical and social conditioning; on the other, we have the vertiginous evolution of the technology of the computer sciences, which have an search field dedicated of to the reproduction of human abilities, handicrafts as well as intellectual capacities, which is AI.

The present study intends to start with the elements for the development of intelligent applications in the legal domain (section 2), demonstrating the intersection between AI and the NI, applied to Law (section 3). It intends to evaluate how the research is getting on, in a world-wide context (section 4), we will illustrate (section 5) the application of AI in Law through some empirical procedures adopted by the author and his team (section 5).

2. ELEMENTS FOR THE APPLICATION OF AI TO THE LAW SPHERE

The AI sphere has been studied academically since the 1950s, but it has generated an increasing interest nowadays because of the arising of practical commercial applications.

Researches in AI are related to areas of application that involve human reasoning, trying to imitate it and performing inferences. According to Savory[22], these areas of application that are generally enclosed in the definitions of AI include, among others: specialized systems or systems based on knowledge; intelligent / learning systems; understanding / translation from natural language; understanding / voice generating; analysis of image, scene in real time and automatic programming.

Notice, then, an introductory and superficial vision, about how artificial intelligence can be defined [18]: “Artificial intelligence - The field of the computer sciences that intends to perfect the computers endowing them with some peculiar characteristics of human human intelligence, as the capacity to understand natural language and to simulate the reasoning in uncertainty conditions”.

The following are important aspects of AI, as Rabuske [21], among others: development of heuristical methods for the solution of problems; representation of knowledge; treatment of natural language; acquisition of knowledge; artificial reasoning and logics and tools. Amongst its main applications, we have the following: mastering systems; processing of natural language; recognition of standards; robotics; intelligent databases; test of theorems and games.

To make use of intelligent techniques and to try to develop computational tools endowed with logic or structured in cases, in order to assist in the study of legal data, involves another difficult task, which is, to analyze the form chosen by men to communicate and to materialize its norms: the codification of the word in abstract symbols and rigorous grammar rules.

The study and development of any system of automatic and intelligent treatment of the legal information involves, basically, two tasks: the

treatment of the natural language and the search of new techniques of storage.

In the first one, the structure of a mechanism, which reads texts and, properly guided, identifies a series of relevant characteristics for the user, in some specific stages. It must search superficial and static references, as dates, names, numbers, etc; to identify subjects, subjects and sub-subjects and, finally, to detect conclusions and lessons, highlighting them, obviously, from other functions.

In the second task, it is good to inquire about the return to the origins of the language. i.e.: the first forms of writing were pictographic, and, in the computational scope, the development of languages and interfaces are in allowing the use of icons (pictographic forms) [12], a more comfortable and practical means of communication than orthography.

This is allowing to idealize a significant advance in communication, according to which “written texts will give place to mental images that present real as well as symbolic objects and emphasize the interaction and the experience in detriment of the passive learning” [12].

3. ARTIFICIAL INTELLIGENCE vs. NATURAL INTELLIGENCE

In the sense of searching, in the practical sphere, this evolution announced, has a powerful referential: the intersection between NI and AI, where it is possible to try to conciliate the processing speed of the second and sophistication of the first one, as pointed by Epstein [11].

Artificial intelligence, in the delimited context - without damage of the already already presented definition - can also be understood, in a still very primary vision, as “the set of techniques used to try to carry through automatons adopting behaviors similar to the ones of human thought”, as pointed by Morvan (apud Epstein) [11].

We know that NI is inferior to AI in the capacity of search and the examination of options, but superior in refined and percipient tasks, such as making analogies and to creating metaphors.

Thus, a mechanism that combines NI and AI techniques, intending an adequate manipulation of natural language, allows the identification of ideas of a legal text.

However, it is important to emphasize that a step in the searching direction, the body of a writing piece, in what a person “thought”, or either, theirs ideas and conclusions, is teleologically linked to the desire of searching what a person really “felt” when analyzing the subject on which they wrote.

3.1 Reasoning's figures

Is important to emphasize that AI it is a figure typical of the information technology, practically molded by it. For the delineation of the intersection pointed, we will soon devote attention to some figures linked to NI, as the analogical reasoning, existing before computers [18]:

Analogical reasoning - A form of knowledge in which the dynamics of a phenomenon of the real world – such as aerodynamics of an airplane which is intended to make - is understood from the study of a model of the phenomenon. One of the biggest contributions of the computer sciences was to reduce costs (and to increase convenience) of analogical reasoning.

The reasoning based on some case is something almost as old as the human habit of “to walking forward”. However, we are dealing with a tool of artificial intelligence that uses such nomenclature, being able to be defined as a “methodology”, which has as a basic characteristic to search the best solution for a current situation in previous experiences in previous experiences, applying the already consolidated knowledge and whose effectiveness was already validated.

Such procedures, derived from the information technology, has an evident similarity to a traditional figure of the legal reasoning, analogy, one of the most efficient and pertinent instruments for the integration of the commands of law.

According to Bobbio, the analogy can be defined as follows [3]: “we understood by “analogy” the procedure by which a not-regulated case is attributed the same discipline than to a similar regulated case.... The analogy is certainly more typical and the most important interpretative procedures of a certain normative system.; it is the procedure by means of which the called trend of each legal system to become is explained to enlarge itself beyond the cases expressly regulated.”

According to Bobbio, “To be able to come to a conclusion, that is, to make the attribution to the non-regulated case of the same legal consequences attributed to the similar regulated case, there is a need of not any similarity between the two cases, but a relevant similarity, is necessary to ascend from the two cases to a quality that both have in common, that is at the same time the very reason by which those and not other consequences had been attributed to the regulated case”.

Other figures resemble the presented context, as the extensive interpretation and the syllogism, with which the analogy cannot be confused. The syllogism has a vertical mechanism of drawing conclusions, while the analogy and the extensive interpretation have a horizontal resource. But, even though analogy and extensive interpretation are next to one another and

horizontalized, they are significantly different from each other, pointed also by the very author [3].

This difference causes a strong impact on the construction and modeling of intelligent systems in the legal area, since the proposal is not the construction of systems that generate norms, but that facilitate its application (at least for the time being).

The comparison between institutes demonstrates the importance of the analysis of the structuralized logical processes around the reasoning of a specific area, and demonstrates also, that the logics has much to contribute with artificial intelligence – even in systems based on cases -, being exactly this one of the most favorable aspects of the intersection pointed between AI and NI. This comparison has the purpose of demonstrating that the approach of these institutes tends to produce good results, as well as the viability of the intersections, of AI with the NI, as well as of the figures of reasoning derived from the technology of information with those particular to the legal universe.

4. STATE OF ART IN THE INTERNATIONAL SCENERY

We focus on the scientific production in the area of artificial intelligence and law in the International Conference of Artificial Intelligence and Law - ICAIL, edition carried through in Oslo, Norway. In this context, the following works are distinguished:

Towards adding knowledge to learning algorithms for indexing legal cases, Bruninghaus[6]. The authors mainly ratify important basic concepts in the scope of the development of intelligent systems for the legal domain - those structured in cases - as, for example the high cost and the slowness of the manual representation of concrete situations. A classification based on boarding was used in the Smile System, constructed by the authors, to locate prompt situations in legal texts, in a automatic way. A controlled vocabulary and linguistic information were integrated to the system with an algorithm of machine learning, important allies in the task of surpassing the traditional difficulties of language.

Bankruptcy case law: a hybrid IR-CBR approach, Elhadi and Tibor [10] describe a work of combination between retrieval of information (information retrieval, IR) and CBR, with a modeling based on the procedures according to which the legal operators effect its research techniques as a parcel of the procedural dialectic, suggesting, specifically, that the experiences accumulated by the professionals of the legal domain are used in the modeling of the system.

Some observations on modeling case based reasoning with formal argument models, Bench-Capon [2] warns the international community about the importance of conciliating cases and norms in the modeling of a system for this type of application, affirming that “the truth on the subject is that both are essential”.

The evaluation of legal knowledge based system, Stranieri and Zeleznikow [23] perform important premises on the evaluation of systems based on the legal knowledge, affirming that strategical evaluations of systems that operate in a so complex domain as the legal one are difficult because of the specificity of the systems, considering a model of evaluation with neural nets, referenced by the binoms “structural/functional” and “ qualitative/ quantitative” to evaluate the answers emitted by a system.

Dialectic semantic for argumentation frameworks. Jakobovits and Vernier [15] proposed a formalist study of dialogues, where a dialogue is seen with a shock between two people, initiated by the proponent who defends the proposed thesis. Carrying through an examination of the argumentative criteria and the different types of dialogues, the authors consider to provide a semantics correspondence allusive to the blocked dialogue.

Precedent, deontic logic and inheritance. Horty [14] considers the establishment of some connections between reasoning based on precedents and deontic and monotonic logics He supports that deontic logics acts as a priority sensitive reasoning in a norms conflict, reformulating and simplifying a reasoning model based in Ashley’s precedents, according to the deontic logics.

AI techniques for modeling legal negotiation. Bellucci and Zeleznikow [1], the authors centralize the study in the introduction of the development of an algorithm that uses methods of AI to support the production of a business decision, using a form of cognitive mapping called “bi directed fuzzy cognitive maps”.

The integration of retrieval, reasoning and drafting for refugee law: a third generation legal knowledge based system. Yearwood and Stranieri [25]. The authors had developed a structure for the construction of arguments that includes more than 200 arguments, in contribution with the Refugee Review Court of Australia. The process of construction of these arguments requires the integration of retrieval of literal information (IR) with reasoning.

Justice: A judicial search tool using intelligent concept extraction. Osborn and Sterling present the modeling of a system based on legal knowledge called “Justice”, whose target is to retrieve previous cases. It uses concepts of conceptual retrieval of information, conceptual summarization, analysis automatized statistics and informal document conversion for formalized semi-structured representations.

A demonstration of a legal reasoning system based on teleological analogies, text in the which Kakuta and Haraguchi [16], using a structure called GDA (Goal-Dependent Abstraction), the authors analyze an exemplary situation judged by the Supreme Court of Japan, ahead of two consistent doctrinal trends, demonstrating how the system can become an important aid in the task of evaluating and to revise interpretations of norms.

Agents and norms: how to fill the gap?, Falcone and Sartor [9] affirm that two specific structural approaches are important to the work described: 1. That of the legal theory and related computational applications, especially in the areas of specialist legal systems, normative reasoning and juridical diagnostic; e 2. That of the theory of the multiagent systems (MAS) and the related computational applications, especially in the areas of computerized cooperative work (to computer supported cooperative work, CSCW). The most important aspects are the following: language and its formalism; reference theories (legal philosophy and deontic philosophy, revered by the theory of the agents); targets (models of legal institutions, systems of legal information); rhetoric philosophy and the norm concept.

Norms in artificial decision making, Boman [5] effected a study on independent artificial agents programmed to represent and to evaluate vacant or inexact information, with the characterization of agents with a production method of decision in real time, at risk or uncertainty, finishing for presenting a model of “constraining action” using norms.

Prescribed mental attitudes in goal-adoption and norm-adoption. In this paper, with a theoretical approach, Castelfranchi [8] affirms that the norms do not only want behavioral conformity, but produces culturing and reassures the authority of the norms, considering that they require submission.

Approximate syllogisms, on the logic of everyday life, Philips [19] affirms that, since Aristotle, it is recognized that a valid syllogism cannot have two specific premises, claiming that some rules can be established to similar syllogisms with particular premises, affirming that the lay are correct if it is considered that that these syllogisms do not have strict validity, but similar, having in mind that the premises available in daily life are typically particular.

5. APPLICATION OF AI TO LAW

We will illustrate the application of AI to law through some empirical procedures adopted by the author and his team.

Called methodology CBR is used in parts with techniques of retrieval of literal information, presenting a superior performance to the traditional data bases. For in such a way, had been developed two new technologies for the

team the Context Structured Search– CSS and the Dynamically Contextualised Knowledge Representation (DCKR).

CSS® is a methodology that allows the search in natural language through the context of the information contained in the knowledge base, thus breaching, the search paradigm by means of key words and connectors, making it possible for the user to describe a number of characters presented by each consultation, allowing thus, a more elaborated conception of the search. The research is considered ‘ contextual ’ and ‘ structured ’ because of the following reasons: 1. We take into consideration the context of documents stored at the formation of the rhetorical structure of the system 2. This context guides the process of adjustment of the entrance as well as the comparison and election of documents; 3. At the moment of the elaboration of the consultation, the entrance is not limited to a set of words, or the indication of attributes, being able to assume the format of a question structured by the set of a long text is added to the possibility of operating dynamic weights on specific attributes, that work as ‘ filters ’ and make a preliminary election of documents to be analyzed.

DCKR® consists of a dynamic process of analysis of the general context that involves the problem focused. It makes comparisons between the context of documents, enabling the accomplishment of a more precise search and with a better quality. Moreover, the documents are retrieved through pre-determined indexes, that can be valued by the user when consulting. This technique implies a significant increment in the performance in knowledge structured systems

The Group of intelligence applied to law has been developing researches and implementing systems, involving technology of the legal information. Among the already developed systems, the following ones are distinguished among others:

Alpha Themis® - Intelligent software for the retrieval of the knowledge contained in the “resolutions” of the national courts. It is a system of legal technology, one of the first ones in Brazil to unite Artificial Intelligence and Law. It uses techniques of textual Data base and CBR.

Jurisconsulto® - Innovative system to retrieve sentences in computerized data bases through CBR. It uses techniques of textual Data Base and CBR.

Jurisconsulto® – Sistema inovador para recuperar decisões judiciais em bancos de dados informatizados através de CBR. Utiliza técnicas de Bando de Dados textuais e CBR.

Olimpo®- The system has its performance centered in the combination of aspects derived from CBR and from the representation of added literal information to an suitable organization of knowledge the referring to the resolutions of the Security Council of the UN, what allows the retrieval of texts with characteristics similar to the information supplied by the user in

natural language. New documents are automatically enclosed in the knowledge base through the extraction of relevant information through a technique called DCKR®. Concepts of CBR and techniques of information retrieval have been applied for a better performance of the system, resulting in the methodology called CSS®.

Such techniques are consolidated through the application in systems and, mainly, by the approval of papers in International Congresses, such as ICAIL (International Conference on Artificial Intelligence and Law), ICEIS (International Conference on Enterprise Information Systems) among others.

6. CONCLUSION

The intention is in this work, yet in a synthetic way, to discourse on the intersection between the NI and AI, trying to conciliate them, considering their specificities, in the scope of law. We present some summaries of the activities of international scientific community of artificial intelligence and right, mainly in the development of applications.

The comparison of the institutes demonstrates the importance of the analysis of the logical processes structuralized around the reasoning of a specific area, even in systems based on knowledge, having exactly there, one the strongest favorable aspects of the pointed intersection between AI and NI.

It is possible to conclude that there is a real necessity of attention to the production of tools that emphasize such activity, because, thus, new methods and techniques of storage and manipulation of information will be generated, what it will reflect in a strong way on law and justice, as writing has done.

REFERENCES

1. BELLUCCI, Emilia, ZELEZNIKOV, John. AI techniques for modeling legal negotiation. In proceedings of the seventh international conference on artificial intelligence and law, p. 108-116, Oslo: Norway, June, 14-18, 1999. 220 p.
2. BENCH-CAPON, T. J. M. Some observations on modeling case based reasoning with formal argument models. In proceedings of the seventh international conference on artificial intelligence and law, p. 36-42, Oslo: Norway, June, 14-18, 1999. 220 p.
3. BOBBIO, Norberto. Teoria do ordenamento jurídico. 4 ed., São Paulo: Unb, 1994.
4. BOBBIO, Norberto. Teoria general del derecho. Bogotá: Temis, 1987.
5. BOMAN, Magnus. Norms in artificial decision making. Artificial intelligence and law, Dordrecht: Netherlands, v 7, n. 1, p. 17-35, march, 1999.
6. BRUNINGHAUS, Stefanie, ASHLEY, Kevin D. Toward adding knowledge to learning algorithms for indexing legal cases. In proceedings of the seventh international conference on artificial intelligence and law, p. 9-17, Oslo: Norway, June, 14-18, 1999. 220 p.
7. CARNELUTTI, Francesco. Metodologia do Direito, **1ª ed.**, Campinas:Bookseller, 2002.

8. CASTELFRANCHI, Cristiano. Prescribed mental attitudes in goal-adoption and norm-adoption. *Artificial intelligence and law*, Dordrecht: Netherlands, v 7, n. 1, p. 37-50, march, 1999.
9. CONTE, Rosaria, FALCONE, Rino, SARTOR, Giovanni. Introduction: agents and norms: how to fill the gap-. *Artificial intelligence and law*, Dordrecht: Netherlands, v 7, n. 1, p. 1-15, march, 1999.
10. ELHADI, Mohamed T., VAMOS, Tibor. Bankruptcy case law: a hybrid IR-CBR approach. In proceedings of the seventh international conference on artificial intelligence and law, p. 134-135, Oslo: Norway, June, 14-18, 1999. 220 p.
11. EPSTEIN, Isaac. *Cibernética*. São Paulo: Ática, 1986.
12. HAMIT, Francis. *A realidade virtual e a exploração do espaço cibernético*. Rio de Janeiro: Berkley, 1993.
13. HOESHL, Hugo Cesar. *Tecnologia da Informação Jurídica para o Conselho de Segurança da UNO*. Ed. Papel Virtual; Rio de Janeiro; 2002.
14. HORTY, John F. Precedent, deontic logic and inheritance. In proceedings of the seventh international conference on artificial intelligence and law, p. 63-72, Oslo: Norway, June, 14-18, 1999. 220 p.
15. JAKOBOVITS, H., VERMEIR, D.. Dialectic semantic for argumentation frameworks. In proceedings of the seventh international conference on artificial intelligence and law, p. 53-62, Oslo: Norway, June, 14-18, 1999. 220 p.
16. KAKUTA, Tokuyasu, HARAGUCHI, Makoto. A demonstration of a legal reasoning system based on teleological analogies. In proceedings of the seventh international conference on artificial intelligence and law, p. 196-205, Oslo: Norway, June, 14-18, 1999. 220 p.
17. OSBORN, James, STERLING, Leon. Justice. A judicial search tool using intelligent concept extraction. In proceedings of the seventh international conference on artificial intelligence and law, p. 173-181, Oslo: Norway, June, 14-18, 1999. 220 p.
18. PFAFFENBERGER, Bryan. *Dicionário dos usuários de micro computadores*. Rio de Janeiro: Campus, 1993.
19. PHILIPS, Lothar. Approximate syllogisms – on the logic of everyday life. *Artificial intelligence and law*, Dordrecht: Netherlands, v 7, ns. 2-3, p. 227-234, march, 1999.
20. PLAZA, Enric (Eds.). *Case-based reasoning research and development*. Berlin; Heidelberg; New York; Barcelona; Budapest; Hong Kong; London; Milan; Paris; Santa Clara; Singapore; Tokyo: Springer, 1997.
21. RABUSKE, Renato Antonio. *Inteligência Artificial*. Florianópolis: Ed. Ufsc, 1995.
22. SAVORY, S. E.(editor), “Some Views on the State of Art in Artificial Intelligence” em “*Artificial Intelligence and Expert Systems*”, Ellis Horwood Limited, 1988, pp. 21-34, Inglaterra.
23. STRANIERI, Andrew, ZELEZNIKOV, John. The evaluation of legal knowledge based system. In proceedings of the seventh international conference on artificial intelligence and law, p. 18-24, Oslo: Norway, June, 14-18, 1999. 220 p.
24. WOLKMER, Antônio Carlos. *Fundamentos da História do direito*.
25. YEARDWOOD, John, STRANIERI, Andrew. The integration of retrieval, reasoning and drafting for refugee law: a third generation legal knowledge based system. In proceedings of the seventh international conference on artificial intelligence and law, p. 117-137, Oslo: Norway, June, 14-18, 1999. 220 p.