Artificial Intelligence and law: Achievements and failures

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Abstract:
This paper aims at giving an overview of Artificial Intelligence and its application in the legal domain. Achievements and failures in the practical as well as in the theoretical area will be discussed.

1 Introduction

In my second week studying law at the University of Vienna, having heard an introduction to legal positivism, I was convinced that it must be possible to completely automate the process of subsumption and therefore replace most adjudicators by computer systems. But as I had to learn, things are not that easy when it comes to law.
Law and Artificial Intelligence (AI) seem to be two disciplines very far apart. One can be traced back thousands of years and the other not past 1950. Nevertheless both disciplines have a lot to learn from each other. The legal domain is very well suited for the application of AI. In contrast to other disciplines like medicine, law is not a natural but a normative science. Therefore reasoning is explicit and in most cases exists in written form. Furthermore law (especially civil law) is mostly adversarial. For this reason we do not only have to deal with the arguments that lead to a certain decision but also with the counter arguments. Other domains do not require such a complex reasoning.

2 Historical overview

The beginning of the modern science of AI can be dated between the 1950s (see [10]) and the 1960s when the first "intelligent" computer applications were developed.

The research field of AI and law first came up in the 1970s. It did not yet take place on an institutional enterprise level but was driven by highly motivated individuals. In the early 1980s a lot of institutions started numerous research projects. But despite the considerable investment of money and manpower it had to be realized at the beginning of the 1990s that the complexity of legal thinking was underestimated.

3 Basic AI Notions

One common way of defining Artificial Intelligence is as "The study of how to make computers do things at which, at the moment, people are better". See [9] for other approaches.

3.1 Knowledge based systems

Knowledge based systems (KBS) are different from traditional computer applications in multiple aspects. First, a KBS represents knowledge explicitly as a set of declarations which is referred to as the *knowledge base*. Traditional applications implement knowledge implicitly as procedures and therefore can only apply it in a predetermined way. Furthermore they are hard to maintain as an update of the information is reflected by the modification of a procedure. A KBS provides problem solving capability which is performed by an *inferential* engine. It is also able to justify its behavior by expressing the inferential steps that have led to a certain conclusion.

3.2 Expert systems

An expert system (ES) has an intelligent behavior and is capable of performing tasks for which a specific competence or expertise is usually required. Most expert systems implement

the model of a KBS with additional tools that enables it to solve specific tasks such as a medical diagnose. A completely general and flexible expert system has not yet been developed. Neural networks have been partly successfully used integrated into expert systems to automate common sense functions such as the identification of forms.

3.3 Neural networks

A Neural network implements the opposite of the intellectual model of a KBS. It is constructed with units called *neurons*, whose behavior is defined by mathematical and statistical functions. There are "input units", "output units" and "hidden units" which are all connected to each other, building the network. They interact by sending and receiving signals over the connections which are assigned weights.

Neural networks can and must be trained by practicing learning patterns (i.e. predefined input/output pairs). If the network's output is incorrect, signals are sent back into the network until it "learned" the right answer. If completely new input is fed into the network, it will try to find an already learned input pattern that is similar and will produce the learned output. This means that the neural network is capable of reasoning by analogy without having been programmed in a traditional way.

3.4 Fuzzy logic

Fuzzy logic is out to solve an ancient problem: a judge has to decide situations which in most cases cannot be described other than in indeterminate terms – but the decision must be determinate sometimes even expressed as a numerical value (such as the amount of compensation to pay). This indeterminacy was best described by Adolf Merkel: "Many legal terms have a blurry quality. Their areas of application are not delineated by insurmountable fences, but rather they spill over into neighboring areas."[1] In modern fuzzy logic this means that for example the application of an open texture such as "negligence" does not lead to an "is" or "is-not" statement but rather to a statement describing to which degree. Mathematic models (described shortly in [4]) allow computing an exact value needed for the decision. In our example the degree of negligence will lead to a certain amount of compensation to pay.

4 Recent developments: legal ontology

In philosophy, ontology is a theory about being as such, i.e. what types of things exist. AI researchers have adopted the term and for them ontology is a document or file that formally defines terms and their relations to other terms. This is very powerful as it would allow KBS and expert systems to understand the information they are dealing with. This would also lead to a new kind of legal information retrieval systems as the search engines would no longer search after terms but after concepts.

This great evolution is not limited to the legal domain. The so-called Semantic Web[2] will mark a new era of the Internet and will change the way computer systems handle information.[3]

5 Types of legal systems classified by task

The first step in every software development project is the analysis and specification of the user's requirements. As the requirements of lawyers, adjudicators, and the public (laypersons) differ, we need to comply with different specifications. One day we will probably be able to build a multi-potential system – but until then it is much easier to develop different systems.

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[1] Cited after Grünhut, M. 1926. Begriffsbildung und Rechtsanwendung im Strafrecht. Tübingen: Mohr.
[2] http://www.w3.org/2001/sw/
[3] Cai Ziegler, Surfende Maschinen – Web Ontology Language (OWL), iX, Verlag Heise 12/2003 S. 108

5.1 Advice systems directed at lawyers

Lawyers per definition know a good deal about law in general but cannot be experts in every area. They are usually interested in a particular outcome of the problem. So a system for lawyers can rely on a general legal expertise of the user and has to output information relevant for a particular position. The system must be able to separate the issues that are beyond dispute and those that can be argued in either way. It has to output arguments for the client's case and against it. This allows the lawyer to find counterarguments and to distinguish precedents potentially cited by the opponent. In contrast to other users, the lawyer is not interested in the system making a decision about the case.

5.2 Advice systems directed at the public

The layperson is unfamiliar with both aspects of the system – the legal and the technical. Therefore such a system must be very easy to use and can only require the user to answer questions of fact. In contrast to lawyers, laypersons are not interested in the arguments or even counterarguments but in a decision of the system (e.g. if a claim of a certain social benefit is likely to be successful).

5.3 Systems directed at adjudicators (in governmental organizations)

In general these systems are directed at people that are making legal decisions. But usually these are not judges but people responsible for administrating the law. The idea of a "computer judge" did rise – and immediately produced a lot of hostility. In fact a judge needs qualities a computer system might never have. Thus there has not been a single serious project with the aim of replacing judges.

People administrating the law usually do not have an interest in a particular outcome. The system can assume that its users know a good deal about the law they are administrating. Furthermore they have the legal power to resolve questions of open texture definitely. Most systems implemented in practice do not try to actually make the decision but to give the adjudicator guidelines as which regulations to apply.

6 Types of legal systems classified by formalism

Despite the long history of law, there has not yet been reached a common ground in legal theory. Depending on the theoretical background one would prefer the one or the other of the formalisms described below. This fragmentation in legal theory prevents a united research effort.

6.1 Rule based systems

Most systems in practice implement a rule base model. Law is seen as a set of general rules (if-then statements) applied to a certain case by means of deduction (or sometimes analogy). But there are also researchers questioning the deductive model, proposing argumentation or non-monotonic logic. This allows the realization of a system containing contradictory rules, expressing a different interpretation. Such a system is capable of modeling disagreements on law.

6.2 Case based systems

Law can also be seen as a collection of individual decisions. The basic reasoning procedure in case based systems is not deduction but analogy. The system tries to find similar cases and applies the principle of treating like cases in a like manner.
Obviously case based systems are preferred by researchers with an Anglo-American background while rule base systems tend to be linked to Continental Europe. But this must

not necessarily be the case; Parkken & Sartor[4] proposed to represent cases by their *rationes decidendi*. This allows a rule based representation of case law.

6.3 Experience based systems

Experience based systems are related to a legal-theoretical background that takes a sociological approach to the law; for example the historical school of Friedrich Karl v. Savigny[5] who propagated a method called "Historisch Systematische Methode". Savigny understood the development of law as a social, evolutionary process.
Neural networks can be very well applied to this legal theory as they learn by experience and develop evolutionary. But as they "intuitively" act by experience they are unable to give a rational argumentation.

7 Practical use of AI in the legal domain

There has not yet been seen a computer system for law practice that implements "true AI". Some achievements can be reported from experimental systems, but in practice most systems use only a limited amount of AI technology. It is important to notice that a computer program in the legal domain does not necessarily have anything to do with AI. Processes that may seem very complicated (and even are) can sometimes also be automated by means of traditional programming and relational database management systems (RDBMS). Marketing departments usually do not hesitate to put an AI label on their product whether it is really "intelligent" or not. But there are as well increasingly more systems on the market that are very advanced and close to "true AI". Nearly all of them deal with a particular problem area. Due to the huge amount of products available, only a representative list can be given here.

7.1 Systems directed at governmental organizations

The most successful systems where applied in governmental organizations. Reasons for this might be that administrative entities usually do not make profit and are therefore predestinated for reducing its costs; secondly the use of such systems is often obligatory or at least highly encouraged within the administration. The applied systems usually deal with social security or taxation.

The Australian company Softlaw[6] has successfully developed several expert systems using rule based technology. These systems partly automate governmental tasks such as dealing with veteran's or worker's compensation claims. They claim to improve productivity by 80%.

Kluwer MRE[7] located in the Netherlands is developing and marketing expert systems in the legal domain since the early 1990s. They have implemented a rule base model and are specialized in social security. In 2000 Groothuis and Svensson investigated the juridical quality of MRE's expert system and found a number of critical errors[8]. They concluded that the quality of legal decisions can be improved by the usage of expert systems but there is no guarantee for the correctness of legal decisions.

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[4] Henry Prakken, G. Sartor, Modelling Reasoning with Precedents in a Formal Dialogue Game, Artificial Intelligence and Law 6: 231-287 (1998), (Available online at http://www.cs.uu.nl/groups/IS/archive/henry/Precdia98.pdf)
[5] Friedrich Karl v. Savigny, Vom Beruf unserer Zeit für Gesetzgebung und Rechtswissenschaft, 1814
[6] http://www.softlaw.com.au
[7] http://www.kluwermre.nl; former MRE; was taken over by the Dutch publishing company Kluwer
[8] Marga M. Groothuis, Jörgen S. Svensson, Expert system support and juridical quality, in: J. Breuker, R. Leenes & R. Winkels (eds.), Legal Knowledge and Information Systems. JURIX-2000: The Thirteenth Annual Conference, Amsterdam: IOS Press, 2000, pp. 1-10, (Available online at http://www.jurix.nl/pdf/j00-01.pdf)

7.2 Systems directed at lawyers

The Dutch publisher Kluwer offers two expert systems: WVP, a system for settlement of pension rights after separation and OVB, a system for bank tax, answering the question whether the tax is due and if it is calculating how much to pay. Both systems have an HTML-interface.

A commercial web based expert system for the formation of Australian companies is available at http://www.incorporator.com.au. The system is built as an interview process with a web-browser interface.

Lawgic[9], a company located in Portland, Oregon markets more than 20 expert systems.

Legal Information Retrieval (IR) tools, not making very much use of AI, became quite common in the last years. Examples are West Publishing's WIN ("West Is Natural") and multiple offerings from Lexis-Nexis.

7.3 Systems directed at laypersons

An increasing number of consumers in the U.S. are convinced that they should be able to handle their own routine legal problems. This leads to a new market for legal expert systems. Tax preparation software such as "TurboTax"[10] or estate planning and contract drafting programs such as "Quicken Family Lawyer"[11] are very popular.

The United States Department of Labor has developed a web-based advisory system called "Elaws" (Employment Laws Assistance for Workers and Small Businesses) which is available at http://www.dol.gov/elaws/. Elaws consists of sixteen separate "Advisors" covering areas such as Employment Standards Administration (ESA), Mine Safety and Health Administration (MSHA), Occupational Safety and Health Administration (OSHA) and Pension and Welfare Benefits Administration (PWBA).

7.4 Reasons for the limited success of AI & law

Most lawyers do not feel comfortable with using the Internet on a daily basis and know the term Artificial Intelligence only from science fiction movies. This obstacle is getting smaller but as long as the competition between law firms does not grow, there is no necessarily to increase productivity. A related aspect is that most lawyers (especially in Europe) are paid by hour. This does not just prevent lawyers from working faster but keeps competition low as well.

The second obvious reason is that AI and especially its combination with law is a very difficult subject.

8. Conclusions

There is still a long way to go until we will see really "intelligent" systems emerging in the legal domain. Tasks such as reasoning and natural language processing are still beyond reach. But a lot of hope can be put into the research efforts concerning legal ontology.
Until then we can dream of a utopia where most of today's legal knowledge is no more a well kept secret but a common good to which everyone has equally access.

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[9] http://www.lawgic.com
[10] http://www.turbotax.com
[11] http://www.quicken.com

Resources

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