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Artificial intelligence,
expert systems and law:
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Italian constitutional
order

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Artificial intelligence, expert systems and law: a perspective on the Italian constitutional order

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ABSTRACT: Artificial intelligence has significantly developed in recent decades, influencing many aspects of human life, including the practice of law. This paper will deal with the main applications of artificial intelligence in the field of law and, in particular, with the use of legal expert systems in jurisdictional activity and its various implications.

KEY-WORDS: Artificial Intelligence; Expert systems; Jurisdictional activity; Constitutional rights

SUMMARY: 1. Introduction – 2. Artificial Intelligence (AI) – 3. Expert Systems – 3.1 Structure – 3.2 Legal Expert Systems – 3.2.1 Legal expert systems currently existing and used in Italy – 3.2.2 Criticalities and limits of legal expert systems – 4. Expert systems in judicial aid and compatibility with the Italian constitutional system – 5. Artificial intelligence in the European Union – 6. Right to explanation, right to be judged by a human and biases in legal expert systems – 7. Legal expert systems in the US Courts – 8. Italian criminal justice and Legal expert system – 9. Conclusions

1. Introduction

This paper will deal with the applications of artificial intelligence in the field of law. In particular, we will make a quick overview of the evolution of artificial intelligence in general, then we will move on to legal expert systems and, finally, we will deal with expert systems used mainly in the jurisdictional area. To conclude, we will examine which legal expert systems are currently used in Italy, we will assume the use of an expert system to support judicial activity and analyze any problems and compatibility with our constitutional system, also by discussing a few international cases.

2. Artificial Intelligence (AI)

«If we asked a hundred AI researchers what artificial intelligence is, they would give at least a hundred different answers»¹. The breadth of the branch in question does not allow us to give it a univocal and perfect definition; nevertheless, we can summarily describe artificial intelligence as the discipline that deals with the computerized reproduction of the most complex mental processes.

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¹ PP. TRAVERSO, Director of FBK Center for Information Technology – IRST, on the occasion of the lecture “L’impatto dell’intelligenza artificiale, fra opportunità e criticità”, March 7, 2018.

The innovativeness and the criticality of this discipline have made it a subject for years of debate and study both among informatics, and among philosophers and ethics scholars. Although the subject was studied since the early 40s of the last century, the actual birth of the discipline can be placed in the summer of 1956, when a conference was held at Dartmouth College (New Hampshire); it was attended by prominent figures in the field of computing dedicated to the development of intelligent systems, such as M. Minsky and J. McCarthy². During this workshop, in which for the first time the term “artificial intelligence” was used, some programs capable of intelligent behavior were presented, for example the Logic Theorist of A. Newell and H. Simon, that was able to demonstrate theorems starting from logical mathematical principles. The result of the meeting in question was the recognition of how thinking can take place outside the human brain, that is in machines, the assumption of how reasoning can be understood in a formal and scientific way and the supposition of the fact that the best way to understand it is through digital computers³.

In a first phase of evolution, artificial intelligence was directed to the solution of logic problems and recorded significant developments in a very few years. In 1957, Newell and Simon created the GPS (General Problem Solver), with the aim of imitating human behavior in the resolution of general problems. In 1959, D. Gelernter created the GTP⁴ (Geometry Theorem Prover – a program capable of demonstrating complex geometry problems) and, later, one for symbolic integration.

Very soon, however, researchers began to encounter the first failures: appropriate methods for simple cases proved to be totally inadequate in more complex and broad contexts⁵. The initial high expectations had to deal with the failure of the automatic translation projects between natural languages programs, that acted at the level of simple syntactic manipulation proved in fact totally inadequate. Despite the difficulties encountered due to the absolute lack of semantic knowledge concerning the domains treated by machines⁶, progress in the field of artificial intelligence⁶ never stopped. After several slowdowns, scholars came to define the previous approaches used as “weak approaches”⁷, because they needed a greater knowledge inherent in the fields of application gradually considered, and developed new programs able to use intensively the knowledge. These programs, initially applied to the field of molecular biology, were then

² N.J. NILSSON, *Intelligenza artificiale*, Milan, 2002, pp. 27.

³ O. CAIRÓ, *El hombre artificial: el futuro de la tecnología*, 2011, pp. 7.

⁴ H. GELERTNER, *Realization of a geometry theorem proving machine*, in *IFIP congress*, 1959, pp. 273-281.

⁵ D. CREVIER, *AI: The Tumultuous Search for Artificial Intelligence*, New York, 1993, pp. 146.

⁶ PP. MCCORDUCK, *Machines who think : a personal inquiry into the history and prospects of artificial intelligence*, Natick, 2004, pp. 300. See also: D. CREVIER, *op. cit.*, pp. 113–114; H. MORAVEC, *Mind Children*, 1988, pp. 13; D. LENAT, R. V. GUHA, *Building Large Knowledge-Based Systems*, 1989, Introduction; S. J. RUSSELL, PP. NORVIG, *Artificial Intelligence: A Modern Approach*, 2003, pp. 21.

⁷ For a brief but incisive definition of weak artificial intelligence, see <https://www.techopedia.com/definition/31621/weak-artificial-intelligence-weak-ai> (last visited 14/11/2018).

extended to other disciplines; in this way, we began to talk about "expert systems", based on the detailed knowledge of the specific domain in question.

In the 1980s, AI systems began to be exported to industry and allowed large companies (to name a few examples, Digital Equipment and DuPont) to save millions of dollars in the production process. In a short time, Japan and the United States created projects of support and funding for artificial intelligence research, consortiums were born, the artificial intelligence industry went on extending for years, to include in 1988 hundreds of companies that were specializing in creation of expert systems, robots, software and hardware specialized in these sectors. In the meantime, the learning algorithm for neural networks was reinvented and applied to many problems related to computer and psychological learning. Thus were born the "connectionist" models, which tried to solve the problems in which the previous models had failed, but there were no particular developments and the connectionist approach was consequently assimilated as complementary to the symbolic one.

Between the eighties and modern times, there have been many advances. Today, AI systems, in addition to being used in research, space missions, technological progress and much more, play an important role in our everyday life, even though users often do not even realize it (for instance, let us just think about our smartphones and the digital assistants they provide – such as Siri, Google Now and Cortana – or the new smart cars, but also music, movies and books recommendation services and smart home devices – such as Google Home – and AI autopilots used on planes by commercial airlines⁸). As was predictable from the beginning, the ethical and moral problems related to AI intelligence systems have multiplied and increased more and more over time, especially with the birth of robots equipped with AI systems that seem almost able to replace a real human being, not only in carrying out concrete tasks, but also in engaging in conversations and relationships with people (this is the case, for example, of sexual robots).

In 2014, for the first time in history, a robot managed to pass the Turing test⁹ by deceiving a human interlocutor and making him believe that it was a person to answer their questions. In 2015, Google developed an AI able to learn how to play Atari, learning from its mistakes after several attempts, increasing its experience and even going beyond the human experts. In 2017, an online Go player named "Master" (which had been confirmed to be the latest iteration of DeepMind's AI AlphaGo) defeated the world's best Go player, Ke Jie. In October of the same year, Google developed a new iteration of AlphaGo

⁸ For a list of AI systems used in everyday life, see <https://www.techemergence.com/everyday-examples-of-ai/> (last visited 14/11/2018) and <https://beebom.com/examples-of-artificial-intelligence/> (last visited 14/11/2018).

⁹ Turing test, developed by Alan Turing in 1950, measures a machine's ability to behave in an intelligent way, being indistinguishable from a human. A machine passes the Turing test if the evaluator cannot recognize which one of the partners in conversation is the machine and which one is the human. See also A. TURING, *Computing Machinery and Intelligence*, 1950.

called “AlphaGo Zero”, a revolutionary algorithm designed to learn entirely from self-play, and a couple months later an even newer version of it was released (“AlphaZero”)¹⁰.

3. Expert systems

An expert system (or knowledge-based system¹¹) is a computer program that emulates the performance of people skilled in a specific field of activity, in order to solve complex problems, starting from a specific base of a specific area of knowledge (“domain”) and a joint of inferential rules¹².

The first expert system ever created was DENDRAL, realized in the second half of the 60s to help organic chemists identify unknown organic molecules, through the analysis of their mass spectra¹³. The project was accomplished by the hand of E. Feigenbaum¹⁴, B. G. Buchanan, J. Lederberg, and C. Djerassi, at the Stanford University. It paved the way for expert systems because for the first time it automated a decision-making process using the problem-solving behavior of human chemists.

Expert systems differ from other similar programs because, by referring to technologies developed with artificial intelligence, they are able to exhibit the logical steps that are subject to their decision-making process.

3.1 Structure

An expert system has elements that compose it and form an indispensable part of its actions.

Basis of facts: it manages the concrete data of the case that has to be solved. It constantly increases with the reasoning of the program¹⁵.

¹⁰ R. HARIDY, 2017: *The year AI beat us at all our own games*, see <https://newatlas.com/ai-2017-beating-humans-games/52741/> (last visited 14/11/2018).

¹¹ PP.L. M. LUCATUORTO, *Intelligenza Artificiale e Diritto: le applicazioni giuridiche dei sistemi esperti*, in *Cyberspazio e Diritto*, vol. 7 (2), 2006.

¹² J.S. AIKINS, *Prototypical knowledge for expert systems*, in *Artificial intelligence*, 20(2), 1983, pp. 163-210.

¹³ R. LINDSAY, B. BUCHANAN, E.A. FEIGENBAUM E J. LEDERBERG, *DENDRAL: a case study of the first expert system for scientific hypothesis formation*, in *Artificial Intelligence*, vol. 61 (2), 1993, pp. 209–261.

¹⁴ We can think about Edward A. Feigenbaum as the father of expert systems. He also gave the very first definition of expert system: «an expert system is a computer program that uses knowledge and reasoning techniques to solve problems that would normally require the help of an expert. An expert system must have the ability to justify or explain the reason for a particular solution to a given problem» (1977).

¹⁵ D. BOURCIER, P.P. CASANOVAS, *Inteligencia artificial y derecho*, 2003, pp. 71.

Rules: combinations of facts that allow to represent knowledge and extract inferences from the same. The machine, therefore, starts from some known facts from which new facts can be deduced¹⁶.

Knowledge base: database with deduction capacity. It differs from the simple basis of facts because the latter contains facts that can be consulted in a static way, while the knowledge base also contains a joint of procedural and heuristic rules, which allow to manage the data in a logical way. The rules (usually in the structure “if <antecedent> then <consequence>”) work in such a way that the inference engine obtains an automatic deductive reasoning, choosing the most suitable to solve a specific problem and obtaining information that is not explicitly listed¹⁷.

The development of the knowledge base is divided into two phases¹⁸:

- 1) Identification and acquisition of information covering the domain object of the system. The purpose of this phase is a formal reproduction as complete as possible of the knowledge possessed by an expert in a given field. One of the difficulties encountered in this phase is that the skilled person often fails to identify and isolate every single part of the mental process that is carried out to get to a certain conclusion; because of this, the acquisition process can remain incomplete, if not supported by analytical cognitive processes.

The corpus of knowledge possessed by the expert (in our case, by the lawyer) consists of:

- Facts (elements known in a “static” way)
 - Procedural rules (unique rules describing sequences of events and relations related to the domain)
 - Heuristic rules (intuitive or empirical rules, which suggest the procedures to follow when permanent rules are not available. Unlike procedural rules, heuristic rules involve a certain degree of uncertainty and can lead to unequivocal results)
- 2) Definition of the mode of knowledge representation (which can take place through a formalistic-procedural approach or through a formalistic-declarative approach).

Inferential engine: it is the active part of the system, it selects the most suitable rules to solve a given problem, applying it to the facts. It starts from the knowledge base and systematically involves the other parts of the expert system to determine which actions should be performed. It makes logical reasoning – normally in a deductive way – and can be applied to different knowledge bases as it is independent of the type of domain implemented.

¹⁶ H.A. TABARES, *Inteligencia artificial: guía de trabajo*, 2012, pp. 26.

¹⁷ H.A. TABARES, *Inteligencia artificial: guía de trabajo*, pp. 26-27.

¹⁸ P.P.L.M. LUCATUORTO, *Intelligenza Artificiale e Diritto: le applicazioni giuridiche dei sistemi esperti*, cit., 2006.

User interface (or dialogue structure): means by which the interaction between the expert system and the operator is visualized, with a structure of questions and answers in relation to the cases treated¹⁹. The information necessary to obtain the solution is called input and is introduced in the graphical interface, while the answers that the system must return are called outputs.

Explanation and justification form: it is used to describe explicitly the reasoning that lead the expert system to a certain conclusion. It starts with access to a record, identifies the steps followed during the reasoning and translates the whole into a form accessible to the user.

3.2 Legal expert systems

Among the expert systems we find the legal expert systems, which represent the main application of artificial intelligence to law. Martínez describes the legal expert systems as «computational systems which can find possible solutions to certain legal problems by applying knowledges in the subject, also explaining their reasoning»²⁰.

They use a formal representation of the knowledge of law and reproduce it in a computer program, in order to carry out a specific activity of a legal expert. All this is possible starting from two basic premises: that the process of legal elaboration is at least partly rationalizable²¹ and that the sources of law are identifiable and reproducible in a formal language manipulated by the computer²².

According to the sources of information, we can divide legal expert systems in three main categories: rule-based systems (they represent the law using rules), case-based systems (they produce advice by analyzing the similarities and differences between cases), and hybrid systems (they use both rule-based and case-based techniques)²³.

The problem arises when we realize that the knowledge necessary for the resolution of legal problems includes knowledge that is within everyone's reach (public knowledge, that is, inferred from written sources), but also elements that are not officially codified that derive from everyone's experience (private knowledge) and also unconscious knowledge²⁴. As is easily understandable, experience is hardly

¹⁹ D. BOURCIER, P.P. CASANOVAS, *Inteligencia artificial y derecho*, 2003, pp. 72.

²⁰ D. MARTÍNEZ, *El yo y la máquina: cerebro, mente e inteligencia artificial*, Madrid, 2012.

²¹ M. IASELLI, *I sistemi esperti legali*, 2012, pp. 42.

²² P.P. L. M. LUCATUORTO, *Intelligenza Artificiale e Diritto: le applicazioni giuridiche dei sistemi esperti*, cit., 2006.

²³ P.P. L. M. LUCATUORTO, *Intelligenza Artificiale e Diritto: le applicazioni giuridiche dei sistemi esperti*, cit., 2006. See also: D. TISCORNIA, *Intelligenza Artificiale e Diritto*, in *Lineamenti di informatica giuridica: teoria, metodi, applicazioni*, Napoli, 2002, pp. 119–156; R.M. DI GIORGI, *L'Intelligenza Artificiale: teoria e applicazioni nel diritto*, in *L'informatica del diritto*, Milano, 2004, pp. 185–235.

²⁴ G. SARTOR, *Le applicazioni giuridiche dell'Intelligenza Artificiale: la rappresentazione della conoscenza*, Milano, 1990.

rationalizable (from a certain point of view, it can be reproduced only in so far as data mining is based on the inclusion of myriads of jurisprudential decisions or doctrinal guidelines followed in certain areas) and this is the main reason for which it is asserted that a total substitution of the human being with the computer system equipped with AI will never be possible, being able to circumscribe itself at most to a relationship of aid.

3.2.1 Legal expert systems currently existing and used in Italy

Legal expert systems can be classified according to the legal activity that they would have to carry out. In Italy, we find systems for legal analysis, judicial support systems, case-based systems, information retrieval systems, and assisted writing systems.

Systems we can use for legal analysis are interactive, that is to say, the user inserts the description of the case in the system and the program deduces a legal effect by using the information contained in the knowledge base. Some examples of this kind of systems are "Automa infortunistico"²⁵ (it gives legal advice on the liquidation of patrimonial damage caused by road accidents, by analyzing a big amount of cases already solved and inserted in the program), "Methodus"²⁶ (it provides assistance in the registration to the road hauliers register), "Proleg"²⁷ (it concerns a series of benefits that the law recognizes to subjects that produce energy savings; the aim of the system is to identify the presence of the requirements for the granting of benefits), "Sefit"²⁸ (it offers information about the access to funding from the Technological Innovation Fund), "Lexis"²⁹ (it contains the legislation on marriage and dissolution of marriage and identifies the potential conditions), "Progetto IRI"³⁰ (it helps the user in the field of environmental law; its

²⁵ E. FAMELI, *L'automa infortunistico: un esperimento di consulenza giuridica automatica*, in *Informatica e diritto*, 2(1), 1976, pp. 1-50. See also: G. FERRARI, C. BIAGIOLI, *Principi per la rappresentazione formale del linguaggio legislativo*, *Preatti II Convegno internazionale Logica Informatica Diritto*, Firenze, 1985; C. BIAGIOLI, A. FUSARO, A. INNOCENTI, G. MARELLO, *Automa giuridico: un sistema sperimentale di liquidazione del danno da sinistro stradale*, in *Atti della "Giornata d'informatica giuridica"*, Firenze, 1976; E. FAMELI, *L'"Automa infortunistico": un esperimento di consulenza giuridica automatica*, in *Informatica e Diritto*, 2(1), 1976, 1, pp. 1-50; L. LOMBARDI VALLAURI, *Esortazione all'informatica giuridica meta-documentaria*, in *Atti del II Convegno internazionale sul tema "L'informatica giuridica al servizio del paese"*, Sess. V, n. 10, pp. 18.

²⁶ P.P. L. M. LUCATUORTO, *op. cit.*, 2006

²⁷ G. BORSARI and others, *HARE: an Italian application of SoftLaw's STATUTE expert technology*, in *Proceedings of the 10th international conference on Artificial intelligence and law*, 2005. See also K. SATOH, K. ASAI, T. KOGAWA, M. KUBOTA, M. NAKAMURA, Y. NISHIGAI, C. TAKANO, *PROLEG: an implementation of the presupposed ultimate fact theory of Japanese civil code by PROLOG technology*, in *JSAI International Symposium on Artificial Intelligence*, 2010, pp. 153-164.

²⁸ A. VALENTE, *SEFIT: la progettazione di un sistema esperto per l'accesso al fondo per l'innovazione tecnologica*, in *Informatica e diritto*, 14(3), 1988, pp. 223-234.

²⁹ P.P. L. M. LUCATUORTO, *op. cit.*, 2006

³⁰ E. FAMELI, R. NANNUCCI, R. M. DI GIORGI, *Expert systems and databases: a prototype in environmental law*, in *Informatica e diritto*, 17(1-3), 1991, pp. 227-247. See also PP. BALDINI, A. CAPELLI, A. REVELINO, G. SARTOR, F. TURA, *IRI-AL: un Ambiente informatico per la redazione di testi legislativi*, in *Informatica e diritto*, 2(1), 1993, pp. 151-184.

first functioning prototype has been created in Prolog), “Remida Famiglia”³¹ (it quantifies the spousal support in family proceedings, according to the type of obligation that creates the right to compensation), “Progetto Daedalus-Cassazione”³² (it calculates the deadlines for precautionary measures and for statute barred). Another system to mention is “Esplex”³³, a development of the “Analisi automatica della legislazione” project which represents the legal knowledge and distinguishes it into explicit and implicit knowledge, according to the explicitness of the legislative text.

Speaking of judicial activity, we must distinguish between decision-support systems and expert systems supporting judicial activity. While the former assist the user in the course of long and complex decision-making processes without indicating the final outcome, the latter arrive to definite conclusions. In Italy, we have systems created to support the activity of the prosecutor. To mention only two of them: “Minerv@” (created to make the criminal procedure efficient in its various phases; however, it never passed the prototype phase³⁴) and “Daedalus PM Assistant”³⁵ (the prosecutor inserts the facts of a specific case and the system explains its own conclusions on the basis of logical arguments, thanks to the application of a hybrid reasoning model that uses analogies, deductions and inductions).

Case-based systems are very useful to find cases similar to the one concerned. They can be used to justify the interpretation of vague concepts or to carry out analogical arguments. Due to their structure and purpose, they are mostly used in common law jurisdictions, where the main sources of law are judicial precedents. If we wanted to make a comparison between traditional expert systems and case-based reasoning³⁶, we would note that traditional expert systems require an exact knowledge of the domain, while the case-based reasoning approach does not; moreover, traditional expert systems use rules, frames, and logic to represent knowledge, whereas case-based reasoning uses cases; again, we find great differences in the inference engine; finally, in traditional systems the learning capacity is very limited, while in the case-based reasoning it is more powerful as it is obtained by the acquisition of new cases.

Talking about case-based approach, we have to mention the importance that data mining has played in this sector³⁷. Data mining is a technique that allows extracting from a plurality of materials the one that is actually useful; as it is easy to guess, it is the mechanism that underlies the systems concerned, as well as

³¹ See <https://www.remidafamiglia.com/> (last visited 14/11/2018).

³² C. ASARO and others, *A domain ontology: Italian crime ontology*, in *Proceedings of the ICAIL 2003 Workshop on Legal Ontologies & Web based legal information management*, 2003.

³³ C. BIAGIOLI, P.P. MARIANI, D. TISCORNIA, *Esplex: A rule and conceptual model for representing statutes*, in *Proceedings of the 1st international conference on Artificial intelligence and law*, 1987.

³⁴ A. C. AMATO, *Informatica giuridica: Seconda edizione riveduta e aggiornata*, Torino, 2015, pp. 66.

³⁵ C. ASARO, *Daedalus PP.M. Assistant*, in *Informatica giuridica, I nuovi temi del diritto dell'informatica e dell'Internet*, Napoli, 2001.

³⁶ B. LAZZERINI, *Introduzione ai sistemi esperti*, available online: <http://spazioinwind.libero.it/fanciullimassimiliano/files/universita/SistEspp.pdf> (last visited 14/11/2018).

³⁷ G. SARTOR, *L'informatica giuridica e le tecnologie dell'informazione*, Torino, 2016, pp. 283.

information retrieval systems. A particular type of data mining is text mining, which consists in applying data mining techniques to non-structured texts (that is to say, written in natural language), in order to extract high-quality information for predictive classification. Furthermore, clustering techniques have been very important, aimed at selecting and comparing homogeneous elements in a set of data for the identification of anomalous data, just like parsers, algorithms for the syntactic recognition of the language that are used together with the programming languages and are used to transform a flow of data into a defined structure.

Assisted writing systems are used for the preparation of legal documents. While traditional computer systems automate the preparation of certain types of documents, assisted writing systems allow the automatic aggregation of useful information into the document. Many law firms all over the world already use writing systems to expedite the drafting process; in particular, one of the most important law firms of the world, DLA Piper³⁸, uses a software created in Canada to analyze contracts word by word and find the most problematic clauses. Since 2017, the Italian headquarter is also experimenting the program, which is a machine-learning software that deals with contract revision. To name a few of these systems: “Sistema Noemi”, created to help notary studies in the compilation of documents³⁹; “Lexedit”⁴⁰ (it introduces a word-processing program that collaborates with the editor in the preparation of the normative references and in the drafting of the text, analyzing it, identifying errors and providing help in the subdivision and qualification of parts of the text), “Iperinflex”⁴¹ (it suggests to the user an easily understandable basic structure, on which to expand the documentation in hypertext form), and “Norma-editor”⁴².

3.2.2 Criticalities and limits of legal expert systems

Despite the usefulness of legal expert systems, artificial intelligence has to face many difficulties that limit its potential and are due to our regulatory system⁴³. First of all, there is an excessive breadth of sources and legislation, which causes difficulty in obtaining the rules of the domain. Because of this, the reproducibility of the domain in the knowledge base is always limited and relatively incomplete. Secondly, we have to take into account the semantic complexity of legal language, which is full of ambiguities and vagueness; one

³⁸ See <https://www.dlapiper.com/en/uk/> (last visited 14/11/2018).

³⁹ J. ESTAPA, A. GALLIZIA, E. MARETTI, *La redazione mediante calcolatore di testi giuridici*, in *Informatica e diritto*, 3(2), 1977, pp. 370-385. See also A.A. MARTINO, *L'informatica giuridica oggi*, in *Informatica e diritto*, 12(3), 1986, pp. 5-28.

⁴⁰ A.C. AMATO, *Informatica giuridica*, Torino, 2015, pp. 2. See also M. IASELLI, *I sistemi esperti legali*, 2012, pp. 78.

⁴¹ P.P. MERCATALI, *Iperinflex: a hypertext for legislative drafting*, in *Informatica e diritto*, 4(1), 1995, pp. 85-109. See also P.P. MERCATALI, *Legimatica e redazione delle leggi*, available on <http://www.ittig.cnr.it/Ricerca/Testi/mercatali1995.htm> (last visited 16/07/2018).

⁴² M. PALMIRANI, G. SARTOR, *Norma : un progetto integrato per la redazione, archiviazione e consolidazione dei testi normativi comunali*, in *Informatica e diritto*, vol. 22 (2), 1996, pp. 172-201.

⁴³ P.P.L.M. LUCATUORTO, *Intelligenza Artificiale e Diritto: le applicazioni giuridiche dei sistemi esperti*, cit., 2006.

need only think of the effort that lawyers and academics make when they have to interpret laws and contracts, reason that pushed the legislator to write a specific rule about interpretation⁴⁴. As said above, another limit of computer systems is human experience, that cannot be formally coded or rationalizable⁴⁵. Finally, the question arises about the possible liability of expert systems users: let us consider the situation where an Appeal Court declares the decision of the Court of First Instance wrong, and let us assume that such decision was made on the basis of an expert system advice. *Quid iuris?* Is the judge liable to disciplinary measures for having followed the expert system instructions without overturning their opinion? And what about the creator of the algorithm?⁴⁶

4. Expert systems in judicial aid and compatibility with the Italian constitutional system

The use of expert legal systems in Italy must be balanced with various other rights and requirements. The principles that come into play are multiple; in this paper, we will deal with the principle of equality (art. 3 Cost.), the right to a natural judge (art. 25, par. 1, Cost. and art. 6, par. 1, of the Universal Declaration of Human Rights⁴⁷), the right to be judged by a human natural judge, the right to a due process (art. 111 Cost.), and a balance between copyright and the right of defense.

The principle of equality is set out in art. 3 Cost.⁴⁸; in the first paragraph, we find the enunciation of the principle of formal equality, while the second paragraph is about the substantial equality.

With regard to this, it is clear that the use of computer systems for the resolution of disputes may lead to a more neutral, impartial, honest, and far from corruption and procedural slowness justice. Indeed, it cannot be denied that the human being is a fallible being and that, in addition to fatigue and the need for breaks and rest⁴⁹, is often left to be conditioned by threats or rewards. A computer system would not be

⁴⁴ Art. 12 preleggi: «In applying the law, one cannot attribute to it any other meaning than the one made clear by the proper meaning of the words according to the connection of them, and by the intention of the legislator. If a dispute cannot be decided by a specific provision, one has to do with the provisions governing similar cases or similar matters; if the case still remains doubtful, it is decided according to the general principles of the legal system of the State».

⁴⁵ As above: see M. IASELLI, *op. cit.*, 2012, pp. 78.

⁴⁶ M. C. GEMIGNANI, *Some legal aspects of expert systems*, in *Expert Systems with Applications*, vol. 2(4), 1991, pp. 269–283.

⁴⁷ Art. 6 UDHR: «Everyone has the right to recognition everywhere as a person before the law».

⁴⁸ Art. 3 Cost.: «All citizens have equal social dignity and are equal before the law, without distinction of sex, race, language, religion, political opinion, personal and social conditions. It is the duty of the Republic to remove those obstacles of an economic or social nature which constrain the freedom and equality of citizens, thereby impeding the full development of the human person and the effective participation of all workers in the political, economic and social organization of the country».

⁴⁹ Daniel Kahneman believes in the existence of a correlation between the reduction of glucose in the brain and the decrease of the rational evaluation faculties. A 2011 survey conducted by the economic sciences departments of Columbia University and Ben Gurion University examined the behavior of eight Israeli judges, responsible for the concession of parole to prisoners appealing to the court. The judges were limited to three breaks in the working day: one for coffee in the morning, one for lunch and one for snack. The researchers have timed the distance between meals and the permissions for freedom, finding that the peak of

influenced by these facts and would ensure a neutrality beyond all human expectations, in accordance with art. 3 Cost. In addition to this, a computer system would overcome any cultural barrier and would be the same throughout the national territory, thus leaving minimal relevance to the discretion of the judge and guaranteeing as much as possible the same treatment in any part of Italy⁵⁰.

The right to a natural judge pre-established by law is set forth in art. 25 Cost⁵¹. The guarantee of the natural judge implies that it is only the law that dictates the criteria by which to identify, before the judgment, the competent judge, understood both as a court and as an individual. If the judge were an information system, there would be no possibility of incompatibility (see the abstention and remission institutes), as the neutrality and impartiality would be guaranteed in any courtroom. Despite the positive implications that the use of a legal expert system could entail, an analysis should be carried out on the possible right of the individual who wanted to be judged by a person-judge in the whole procedure. Would it be convenient to assume such a right for each person? If so, which could be the consequences?

From our point of view, such a claim could be justified if the computer system carried out all the decision-making operations without any kind of human intervention, even more so if the logical steps taken by the legal expert system in question were not explained. Nevertheless, as mentioned above, our vision of coexistence between judges-people and information systems would be based on a relationship that basically helped the latter to the former; relationship in which, at the end of the operations, the judge-person would still have to motivate the decision made expressing every logical step. On the basis of these premises, it seems risky to recognize the right of individuals to see their proceedings handled entirely by human judges, at least during the near future and especially at the moment.

consensus is recorded immediately after the breaks, with 65% of permits, while it drops almost to zero in the two hours before refreshment. See <http://www.pagina99.it/2017/10/09/algorithmi-tribunale-giudici-intelligenza-artificiale/> (last visited 14/11/2018).

⁵⁰ Nevertheless, several studies have shown that machine learning systems are as biased as humans. In this regard, let us just mention what happened when in the United States a system of artificial intelligence judged a girl – guilty of committing a slight crime – as less suited to release on bail as black, assigning her a recidivism risk score much higher than that of a white man who had committed a much more serious crime. Although the algorithms bring tangible benefits to procedural efficiency (such as reducing the prison population without negative implications for public safety), it cannot be denied that the problems that their use raises are many, especially when it comes to racial discrimination. There are those who defend the machine, claiming that the prejudices of the systems are nothing more than the direct consequence of the prejudices of real people; on the contrary, there are those who accuse it and even sue the US justice system (see the *Wisconsin v. Loomis* case, in which Loomis tried to prove that his right to due process had been violated as his conviction had been calculated based on the suggestions given by a private algorithm whose logical processes could not be known by the parties; the rights he felt infringed were the right to an individualized sentence and the right to be sentenced on accurate information). S. CORBETT-DAVIES, S. GOEL, S. GONZÁLEZ-BAILÓN, *Even Imperfect Algorithms Can Improve the Criminal Justice System*, 2017. See <https://www.nytimes.com/2017/12/20/upshot/algorithms-bail-criminal-justice-system.html> (last visited 14/11/2018). See also J. TASHEA, Risk-assessment algorithms challenged in bail, sentencing and parole decisions, http://www.abajournal.com/magazine/article/algorithm_bail_sentencing_parole (last visited 14/11/2018).

⁵¹ Art. 25 Cost.: «No case may be removed from the court seized with it as established by law. No punishment may be inflicted except by virtue of a law in force at the time the offence was committed. No restriction may be placed on a person's liberty save for as provided by law».

In this regard, we cannot fail to recall the art. 8⁵² of D. Lgs. 51/2018, implementing the European Directive 680/2016 “on the protection of natural persons with regard to the processing of personal data by competent authorities for the purposes of the prevention, investigation, detection or prosecution of criminal offences or the execution of criminal penalties, and on the free movement of such data, and repealing Council Framework Decision 2008/977/JHA”. On the basis of this new regulation, new types of offenses have been introduced in the Italian penal code and the privacy field has been widely updated. Consistently with what has been analyzed so far, art. 8 D. Lgs. 51/2018 prohibits the production of adverse effects towards an individual on the basis of totally automated treatments (unless special regulatory authorizations are introduced at European or State level). It seems to us that this mandatory measure marks a guarantee for the citizen, especially in view of an increasingly computerized justice and a system in which personal data are handled with increasing ease. In fact, as mentioned above, the expert system should always be an aid to the professional of the laws, and never a substitute, and we believe that this provision can be the right handhold to never fall into unbridled automatism.

With regard to the due process, we have to mention the art. 111 Cost.⁵³, as reformed by L. Cost. n. 2/1999. The regulation aims to guarantee the fundamental rights that the individual must have in judicial trials, especially in the criminal ones. In this regard, we believe that a situation such as the one that occurred in the United States, in which the judge’s decision was based on algorithms that were not known not only by

⁵² Art. 8 D.Lgs. 51/2018: «Automated decision-making process concerning natural persons. 1. Decisions based solely on automated processing, including profiling, which produce adverse effects on the concerned subject are prohibited unless they are authorized by European Union law or by specific legal provisions. 2. The provisions of law must provide adequate guarantees for the rights and freedoms of the interested party. In any case, the right to obtain human intervention by the data controller is guaranteed. 3. The decisions referred to in paragraph 1 may not be based on the particular categories of personal data referred to in Article 9 of the EU Regulation, unless appropriate measures are in place to safeguard the rights, freedoms and legitimate interests of the interested party. 4. Without prejudice to the prohibition laid down in Article 21 of the Charter of Fundamental Rights of the European Union, profiling for the purpose of discrimination against natural persons on the basis of particular categories of personal data referred to in Article 9 of the EU Regulation is prohibited».

⁵³ Art. 111 Cost.: «Jurisdiction is implemented through due process regulated by law. All court trials are conducted with adversary proceedings and the parties are entitled to equal conditions before an impartial judge in third party position. The law provides for the reasonable duration of trials. In criminal law trials, the law provides that the alleged offender shall be promptly informed confidentially of the nature and reasons for the charges that are brought and shall have adequate time and conditions to prepare a defence. The defendant shall have the right to cross-examine or to have cross-examined before a judge the persons making accusations and to summon and examine persons for the defence in the same conditions as the prosecution, as well as the right to produce all other evidence in favour of the defence. The defendant is entitled to the assistance of an interpreter in the case that he or she does not speak or understand the language in which the court proceedings are conducted. In criminal law proceedings, the formation of evidence is based on the principle of adversary hearings. The guilt of the defendant cannot be established on the basis of statements by persons who, out of their own free choice, have always voluntarily avoided undergoing cross examination by the defendant or the defence counsel. The law regulates the cases in which the formation of evidence does not occur in an adversary proceeding with the consent of the defendant or owing to reasons of ascertained objective impossibility or proven illicit conduct. All judicial decisions shall include a statement of reasons. Appeals to the Court of Cassation in cases of violations of the law are always allowed against sentences and against measures affecting personal freedom pronounced by ordinary and special courts. This rule can only be waived in cases of sentences by military tribunals in time of war. Appeals to the Court of Cassation against decisions of the Council of State and the Court of Accounts are permitted only for reasons of jurisdiction».

the parties, but not even by the judge himself⁵⁴, cannot be considered compatible with our Constitution. Since every measure issued by the court must be adequately motivated, what guarantees can be given to citizens if the decision-making process lacks transparency? We are hopeful in believing that such a situation can never occur in our judicial system⁵⁵, as it is profoundly different from the US' one and above all because we trust in the strict adherence to the constitutional legitimacy of our trials.

Concerning the legitimacy of our trials, it must be said that Italy has been repeatedly condemned by international courts for their excessive duration⁵⁶: a use of expert systems could probably bring benefits to their rapidity, so as to make the current system more compliant with constitutional and international provisions.

Finally, we must analyze the relationship between copyright and the right to defense and the cases in which these rights may come into conflict. As we know, *diritto d'autore*⁵⁷ is the legal institution typical of civil law systems that aims to protect the outcomes of intellectual activity through the recognition to the original author of the work of a series of rights (both moral, both patrimonial). In Italy, it is regulated by law n. 663/1941 and by art. 2577 cod. civ.⁵⁸ The law about *diritto d'autore* protects the software codes considering them literary texts. The problem arises when there is potential opposition between *diritto d'autore* and the right to defense. As we know, the latter must be concrete and effective, particularly in criminal proceedings. In the event that a person is accused by a machine or judged on the basis of an algorithm that cannot be known as protected by copyright⁵⁹, the lawyer would have to balance two rights, both protected by our system, and decide which of the two must prevail. In our opinion, the right to defense is certainly more important than the moral and economic rights connected to intellectual work: for

⁵⁴ See A. LIPTAK, *Sent to Prison by a Software Program's Secret Algorithms*, available on <https://www.nytimes.com/2017/05/01/us/politics/sent-to-prison-by-a-software-programs-secret-algorithms.html> (last visited 14/11/2018).

⁵⁵ Maybe such a situation could be avoided by regulating in a different way the property of the algorithms, that is to say, by not allowing the rights related to them to be left uniquely to their creators. As we can read from A. Liptak's words, «*There are good reasons to use data to ensure uniformity in sentencing. It is less clear that uniformity must come at the price of secrecy, particularly when the justification for secrecy is the protection of a private company's profits. The government can surely develop its own algorithms and allow defense lawyers to evaluate them*».

⁵⁶ The excessive duration of Italian trials led the European Court of Human Rights to repeatedly condemn Italy for violating art. 6 of the European Convention on Human Rights, which establishes the right of the individual to be tried within a reasonable time.

⁵⁷ We cannot properly translate "*diritto d'autore*" with 'copyright', since copyright is a particular institution typical of common law countries and slightly different from *diritto d'autore*. In fact, *diritto d'autore* protection and copyright protection are not exactly coincident: in common law systems (in particular United States and Great Britain) the copyright is born with the deposit of the work to the Copyright Office; on the contrary, our *diritto d'autore* arises with the simple creation of the work. However, forms of deposit or registration of the work are frequently also practiced in our legal system and in general also in the European civil law countries because they allow, through specific procedures, to give a certain date to the creation and to prove the prior art of the intellectual property if the need arises.

⁵⁸ Art. 2577 cod. civ.: «*The author has the exclusive right to publish the work and to use it economically in every form and manner, within the limits and for the effects established by law. The author, even after the assignment of the rights provided by the preceding paragraph, can claim the authorship of the work and can oppose any deformation, mutilation or other modification of the work itself, which could be prejudicial to his honor or reputation*».

⁵⁹ We have already examined the US petition (*Loomis v. Wisconsin*) in which the right to defense and due process has been opposed to the property and secrecy of the algorithm. See <https://harvardlawreview.org/2017/03/state-v-loomis/> (last visited 14/11/2018). See also *State v. Loomis*, 881 N. W. 2d 749 (Wis. 2016).

this reason, in such a situation the legislator should enact legislation on the acquisition of rights on the algorithm by the State, in order to be able to make it public and guarantee a concrete and effective defense to everybody.

5. Artificial intelligence in the European Union

The European Union is increasing its annual investments in artificial intelligence by 70% under the research and innovation programme Horizon 2020⁶⁰. It will reach EUR 1.5 billion for the period 2018-2020 and its goal is to ensure Europe's competitiveness in the research and development of artificial intelligence and to deal with social, economic, ethical and legal questions. To achieve this results in the best way possible, on April 10, 2018 a large number of European countries signed a Declaration of cooperation on Artificial Intelligence⁶¹, declaring a strong will to join forces and work together on the most important issues raised by artificial intelligence. The European Commission stated that one of the most important goals that has to be reached is the creation of «an appropriate ethical and legal framework» based on EU values and that artificial intelligence «should respect the EU's values and fundamental rights as well as ethical principles such as accountability and transparency».

An important step in this direction was taken by enacting the GDPR, the General Data Protection Regulation, a regulation that entered into force on May 25, 2018 with the task of establishing a uniform discipline at European level in the area of data processing and privacy and whose main purpose is to protect the personal information of European citizens from unfair and unethical uses of their data. The implementation of the GDPR, that will replace the existing EU Data Protection Directive, puts restrictions on the use of artificial intelligence and machine learning as the article 22⁶² of the same normative states that “the regulation prohibits any automated decision that significantly affects EU citizens” and in addition the new rules give the subjects the right to review how the algorithm of the automated tool make his choice who affects people. This may be a problem as a large number of artificial intelligent systems are not

⁶⁰ <https://ec.europa.eu/programmes/horizon2020/what-horizon-2020> (last visited 14/11/2018).

⁶¹ http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=50951 (last visited 14/11/2018).

⁶² Art. 22 GDPR: «Automated individual decision-making, including profiling. 1. The data subject shall have the right not to be subject to a decision based solely on automated processing, including profiling, which produces legal effects concerning him or her or similarly significantly affects him or her. Paragraph 1 shall not apply if the decision: (a) is necessary for entering into, or performance of, a contract between the data subject and a data controller; (b) is authorized by Union or Member State law to which the controller is subject and which also lays down suitable measures to safeguard the data subject's rights and freedoms and legitimate interests; or (c) is based on the data subject's explicit consent. In the cases referred to in points (a) and (c) of paragraph 2, the data controller shall implement suitable measures to safeguard the data subject's rights and freedoms and legitimate interests, at least the right to obtain human intervention on the part of the controller, to express his or her point of view and to contest the decision. Decisions referred to in paragraph 2 shall not be based on special categories of personal data referred to in Article 9(2)1), unless point (a) or (g) of Article 9(2) applies and suitable measures to safeguard the data subject's rights and freedoms and legitimate interests are in place».

very clear about how their machine learning algorithms reach decisions, that is why they are called “black boxes”⁶³. Not even the creators of artificial intelligence systems can always fully explain why a system makes its decision and a regulation like the GDPR, that requires this kind of explanations, could limit the efficacy of these tools.

As the AI is now covering all aspects of human life, it is not science fiction anymore to imagine in the future individuals being replaced by robots built to do their jobs⁶⁴, but not all of the human work can be replaced by an intelligent machine. The legal field is among the areas in which it will be most unlikely to see the complete overcoming of new technologies, because of the relevance of the human contribution to the subject.

This theory is supported even by the experts working on the implementation of the artificial intelligence method to the law field. In 2016 some researchers of the University College of London developed a cognitive system that was able to predict the judicial decision of the European Court of Human Rights with a 79% of accuracy. The algorithm used by the machine examined data sets for 584 cases relating to torture and degrading treatment, fair trials and privacy⁶⁵.

The lead researcher of the case, Nikolas Aletras⁶⁶, although these outstanding outcomes, stated that it is unlikely that in the future text-based predictive system of judicial decision will be replacing judges or lawyers, but this assisting tool would be useful to rapidly identify cases and extract patterns that lead to certain outcomes and it can also be used to highlight which cases are most likely to be violations of the European Convention of Human Rights. For these reasons, the artificial intelligence method could help the courts to improve efficiency and legal certainty but will not be a substitute of the judge in the decision-making process⁶⁷.

The spread and the developing of these new systems based on predictive algorithm and on the use of this technology submits some inevitable questions concerning the ethics of the means used and the accountability of the outcomes reached, together with the need to adapt the use of these instruments to the public interest and to the fundamental human rights.

⁶³ The term “black box” was coined by David Easton in *“A System Analysis of Political Life”*, 1965.

⁶⁴ <https://www.forbes.com/sites/quora/2017/12/18/artificial-intelligence-will-change-the-job-landscape-forever-heres-how-to-prepare/#46c498c327f4> (last visited 14/11/2018).

⁶⁵ See <https://www.theguardian.com/technology/2016/oct/24/artificial-intelligence-judge-university-college-london-computer-scientists> (last visited 14/11/2018).

⁶⁶ Lecturer in Data Science and Social Media at the University of Sheffield and a research associate at UCL, Department of Computer Science.

⁶⁷ The researcher said: «We don’t see AI replacing judges or lawyers, but we think they’d find it useful for rapidly identifying patterns in cases that lead to certain outcomes. It could also be a valuable tool for highlighting which cases are most likely to be violations of the European Convention on Human Rights». See <http://www.ucl.ac.uk/news/news-articles/1016/241016-AI-predicts-outcomes-human-rights-trials> (last visited 14/11/2018).

The Parliamentary Assembly of the Council of Europe has adopted unanimously a recommendation on April 28, 2017 named “*Technological convergence, artificial intelligence and human rights*”⁶⁸, addressed to the Committee of Ministers and regarding the pervasiveness of new technologies and their applications that is blurring the lines between human and machine.

This situation could affect human rights and the way in which they can be exercised. As a matter of fact, one of the problems is that the law can hardly keep up with the endless changes submitted by the science and the new technologies. This is one of the challenges that have to be faced according to the Assembly, that claims the need to draw up the necessary regulations and standards in order to be able to keep the phenomenon under control. For this reason, the Parliamentary Assembly strongly believes that safeguarding human dignity nowadays implies developing new forms of governance, new forms of open, informed and adversarial public debate and, most important of all, the establishment of an international cooperation making it possible to achieve the results in the most effective way possible.

In the recommendation, reference is made to the fact that the Courts increasingly use tools that automate their decision processes: artificial intelligence instruments that are able to make more consistent legal decisions than humans, reduce the length of court proceedings and maybe also help the judges to ensure a fair trial. The most important issue that has to be considered is that some principles, aimed at maintaining reliable transparency and recognisability, should be taken into account when judges use an automated tool to aid the decision-making process. It is very important to make clear whether an artificial intelligence tool is being used by the judge in the making of their final decision and in which way this tool may affect their outcome. Moreover, the judge should remain responsible for the final decision even if, in the making of it, they have been helped by an artificial intelligence tool and besides, if he or she deviates from the advice given by the computer, they should motivate this decision.

It is very important to respect some essential principles that guide the explication of the judicial function, even in the use of tools that make use of artificial intelligence. The compliance with these principles is one of the main issues that the spread of artificial intelligence has to face: in fact, even in the use of alternative tools for the resolution of disputes in the courts there are some limits and some key principles that cannot be overshadowed by an automated tool. In the next paragraph we will examine some of them.

⁶⁸ Recommendation 2102, April 28, 2017, <http://assembly.coe.int/nw/xml/XRef/Xref-XML2HTML-en.asp?fileid=23726&lang=en> (last visited 14/11/2018).

6. Right to explanation, right to be judged by a human and biases in legal expert systems

Recently a considerable interest in the development of computer systems for automatic legal reasoning has emerged, and the researches in the field of artificial intelligence have allowed the realization of the so called legal expert systems (computer systems based on legal knowledge, capable of simulating intelligent behaviour and automatically solve problems of a legal nature). The system receives an input, which may be the relevant facts of the case, and delivers an output which may be the whole judicial outcome or the answer to a specific question needed in order to grant a decision⁶⁹. Using this technological tool ensures the consistency of legal reasoning with the legislation and ensures that the necessary steps of the logical reasoning are taken into account.

The advantages in using legal expert systems are considerable and, at first glance, it would seem that they far outweigh the drawbacks. Probable advantages deriving from the use of legal expert systems could be the reduction of errors, and a guarantee of equality and fairness (which will derive from correcting some of the biases, distributional inequalities and external factors that influence the judge), efficiency (the use of computerized system saves part of the judicial time in finding the legal state of affairs, for example comparing the case to similar cases), and a reduction in the number of legal proceedings. The implementation of these systems would be preferable, above all, in cases in which repetitive and constant elements prevail in the application of the law (clear cases), rather than in cases where purely discretionary evaluations are required (hard cases)⁷⁰. In fact, the intervention of the system, in the cases in which there is constant presence of certain well-defined premises from which it is possible to draw constant conclusions, would relieve the judge from a repetitive and routine work that prevents him from devoting himself more seriously to the most complex cases⁷¹. However, the support of expert systems cannot be completely put aside, even when talking about the reach of more complex conclusions that, anyway, do not exclude the valorisation of the independence and discretion of the judge.

But if the judges, in the performance of their judicial function, were to be supported by a legal expert system, some safeguard measures should be set up to protect the rights of the subject against whom the decision will take effect. It is important to analyse which protections should be guaranteed to the individual for what concerns the right to be judged by a human and not by a machine, and the right to transparency in the decision-making process.

⁶⁹ J. ZELEZNIKOW, A. STRANIERI, *An Ontology for the Construction Of Legal Decision Support Systems*, in *Second International Workshop on Legal Ontologies*, Amsterdam, 2001.

⁷⁰ M. IASELLI, *Informatica e nuove regole per la produzione del diritto*, contenuto in *Diritto delle nuove tecnologie informatiche e dell'internet*, Ipsoa, Milano, 2002.

⁷¹ M. IASELLI, *Informatica giuridica*, contenuto in *Diritto delle nuove tecnologie informatiche e dell'internet*, Ipsoa, Milano, 2002.

It assumes particular relevance the right to be given certain information and motivation, in particular as regards the method of operation of the expert system and what information this uses and how these are reworked. In the field of artificial intelligence, transparency plays a fundamental role in raising accountability, because without true clarity on how algorithms are used by the neural networks in the operation, there can be no accountability for decisions that affect the public⁷². In the regulation of algorithms and particularly artificial intelligence, a right to explanation is the right to be given a justification for any output of the algorithm, but many algorithms used in machine learning are not easily explainable. In fact, the way in which the artificial intelligence system makes its decision is known as “black box”, as said before, because one can be aware of which information and data are put inside the tool but how this information is assembled to give the outcome provided by the system remains unknown⁷³.

This is a problem that could limit the use of expert legal systems, because the subject submitted to a decision took with the help of these tools could challenge the decision for lack of transparency. Especially in the case where expert legal systems are used by a judge to help his decision-making process, the steps that lead to one decision rather than another should be made clear: the judge must always be able to motivate his choices and this assumption is even more relevant in the case that the decision affects the individual personally⁷⁴. Besides, a system that can demonstrate how the decision is made could lead the public to trust the way in which the judge works, and decrease the level of public criticism in the court.

The judicial decision needs motivation; the decision-making activity has to be explained in its whole process, the judge’s response in fact requires a detailed reasoning that expresses arguments on the basis of which the final judgment appears valid and reasonable. It is necessary that the process is complete, without conflicting arguments and equipped with arguments sufficiently supported by good reasons, able to account for every relevant fact on which the decision is based⁷⁵. So, as not to affect the credibility and responsibility of the response to which the judge should arrive, even though the contribution of the expert system, it would be necessary to incorporate the system with some kind of justification model, which

⁷² We doubt a possible full use of expert systems regarding judgments on procedure. In fact, although an expert system can be used in a profitable way to check the legality and legitimacy of previous judgments, we consider it dangerous to entrust a machine with a preponderant role in a judgment that cannot be further contested.

⁷³ <https://www.sentient.ai/blog/understanding-black-box-artificial-intelligence/> (last visited 14/11/2018).

⁷⁴ According to A. Harel and others, the right to a hearing serves as a main justification for judicial review. This right has three components: the right to voice a grievance, the right to receive an explanation and the right to reconsideration of the decision. Y. EYLON, A. HAREL, *The Right to Judicial Review*, 2006; A. HAREL, T. KAHANA, *The Easy Core Case for Judicial Review*, in *Legal Analysis*, 2010, pp. 227.

⁷⁵ According to D. W. ROLSTON (*Principles of Artificial Intelligence and Expert Systems Development*), the credibility of an expert system depends on its ability to justify its reasoning processes.

would equip the system with the requirements of completeness, adequacy and coherence necessary for the justification of a judicial decision⁷⁶.

Furthermore, the right to obtain a human intervention in the decision process should be given to the subject. The right not to be judged only by a legal expert system would be satisfied if the judge in issuing his decision is never replaced in all his functions by the automated tool, but this instrument should play an auxiliary function, providing a starting knowledge base and eventually a decision from which the judge could also choose to depart, adequately motivating this choice⁷⁷. As Carsten Smith, Chief Justice of Norway, correctly said: «We must never forget that the main element in the judicial process is the human element».

The decision proposed by the software is not binding for the judge, who always retains the power to decide independently. But even if the judge decides to fully comply with the decision reached by the system, they should still carry out the appropriate assessments and not accept without doubt the conclusion of the system before having completed a careful examination.

Nevertheless, this is what happened in the Chinese Court of Zibo in 2006, where an expert system was employed to exactly establish the period of imprisonment expected in a given case – by taking into account some elements of the event such as the severity of the offense and the circumstances – and the compensation for the damage suffered by the victim. The software, *Penalty Calculator*, had imposed six months imprisonment on a farmer who had stabbed his neighbour, and the judge rigorously followed the response given. This system tries to ensure the consistency of judicial decisions by examining about a thousand previous cases and aims at avoiding the abuse of discretionary power due to corruption or insufficient legal preparation⁷⁸.

But this method is not acceptable because the judge – who does not know how to evaluate the response of the machine – assumes it as his own, relying excessive confidence on the system and not questioning the outcomes. Software such as this one present big limits, because they end up limiting the judge's evaluation capacity, whereas independence and discretion are exclusive prerogatives of the judging function.

Therefore, the right to a human intervention should not integrate the possibility for the subject to choose to avoid being judged also by a legal expert system, but only to ensure that this tool does not fully embrace the whole decision-making process. The obligation to be submitted to such a judgment, in which both the judge and the legal expert system appear, is necessary for the legal certainty and to guarantee the same

⁷⁶ K. YALIN-MOR, *Using Decision Support Systems in Judicial Decision-Making*, Tel Aviv University, 2011.

⁷⁷ S. SCHJØLBERG said that «such systems must not take the decisions, but only be used as a new remedy in the decision process. The judge must always be able to choose the proposed solution or reject it independently».

⁷⁸ Zichuan District Court chief judge, Wang Hongmei, said: «The software can avoid abuse of discretionary power of judges as a result of corruption or insufficient training». See https://www.theregister.co.uk/2006/09/13/sentencing_software/ (last visited 14/11/2018).

treatment to everybody, avoiding the risk that different subjects are judged in different ways. The decision-making process should be the same for everyone and it would not be so if some subjects chose not to be submitted to a decision made by using an automated tool. Nevertheless, there should be no need to avoid a judgment in which an expert system is used, if we consider that this does not replace the judging body but is instead designed to improve and increase the judge capacities.

In order to take advantage of these legal expert systems, it should be set up an *ad hoc* legislation to regulate and monitor the exercise of this function and to avoid an incorrect use of this technology.

7. Legal expert system in the US Courts

The problem of the lack of transparency and accountability in using these automated tools has been demonstrated during a trial before an US Court. In the United States the algorithm implementation to the decision-making process is already reality and some shortcomings have been found.

In particular, in the US courts the use of a risk-assessment tool has widely spread: this tool provides an objective analysis of whether an arrested person is likely to appear in court and not get rearrested if released before trial, using a research-based and data-driven pre-trial tool. A risk-assessment tool should reduce bias and subjectivity in court decisions about who should be detained before trial and which conditions should be required of those who are released⁷⁹. This kind of tools presents obvious advantages if correctly used, but there are some assumptions that have to be respected.

In the case of *Wisconsin v. Loomis*, the defendant Eric Loomis was found guilty for his role in a drive-by shooting. During the intake, the defendant answered a series of questions that were entered into COMPAS, a risk assessment tool developed by a privately held company and used by the Wisconsin Department of Corrections⁸⁰. The trial judge gave to the defendant a long criminal conviction to serve, partially because of the high-risk score that the defendant received from the black-box risk-assessment tool.

The defendant challenged his sentence because he was not allowed to assess the algorithm, asserting that “the circuit court’s consideration of a COMPAS risk assessment at sentencing violates a defendant’s right to due process” and that “the court erroneously exercised its discretion by assuming that the factual bases for

⁷⁹ See <https://qz.com/920196/criminal-court-judges-in-new-jersey-now-use-algorithms-to-guide-decisions-on-bail/> (last visited 14/11/2018).

⁸⁰ See <https://www.nytimes.com/2016/06/23/us/backlash-in-wisconsin-against-using-data-to-foretell-defendants-futures.html> (last visited 14/11/2018).

the read-in charges were true”⁸¹. Loomis asserted that the use of COMPAS made by the circuit’s court violated the defendant’s right to be sentenced based upon accurate information, partly because of the proprietary nature of COMPAS that prevented him from assessing its accuracy, and partly because the use of the risk assessment tool violated the defendant’s right to an individualized sentence. In fact, the COMPAS risk assessment does not predict the specific likelihood that an individual offender will reoffend, but provides a prediction based on a comparison of information about the individual to a similar group.

The main concern of the defendant was that the developer of COMPAS, the Northpointe, Inc., considered COMPAS a proprietary instrument and a trade secret and accordingly to that, refused to disclose its methodology about how the risk scores are determined or how the factors are weighed. Loomis asserted that, because COMPAS process remains hidden, he has been denied information that the circuit considered at sentencing, so, unless it could be revised the way in which factors are weighed and how risk scores are determined, the COMPAS assessment cannot be verified. The defendant knew the information COMPAS was using (his criminal history and a pre-sentencing questionnaire he had filled out), but he was not aware about how the tool was using the information to predict his recidivism⁸². The Supreme Court confirmed the fact that the risk score did not explain how the COMPAS program uses information to calculate the risk scores, but stated at the same time that some States that use COMPAS have conducted validation studies of the system, concluding that it is a sufficiently accurate risk assessment tool.

So, despite the concerns advanced by the defendant, the State Supreme Court ruled against him, stating that the knowledge of the algorithm’s output was a sufficient level of transparency. The Court denied the resentencing hearing requested by the defendant, concluding that «if used properly, observing the limitations and cautions set forth herein, a circuit court’s consideration of a COMPAS risk assessment at sentencing does not violate a defendant’s right due to process». The Supreme Court decision determined that the circuit’s court did not erroneously exercised its discretion because the consideration of the COMPAS risk scores was supported by other independent factors.

It is arguably constitutional and troubling that the Court allowed an algorithm to play a role, even the slightest, in depriving an individual of his liberty when the actors in the justice system have limited visibility about the way in which the algorithm itself works⁸³. Not proceeding to an adequate explanation of how the instrument works could be a violation of the right of transparency, because the subject cannot be denied to know the reasons why a specific conviction is pronounced against them; moreover, if the decision-making

⁸¹ *Eric L. Loomis v. Wisconsin*, No 2015AP157-CR, 2016 WI, (July 13, 2016).

⁸² E. ISLANI, *Algorithmic Due Process: Mistaken Accountability and Attribution in State v. Loomis*, edited in *Harvard Journal of Law & Technology*, 2017. Available on: <https://jolt.law.harvard.edu/digest/algorithmic-due-process-mistaken-accountability-and-attribution-in-state-v-loomis-1> (last visited 14/11/2018).

⁸³ E. ISLANI, *op. cit.*

process remains hidden, the judge's ability to make a decision and a fully informed motivation is limited, and they could also not be able to take a full responsibility for the outcome of the trial.

Almost all aspects of this algorithmic decision-making remain opaque and the lack of transparency due to this opacity is one of the biggest obstacles to a proper accountability that concerns artificial intelligence systems⁸⁴. This is the reason why there is a need of transparency in the decision-making process and why it has to be explained how the algorithm works, how it makes its decision and how data have been used in the process; it has to be an impartial tool and the defendant has to have the right to know on which bases he is being partly judged by an artificial intelligence instrument.

But the lack of transparency in this kind of human-decision maker is not the only problem due to the use of a legal expert system: as a matter of fact, another risk that must be taken into consideration is the breach of the right not to be discriminated. The algorithm used in the process is the same as we mentioned before, the already seen COMPAS, that the investigative organization ProPublica⁸⁵ claimed as biased against black defendants in the making of decisions about predicting recidivism.

The COMPAS tool assigns a score to the defendant, that is defined as low, medium or high risk based on more than one hundred factors including age, sex and criminal history (but – of course – not race). The defendants who get scores from five to ten are more likely to be detained while awaiting trial than low risk defendant with scores from one to four are⁸⁶. The problems lay in the algorithm's mistakes, because the results of the tool say that black people are almost twice as likely as whites to be labelled a higher risk, but not actually re-offend and make the opposite mistake towards white people: they are much more likely than blacks to be labelled lower risk but go on to commit other crimes.⁸⁷ In spite of the fact that COMPAS is, or at least is supposed to be, a neutral tool, it entails certain prejudices. Such a situation leads to wondering the origins of the aforementioned prejudices.

The answer probably lies in the inputs given to the algorithm. It is possible that, even if race or another constitutionally impermissible factor is ever mentioned in the source code (the list of human-readable instructions that a programmer writes when developing a program⁸⁸), the algorithm is achieving the same,

⁸⁴ See <https://www.theguardian.com/science/2017/nov/05/computer-says-no-why-making-ais-fair-accountable-and-transparent-is-crucial> (last visited 14/11/2018).

⁸⁵ See <https://www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing> (last visited 14/11/2018).

⁸⁶ See https://www.washingtonpost.com/news/monkey-cage/wp/2016/10/17/can-an-algorithm-be-racist-our-analysis-is-more-cautious-than-propublicas/?utm_term=.c474e5e358bb (last visited 14/11/2018).

⁸⁷ See <https://www.theatlantic.com/technology/archive/2018/01/equivant-compas-algorithm/550646/> (last visited 14/11/2018).

⁸⁸ See <https://www.thoughtco.com/source-code-definition-958200> (last visited 14/11/2018).

racist or inappropriately biased result by placing a high weight on some variable that is the starting point for a future discrimination based on race⁸⁹.

But the main problem with the COMPAS tool is that it is impossible to find a rule to satisfy fairness⁹⁰, because what is fair could be different for different parties and so the way in which the algorithm works. This is the reason why the actual usefulness of this instrument is criticised and it has been claimed that it is wrong to assume that an algorithm prediction is undoubtedly better than human ones⁹¹; machine learning algorithms are merely reflections of the input data that trains them and if the input data are biased, the computer will be biased too.

According to these studies on the subject, this does not mean that algorithms cannot be used; instead, this kind of tool needs to be tested and perfected before being used by the criminal justice system to decide about people's lives. More attempts are needed to create a tool that could actually promote safety, equity and justice, instead of trusting an algorithm that facilitates and strengthens the spread of discrimination and racism; in fact, algorithms trained with biased data replicate these biases and develop new ones⁹². If a machine learning algorithm is not constantly retrained and if the flaws in their initial determinations are not modified, the biases are continuously affirmed⁹³.

A decision like the one seen before of the Supreme Court in the Loomis case is not reassuring at all, because it merely establishes certain limits that the judge must not overcome in the use of the COMPAS tool but does not care about the true nature of this instrument and about the fact that even a computer can be wrong. The use of these tools requires a lot of caution, because what is going to be affected by an erroneous decision are the fundamental rights of the individuals that can be sacrificed only after a careful examination, that should be accomplished only by a human judge.

The judge cannot rely too much on the computer to issue their decision and cannot justify their actions relying solely on the outputs thereof, because in the end the final judgment will always be their responsibility. And we can reach a similar conclusion talking about the creator of the machine learning algorithm, because «the programmers need to be held to the same high ethical and constitutional standards to which we hold other actors in the criminal justice system»⁹⁴. If the judge is obliged to justify their decision and to explain its decision-making process, programmers have to disclose some information

⁸⁹ See K. NOYES, *Will big data help end discrimination — or make it worse?*, Fortune, 15 January 2015, <https://fortune.com/2015/01/15/will-big-data-help-end-discrimination-or-make-it-worse/> (last visited 14/11/2018).

⁹⁰ A. CHOULECHOVA, *Fair prediction with disparate impact: A study of biases in recidivism prediction instruments*, 2016.

⁹¹ See <https://www.theatlantic.com/technology/archive/2018/01/equivant-compas-algorithm/550646/> (last visited 14/11/2018).

⁹² Google's AI chief John Giannandrea said: «It's important that we be transparent about the training data that we are using, and are looking for hidden biases in it, otherwise we are building biased systems». See <https://www.technologyreview.com/s/608986/forget-killer-robot-bias-is-the-real-ai-danger/> (last visited 14/11/2018).

⁹³ C. O' NEIL, *Weapons of math destruction: how big data increases inequality and threatened democracy*, Penguins Book, 2016.

⁹⁴ E. ISLANI, *op. cit.*

in order to satisfy the need of transparency necessary in the relationship with the subjects to whom the decision is addressed.

8. Italian criminal justice and legal expert systems

The US criminal justice has already begun to employ legal expert systems to evaluate whether a person accused of a crime will replicate it in the future, or the likelihood that a person released on bail will report to the court for judgment. Therefore, applications of artificial intelligence to the field of criminal justice are already being tested: just think of the paradigmatic case previously seen, about the software created by the University College of London that simulated the judgments of the European Court of Human Rights in matters of torture, degrading treatment and violation of privacy. In fact, the idea of an automatic judge replacing the human judge in the making of fair decisions without typical human prejudices would have an advantage from the point of view of procedural economy and efficiency.

But talking about the Italian criminal justice system, it is difficult to think of an artificial intelligence machine replacing the judge in their functions. This difficulty is due to the way in which in our legal system the criminal trial is designed and built: in fact, if the judge used an expert system that uses artificial intelligence for the evaluation of the evidence, we should assume a return to what the system was before the affirmation of the accusatory model, where the judge had no discretion in the evaluation of the evidences but there was instead a system of legal criteria that the judge had to follow.

If there was an expert system with the task of evaluating the evidences, it should be conjectured a criterion for assessing them, but that would leave no discretion to the judge and would reinstate that system used in the *ancien régime*, in which there were rules that required the judge to consider certain facts as proved where certain legal parameters were met⁹⁵. If we followed this approach, then the free conviction of the judge (that is to say, the principle according to which the judge is not subject to rules that require him to positively attribute a certain probative value to a certain evidence) would be cancelled.

But this system cannot work, because it is impossible to predetermine correctly the probative value of a given fact and using an algorithm to analyse the evidence would mean entering legal criteria within the legal expert system and in doing so, predetermine in advance how certain situations should be judged. It is inevitable to leave to the judge the discretion that allows a free application of the specific case.

⁹⁵ P.P. TONINI, C. CONTI, *Il diritto delle prove penali*, Giuffrè Editore, 2014, pp. 68.

So, in all cases in which the intervention of the judge in the decision-making process is so intense and a discretionary appreciation is required, it is not easy to imagine an expert system assuming these functions onto itself. The function of the judge in the criminal trial necessarily requires a meaningful human approach, it is not possible to disregard an assessment of the concrete case that does not present those characteristic and peculiarities of human logical reasoning, including ethical and moral values that a machine will never be able to reproduce. The activity of judging is a human fact, in which there are also emotional components and subjective convictions that are not traceable to the simple identification of legal cases.

But if the judge in the criminal trial cannot be replaced by an expert system, he can still be assisted by a tool that reproduces the cognitive process. An innovative legal expert system elaborated by judge Carmelo Asaro is the Daedalus P.M. Assistant, an application program designed for judicial assistance to the Public Prosecutor⁹⁶. Daedalus P.M. is not only an expert system for consulting or decision aid, but also a real system for intelligent retrieval in databases, and it is able to manage structured information in databases using a specific formal knowledge. This legal expert system is able to know and treat the concepts contained in the rules, and to choose the rules that could be relevant to the specific case and to the justification of the reasoning in an intelligent way⁹⁷.

The Daedalus assists the P.M. (*pubblico ministero*) and helps them make decisions, and is able to avoid mistakes and to warn about their existence; it can also explain its conclusions by showing the assumptions on which they are based. It is a system that is able to represent the interpretation of a given regulation, as a matter of fact the answers and the elaborations of the system are a logical application of the information contained in the knowledge base or combined with the information added by the P.M.⁹⁸. The Daedalus would be able to analyse the case proposed and trace the precedents, and in the second phase to activate a deductive procedure arriving autonomously to conclusions. Even if the judge could never be replaced by a legal expert system, this kind of tool could provide the aims that allow the simulation of different or similar decisions. Another project similar to this one is the Daedalus-Cassazione project: this system could help calculating the expiry dates of the precautionary measures and the prescription of offenses, as well as for the management of related data to crimes⁹⁹.

⁹⁶ See <https://www.diritto.it/articoli/tecnologie/iaselli.html> (last visited 14/11/2018).

⁹⁷ C. ASARO, *Progetto Daedalus*, contenuto in *Diritto delle nuove tecnologie informatiche e dell'internet*, Milano, 2002.

⁹⁸ C. ASARO, E. NISSAN, A.A. MARTINO (2001), *The Daedalus system: a tool for the Italian investigating magistrate*, in *Computing and Informatics*, vol. 20(06), pp. 515-554.

⁹⁹ See <https://www.diritto.it/articoli/tecnologie/iaselli.html> (last visited 14/11/2018).

9. Conclusions

There are many implications of artificial intelligence in the field of law and, in particular, of expert systems. As we said, these systems can never replace the professional of the law in all its functions, but could serve as an aid: in fact, the application of law requires certain faculties typical of human beings that even the most sophisticated machine cannot never equal, but can surely accelerate and support (for instance, the discretionary judgment based on human perceptions will never be replaced by mechanical and artificial evaluations)¹⁰⁰.

Expert systems could provide legal practitioners with the tools to best perform their functions, improving efficiency, fairness, impartiality and speedy procedures. In order to achieve this result, it will be necessary to have the legislator to intervene, so that a specific discipline is drawn up for the use of these technologies, by establishing authority and limits. Moreover, in order to achieve an efficient implementation of legal expert systems in our legal order, it is desirable for the future to create interdisciplinary courses in Italian universities that can train competent students both in law and in IT¹⁰¹. We hope to see such courses as soon as possible, as the field in question is developing very quickly – especially in other countries – and we think it could be of help to solve the shortcomings of the current Italian (judicial) system¹⁰².

¹⁰⁰ Just think, for example, of the evaluation of “*gravi indizi di colpevolezza*” required by the article 273 cod. proc. pen. for the application of precautionary measures, but also of the hearing of witnesses: there are behavioral characteristics of the human being that the machine, as a machine, cannot grasp.

¹⁰¹ There are currently two courses, one offered by the University of Bologna (Information Technology and Law), the other offered by the University of Trento (Comparative ICT Law), which seem to be excellent bases from which to consolidate and deepen such a wide disciplinary field. We hope that courses of this kind can take hold in every Italian university.

¹⁰² We report the case of the State of Queensland, Australia. Thanks to the constant development and use of information and technology innovations, Australia ranks among the first countries in the world for the efficiency of the judicial system services. In Australia, most judicial services take place online without the physical presence of individuals. Nevertheless, hearings continue to be held in courtrooms, on the basis of a process calendar generated by an information system that apprises the parties well in advance. Specifically in the State of Queensland, a strategic decision was implemented, using the advantages of ICT in the administration of justice by using outsourcing for specialized companies to ensure the design, operation and maintenance of a platform robust enough to meet the justice demand, ensuring the security and reliability of all information received or generated in the course of a judicial process, thus keeping the platform constantly updated in the midst of rapid technological change. This State has 160 judges to attend a judicial volume of around 600,000 new cases each year. Queensland currently has evacuation rates above 100%, and in some Courts up to 120%. They offer services just as the presentation and response of demands, evidence and documents, and there is total interoperability between different public and private institutions that use important information for judicial processes. We can surely assert that the state of Queensland is a model to follow, where law and technology go hand in hand, evidencing the imperative need of the right to go along with the technological advances that represent some utility. See also A.F. SAMACÁ, *Inteligencia artificial aplicada al derecho*, Bogotá, 2016, pp. 15.