A CRITICAL ANALYSIS OF 'LAW 4.0': The use of Automation and Artificial Intelligence and their impact on the judicial of Brazil

UMA ANÁLISE CRÍTICA DO 'DIREITO 4.0': O uso da Automação e Inteligência Artificial e seu impacto no panorama judicial do Brasil

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ABSTRACT: There is a digital revolution, called Industry 4.0, happening around the world (and therefore, in Brazil as well!) that is shifting our activities from an 'ana- logic' to a 'digital' format. From health to education, we can see more and more the digitalisation and the automation taking a key part of the work involved in managing data (being it private or public) and optimising the processes in general. With this move, the 'realisation' that there are several possible ways to perform automation including the use of intelligent systems came to light and it has become a particular favourite term used in any situation to name any computational system. In the justice area, it has not been different, and, particularly, in the Brazilian Justice system, there is a strong move to have as much automation, digitalisation of the processes as possible. However, the general understanding of what algorithms, automation and intelligent systems can be or perform are very foggy and, more often than not, we can see the word 'intelligent' being used inadvertently. Thus, this paper will aim at simply define the keywords from the computer science area: algorithm, automation and intelligent systems (artificial intelligence), evaluate the systems that are in use in the Brazilian Justice System, specifically indicating in which category they fall and, finally, discuss the impact of using intelligent systems without any human intervention in the context of the so called 'Law 4.0'.

KEYWORDS: Automation, Artificial Intelligence, Virtualisation of the Juditial System, Bias in data.

Summary: 1. Introduction. 2 Algorithms, automation and artificial intelligence: what is what? 2.1 Algorithms. 2.2 Automation. 2.3 Artificial intelligence and intelligent systems. 3 The current landscape in Brazil and the law system. 3.1 Simple automation without any 'intelligent' model. 3.2 AI-based solutions for document analysis and distribution. 3.3 Wishfull thinking: Machine Learning for sentences using historical data. 4 Final remarks and the future of AI, automation and law enforcement.

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1 INTRODUCTION

Every revolution that humanity goes through has had an important and unexpected impact on our lives and the way we see the world [18]. The latest one, the 'computer revolution' or Industry 4.0, gave the modern society computer-led new ways of facilitating our day to day workload [19].

There is a strong perception that, with the current computational and algorithmic capabilities, the repetitive tasks of any job could potentially be replaced by a 'robot' that can more efficiently replicate that task. This was true in the industrial revolution of the late 19th century and it is true now as well [27].

In Brazilian Courts, this reality can be traced by the *11419 Act* from 2006 [6] which authorised virtualisation of the judicial processes, laying the foundations for transforming cases on paper into digital data. As a result, there were lots of initiatives, several systems were implemented [8, 9], but until today virtualisation of the judicial processes have not reduced the collection nor was it sufficient to accommodate the demand for new lawsuits. [10].

On a different note, but parallel to the virtualisation move, there has been a huge focus on a new component in the 'game' that is called 'artificial intelligent' (AI), with the term 'Law 4.0, which gave, perhaps mistakenly, the players such as the workforce and specially governments a 'wild understanding' of what can be done with this 'technology'.

From a computer science point of view, AI is "the study and design of intelligent agents, where an intelligent agent is a system that perceives its environment and takes actions that maximise its chances of success" [23]. Thus, the idea of building a mathematical-based model that can solve human-like generic problems was born and became open to interpretation from non-computer scientists.

The capabilities of building 'intelligent' solutions that are available at the moment, only allow us, computer scientists, to build dedicated solutions if and when we have enough information (data) about the problem to be solved (intelligent solution) [1].

What most people would see as being an 'intelligent' solution, very often, in fact, is a simple case of automation of a well designed and defined process [3]. This open interpretation has been a good and a bad advert for data scientists and machine learning modelists and it has affected all the areas of work, and the judicial systems of

the world were not left out.

Around the world is not uncommon in recent years to read news regarding the fact that a 'group of lawyers was replaced by a single machine[3] and that the performance of that specific company increased drastically[4]. There is an increase in literature that explores the possible impacts of using such technology, however, very often, those are told from a law perspective leaving the technical part out of the analysis which can create a misunderstanding of the real capabilities and therefore their impact [26, 2]. In the Brazilian Justice scenario, it is not different. There is a wide interest and use of computational solutions for improving performance and helping with decision making.

Thus, this paper aims to understand the possible ways that computer systems can aid the judicial process as well as, to the best of our knowledge, explain these ways in a very clear manner so anyone can understand which systems are in operation at the moment in Brazil as well as if any of those systems are indeed using intelligent solutions.

This paper is organised as follows: Section 2 will present important definitions regarding algorithms, automation and artificial intelligence. Section 3 will list and discuss the systems that are allegedly using artificial intelligence-based solutions in the judicial system in Brazil and well propose a critical analysis of the pros and cons of using autonomous intelligent solutions as a single decision making unit in this context. And, finally, Section 4 will give conclusions about this work as well as indicate the possible ways of using artificial intelligence-based solutions in the law enforcement systems of Brazil.

2 ALGORITHMS, AUTOMATION AND ARTIFICIAL INTELLIGENCE: WHAT IS WHAT?

The area of computer science has grown extremely fast in the last fifty years with a exponential speed in the last twenty years because of the advances of the miniaturisation of hardware, the popularisation of the personal computer and more

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[3]https://www.forbes.com/sites/cognitiveworld/2019/02/09/will-a-i-put-lawyers-out-of-business/

[4] https://www.bbc.co.uk/news/technology-41829534

recently with the smartphones/tablets/wearables [5].

This popularisation has revolutionised and changed our lives in ways that will only be fully understood in the future when anthropologists look back and analyse our behaviour changes and this impact can be measured. This discussion has several sides, ranging from consumer behaviour, replacement of the workforce in repetitive jobs, access to technology as an essential service and popularisation of information with the internet being widely used. All those points are important, and more significantly to this work, they have a single point in common which is the fact the technology plays a key part in making any of those changes possible [14].

However, the fact that information technology is the drive for this revolution brings another problem that is much harder to solve: the digital illiteracy and the decrease in the school curriculum related to problem-solving and critical thinking. The 'no understanding' that the general population has regarding technology can create a sense that all that is done in smartphones, computers and automatic solutions is a 'magical' and simple process, which is obviously untrue [4].

Thus, it is essential that we explain the workings of what exist behind the 'magical' solutions that are presented and attempt to differentiate the main key words that are becoming more popular in the law side such as 'algorithms', 'automation' and 'artificial intelligence'. Sections 2.1, 2.2 and 2.3 will provide this simple explanation before we can fully analyse the current systems that are used in the Brazilian judicial system at the moment.

2.1   ALGORITHMS

Computers are the machines that were created initially in order to perform mathematical calculations that the 'computers' of the time (humans) were not fast enough to perform. This necessity became very clear, specially, during the second world war, where, in Bletchley Park (Milton Keynes, United Kingdom), a team of 'human computers' worked day and night, led by Alan Turing, to break the crypto keys used by the Germans for exchange messages [25].

Since the 'machine computer' is a calculator, what is important to understand about the workings of the modern day computers is that they are still calculators that perform very complex mathematical procedures. Even though we might not realise,

they also exist in most of the places, notwithstanding, still performing mathematical calculations. From our smartphones, to the personal computer, to the air conditioner, the washing machine; from the car to the airplane; from several children toys to anything that has any electronic circuit inside in an ubiquitous and pervasive way [21].

Performing calculations on computer equipment can be observed, for example, when one clicks on the smartphone screen and moves an object, for this to happen, the finger's pressure is identified on the surface, for a given time interval, in a two-dimensional coordinate, displaced by other coordinates until a final destination. And not just these tasks performed, but all, in the case of computers, are transformed into numbers and calculated continuously.

Thus, all the computational systems are performing mathematical calculations that are originally fed to the hardware (machine) by using algorithms [24]. Based on the Cormen definition [11], an algorithm is "any well-defined computational pro- cedure that takes some value, or set of values, as input and produces some value, or set of values, as output. An algorithm is thus a sequence of computational steps that transform the input into the output. Moreover, an algorithm is a tool for solving a well-specified computational problem".

So, from this definitions, it is essential to understand that [11]:

1.   Any electronic computer, even if it is very simple or limited, to the most complex quantum computer will need algorithms for it to perform any task.

2.   Any task performed by an electronic computer will be a series of mathematical calculations, even if it is not obvious to the reader that those calculations are happening.

In very simple terms, the construction of any algorithm goes through understanding the problem that needs a solution, designing the logic that will be necessary to cover all the possible ways to deal with the possible solutions, deciding which programing language will be used, writing the code, testing if it is working and using the constructed product [11].

Since we now understand that all computer systems will need algorithms, we can move on to understand their role in the differentiation between what is 'automation' and what is 'artificial intelligence'.

2.2   AUTOMATION

From a computational and engineering point of view, it is possible to define automation as the process of specifying a set of rules for solving a problem or executing   a task that is well defined and, then, create an computer-based solution that will execute this set of rules [22]. In essence, the automation uses algorithms that are constructed using predictable rules to execute a task that has been executed by hu- mans in a repetitive work with the aim to improve performance in the sense of time and resources that are consumed.

This can be done by a 'physical robot' that is designed and built to perform that specific task or it can be executed by an 'algorithms only robot' or a computer system that runs in a single computer, a server, several computers or in the cloud. It is very important to make it clear that the automation process does not imply necessarily that the solution is intelligent [17].

These differences are essential for the correct understanding and, therefore, the use of the correct terminology to be used when launching a new system. And finally, all the intelligent systems are automations but not all automations are intelligent systems.

2.3   ARTIFICIAL INTELLIGENCE AND INTELLIGENT SYSTEMS

Since we now understand what is an algorithm and what automation means in a computer science point of view, we can move on to understand what an intelligent system is and how it is implemented as well as its impact.

There are several definitions of what an intelligent system is or what is 'artificial intelligence'. The approach we will use for this context is intelligent systems are organised into four categories: Systems that think like humans; Systems that think rationally (maths and logic); Systems that act like humans and; Systems that act rationally (maths and logic) [16].

This will involve a myriad of ways ranging from logic-based inference, modelling of reasoning, modelling of uncertainty, building models that are able to generalise prediction, systems that can perform autonomous planning of actions, modelling of environments or behaviour, etc [15]. However, the most important concept to understand what an intelligent system does and the main way to identify if a process is

'intelligent' can be defined as:

- simple automation (no intelligence) solution: it does not have a training step; it only automates well defined sets of steps to execute a task; the same inputs will always give the same output in the system; it does not learn.

- intelligent solution: it does have a training step; it MUST use a dataset in order to build the intelligent model; very similar inputs can give different outputs; it learns the patterns of the dataset.

In summary, we can finalise this discussion by saying that all the computational solutions do have algorithms, all the intelligent systems are a form of automation, but, most importantly, not all the automation is intelligent. Now that we have explained these concepts, we can move forward to analyse the currently used systems in the Brazilian judicial system and we will be able to identify which ones are simple automation and which ones are attempting to perform predictions using intelligent solutions.

3 THE CURRENT LANDSCAPE IN BRAZIL AND THE LAW SYSTEM

In a broad perspective, it is notorious the effort being pursued by Brazilian Courts, in different areas and contexts, to improve electronic process-cases systems already available to solve relevant productivity problems that remain even after the implementation of the virtualisation for law cases. It has been more than a decade since the first electronic systems for virtualizing judicial processes started to work, but the lack of continuous business process reviews could lead to sustainable bottlenecks.

Nonetheless, the investment and enthusiastic focus on 'intelligent' solutions has driven the move to have 'anything artificial intelligent' based solution. Among the Brazilian projects that can be officially found, we can list and group them as simple automation or intelligent models for process sorting and machine learning models for decision making:

- Simple automation without any 'intelligent' model
  - Radar (by Minas Gerais Court of Justice)

- POTI (by Rio Grande do Norte Court of Justice)
- SAAJUS (by Federal Justice of Rio Grande do Norte)
- MAMDAMUS/Scriba (by Roraima Court Justice)

- AI-based solutions for document analysis and distribution
    - VICTOR system (by Supreme Federal Court)
    - Horus (by Federal District and Territories Court of Justice)
    - LEIA (by Softplan to various Courts of Justice)
    - Hércules (by Alagoas Court of Justice)
    - ELIS (by Pernambuco Court of Justice)
    - SINAPSES (by Rondônia Court of Justice/TJ-RO and sponsored by the National Council of Justice/CNJ)
    - Sócrates / Athos (by Superior Court of Justice)
    - Corpus 927 (by National School for Magistrates Training and Improvement)

- Wishfull thinking: Machine Learning for sentences using historical data
    - (Not in use yet) Second phase of SINAPSES (by Rondônia Court of Justice/TJ-RO and sponsored by the National Council of Justice/CNJ)
    - (Not in use yet) Jerimum/Clara (by Rio Grande do Norte Court of Justice)

Sections 3.1, 3.2 and 3.3 will detail as much as we could find information in the literature about each of those systems.

3.1   SIMPLE AUTOMATION WITHOUT ANY 'INTELLIGENT' MODEL

Radar project, developed from a state court instance, Minas Gerais Court of Jus- tice (TJ/MG), deals with repetitive demands identification. These cases "require the analysis of textual content of the process and structured information registered in judicial electronic systems is not sufficient for such analysis" [20]. As presented in [20], the system makes use of search algorithms for text comparison but not classification

algorithms based on machine learning, supposedly not adopting intelligent techniques. Despite this absence of machine learning models, the solution streamlined and allowed holding a judgment session with 280 processes in 2018.

POTI is a project conducted by Rio Grande do Norte Court of Justice (TJ/RN), a state court that is part of an Information Technology lato sensu Program in partnership with the Federal University of Rio Grande do Norte, and delivered products to automate bank account blocking procedures. Poti "automatically searches for specific amounts in bank accounts (...) also has the function of updating the value of tax enforcement action and transferring the blocked amount to the official accounts indicated in the process" [20].

The Rio Grande do Norte Federal Justice (JFRN), also inside an Information Technology lato sensu Program in partnership with the Federal University of Rio Grande do Norte, developed and implemented an automation system to streamline the processing of legal proceedings. "The system reads the petition for tax foreclosures and active debt certificates, captures all the data, prepares the initial order and moves the process for signature" [20]. To accomplish this, it uses data scraping and automation techniques operating the judicial system, providing agility and increased productivity in the initial phase of tax enforcement proceedings, doing in a few seconds the same work delivered in almost 10 minutes for a human.

Roraima Court of Justice developed a named Justice 4.0 (also known as MANDAMUS and SCRIBA), which has a goal to assist in cases distribution to bailiffs according to zoning and location criteria, and also the automatic transcription of hearings and sessions. This project has been born with extensive goals, inspired by demands for improvements in the management of the Central of Mandates. Inside its deliveries, the system should guarantee "enforcement of warrant, data updates on parties' addresses, provides real-time citation or subpoena, reducing bureaucracy, and can be used as an app on the bailiff's mobile device, integrated with the Projudi system" [20]. Scriba still cannot discern from different voices and it is up to a civil servant to manually identify each speech to its corresponding interlocutor". Both projects do not yet use AI in their working structure, but they must incorporate machine learning techniques for risk classification of compliance with the warrant and the allocation of bailiffs according to their ability to comply.

3.2   AI-BASED SOLUTIONS FOR DOCUMENT ANALYSIS AND DISTRIBUTION

Victor is a project sponsored by the Federal Supreme Court (Supremo Tribunal Federal/STF), with an academic approach by University of Brasília (UnB), which aims to do 'compliance analysis for the constitutional requirement of admissibility' and 'to speed up analysis of lawsuit cases that reach the supreme court by using document analysis and natural language processing tool' [20]. Using decision trees and convolutional neural networks, the researchers achieved 90.35% accuracy in documents classification. For later works, this project intends to classify the whole process for its compliance to topics of general repercussion [9].

The Federal District and Territories Court of Justice (TJ/DFT) has been incorporating AI-based solutions into its judicial systems, among which we have identified Horus and Ámon. The purpose of Horus is to carry out the automatic distribution of processes in the Tax Enforcement Court, from digitised files cases, using the K-Means clustering technique [9]. Ámon works in image processing and facial recognition, with a tool to support the area of security and access control to the public agency, using machine learning techniques (CNNs and HOG). Using such tools, TJ/DFT has reached 98% of their collection of distributed cases [9].

LEIA (Leal Intelligent Advisor) is a system developed by Softplan to Acre Court of Justice (TJ/AC) and others, attached to e-SAJ system, a former version of electronic process judicial system, designed to read case files (in PDF format), identify candidate cases and connect them to superior courts legal precedents [8]. Early results have shown that over 1.9 million cases at passive, 9% processes were tagged for linked legal precedents, decongesting respective courts[5].

Hércules is a project developed by Alagoas Court of Justice (TJ/AL) and its issue is "to prevent a civil servant from performing repetitive tasks, such as classifying whether a document is a request to block goods, quote a stakeholder, or suspend the process" [8]. This tool is based on natural language processing and machine learning techniques to classify intermediate petitions and provide suggested movements. This initiative had been accomplished in a partnership with a team from the Federal University of Alagoas.

ELIS is a system built for Pernambuco Court of Justice (TJ/PE), in 2018, and is

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[5] https://www.sajdigital.com/lab-da-justica/leia-precedentes-inteligencia-artificial/

a "solution to classify processes of Tax Executives filed in Electronic Judicial Process, to identify data registering divergences, diverse competencies and possible lawsuits prescriptions, and also applies CRISP methodology, a Data Mining technique" [20]. "Elis started using the criteria used by an employee who classified the processes into five types, including information such as the fields to be observed to identify the type of process." This project is still running on TJ/PE and has promoted much faster process movements and reduced its total lifetime execution.

SINAPSES is a framework that aims to develop computational solutions for whole Brazilian judicial systems, using in particular (but not limited to) Electronic Judicial Process system, named PJe, delivered by National Council of Justice (CNJ) [9]. Sinapses is an original Rondonia Court of Justice (TJ/RO) project, started in 2017 and later incorporated by CNJ as one of its portfolio strategic initiatives, "designed to work for any Court, as well as they can define their own machine learning model". One of the applications currently in use in the TJ/RO is the "Intelligent movement, which, given a set of documents that were added to the process, manages to predict, with 91% accuracy, which is the appropriate procedural movement".

Moreover, Sócrates has an initiative to produce "an automated examination of each appeal sent to the STJ and previous decisions of the process, also recommends normative sources and legal precedents, and provides a recommendation for action (the final decision will always be made by the Minister of the STJ)" [8]. Thus, it is focused on data classification, not on decision. This project is based on natural language processing and unsupervised machine learning techniques that have as training data previous petitions and decisions [13].

Corpus 927 is an initiative of the National School for Magistrates Training and Improvement (ENFAM), launched in 2018, in partnership with the STJ, to centralise and consolidate jurisprudence, gathering binding decisions, their statements and guidelines that are presented in the *Art. 927* of the CPC [7], based on the decisions of the STF and STJ, and still presenting similar positions anticipating jurisprudential lines. According to the ENFAM portal[6], Corpus 927 uses AI to assess the similarity between the jurisprudence found in its database, contributing to the fulfilment of the legal requirement of the CPC and streamlining the search for jurisprudence [9].

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[6] https://www.enfam.jus.br/2018/06/novo-sistema-de-pesquisa-de-jurisprudencia-e-lancado/

3.3   WISHFULL THINKING: MACHINE LEARNING FOR SENTENCES USING HISTORICAL DATA

There is a second phase for the SINAPSES, which has plans for one of the most ambitious initiatives that aims to incorporate a coordinated and integrated model, in addition to proposing a standardised architecture of AI-based solutions for whole Brazilian judicial systems [9]. They aim at "designing to work for any Court, as well as they can define their own machine learning model". This project is still ongoing focusing on the development presented in Table 1, inspired on [20, 9].

Model	Application
Prevention	In-depth database search to identify prevention cases
Case similarity	Document scanning and similarity identification based on paradigm-documents (for batch procedures)
Legal text suggestion	Predict and suggest words based on learned dictionary and contextual analysis
Judgements and sessions	Read, identify and extract report, summary and vote inside judgements
Summary	Custom legal text summarizer
Bulk sorting	Classifies initial petitions according to parameterized themes (energy, bank, airline, etc.)
Initial petition check	Classifies a document, stating whether or not it is an Initial Petition

Table 1: Sinapses in-development solutions

After the sponsorship of CNJ, training and dissemination with the Brazilian courts, several solutions presented previously adopted the strategy of migrating their solutions to the Sinapses platform.

Clara and Jerimum are projects conducted by Rio Grande do Norte Court of Justice (TJ/RN), where Jerimum aims to separate and label processes while Clara aims to read documents and recommend decisions, based on Natural Language Processing. These two projects were not completed yet [20].

Based on what was presented in the last three sections, it is clear that by just including the word 'intelligent' does not mean that the computational system will have implemented a real intelligent solution. Moreover, it is important to highlight that there is a good potential that by using NLP or Image processing for document analysis in the context of extracting features and/or automatic reading the text for keywords search can be proven interesting and effective in this context.

An interesting reflection is that in the classification performed in ELIS, Socrates and LEIA, the model decides which processes are suitable for judgment or movement, and which have problems and would be rejected or penalised with a manual review, and this might be already making a negative impact to the dynamic of the judicial decision.

Moreover, using historical data for allocation of processes based on these extracted characteristics has the potential of improving performance of the overall system.

However, there is a massive ethical and social issue that has been pointed out several times of using historical data for sentences [28]. There is inherited bias, from social-economics, racial, misogynistic, lgbtqia+ related, etinical, religious, etc that is very hard to deal with which can potentially be used for modern day situations.

4 FINAL REMARKS AND THE FUTURE OF AI, AUTOMATION AND LAW ENFORCEMENT

This paper aimed at combining the view of two different specialists (Law and Computer Science), we can explain and clarify the terminology that has been widely mis- used in the context of naming computational solutions in the context of the Brazilian Judicial System. From what was presented, we can see that there is a lack in the terminology used as well as in the claims the developers and, maybe even, the responsible judge used to name their automation system.

As the solutions were not made in a coordinated way or integrated with each other, with few exceptions the systems were not reused or influenced globally in

solving productivity problems or reducing the collection. In addition, some of the solutions presented were identified as automation tools, despite the increasing incorporation of the name 'artificial intelligence' based solutions in the portfolio of judicial systems.

The most common approaches identified suggest that Courts are working on solutions to mass demands, such as binding jurisprudence, groupings of similar cases for procedural classification and automation of repetitive activities, looking for productivity and efficiency improvement in the provision of jurisdictional service. Another important aspect is the movements for solutions' integration, for cooperation between the Courts, between Courts and Universities, coordinated and encouraged by the Superior Courts and Councils.

And least, but by no means last, there has to be a deep discussion and consideration about using any intelligent solution that is based on historic data to perform final decisions that can impact the population. There is undeniable bias in these data that must be first identified, prior to any use in the decision making process [12].

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